A democratic country like India needs democratic teachers whose students will be creative citizens, who can display initiative in various enterprises. How can this be achieved? The researches in the area of learning have shown that if the students are involved more and more in the learning situations, play and activities, they will throw themselves wholeheartedly in learning activities. When the experiences are given to the students, they should be able to apply or transfer whatever they have learnt in the classroom. The inner spark or insight of the students into the new problem is seen in the following way.

Sometimes, it happens that the student is confused in a learning situation, but because of some inner spark, he gets out of the confused situation. The inner spark only occurs when he is prepared and his previous knowledge leads him to see the relationship in different elements in the learning situations. He sees the new patterns and solves the problem. So he should learn to see new elements in only encountered problem. His learning activities are enhanced, if he is clear in his objectives and motivated. He should be taught to conceptualize, to discriminate and to generalise. These steps will help him to apply what he has learnt.

The high talks of teaching business are very sweet in theory but sour in practice, because the teacher is unable to
cater to the needs of each and every student. One of the innovative practices, "The programmed learning" can look after the needs of each and every student. Auto instructional programmes are educational material from which students learn by themselves. The teaching technique based on auto-instructional programmes is called programmed instruction. Its purpose is to enable the learner to progress through a pre-arranged sequence of experiences to the acquisition of knowledge or skill. Because the sequence is pre-arranged, it is said to be "Programmed". Since the devices themselves do not teach, but are used to hold programs so that the student may teach himself. They are called self instructional or auto instructional programs.1

In programming, each step is broken down into discrete bits of information. The student reads an instruction, a question or an incomplete sequence, he then answers or responds by filling in a blank, he checks his answers to see if it is correct and then moves on to the next step. Each question or item is called a frame.2

-----------------------------
Frame:

Each instructional unit, consisting of initial information, request for a response and information relevant to the correctness of the response is called a frame and the amount of instruction given from frame to frame is called size of step.

Cuing:

Programmes have given the name cuing to the technique that is used to insure a correct response. A cue is a subtle hint which suggests the correct answer. There are different type of cuing, the limit depending on a programmer's ingenuity. When a response is being introduced, the programmer maximizes the number of cues. A student knows his subject when he responds correctly without any cues. Cues are withdrawn gradually. The term for withdrawing cues is fading.

2.1 The Meaning of Programmed Learning:

Programmed learning as an instructional system is still not vigorously tried out and empirically tested in the classroom. The experiments and researches have been started but many more researches are needed. It is the direct application of the findings of the careful study of learning process. This type of design, which guarantees success, is the innovation in the process of instruction. Programmed learning which is known as programmed instruction is different from more commonly used term "A Programme of Instruction". Programmed learning
has principles and characteristics of learning and it promises to improve instruction. Edgar Dale writes, "The programmed learning is the product of the earlier efforts towards instructional improvement." These were relevant to the scientific approach activity-analysis and specification of behavioral objectives, criterion tests of terminal behavior, feedback on the results of learning efforts and instructional design, individualized instruction and self-managed instructional materials. Environmental and educational engineering psychologists, after careful study of learning process, have found that if the findings of the study are applied to educational strategy, the learning would be more effective.

Dr. S.S. Kulkarni has summarised the research findings in the following manner:

1. Behaviours which are rewarded (reinforced) are more likely to recur.

2. Sheer repetition without indications of improvement is a poor way to attempt to learn.

---


3. Reward (Reinforcement), to be most effective in learning, must follow almost immediately after the desired behaviour and should be clearly connected with that behaviour in the mind of the learner.

4. The type of reward (reinforcement) which has the greatest transfer value in other life-situations is the kind one gives oneself the sense of satisfaction in achieving purposes.

5. Opportunity for fresh, novel stimulating experience is a kind of reward which is quite effective in conditioning and learning.

The above stated findings are the basis on which programmed learning is developed. Thus, programmed learning can claim to be a good instructor, though unable to put the shoulder of a student but able to instruct him to conceptualize, to discriminate and to apply. The definitions of programmed learning are given below.

2.2 Definitions of programmed learning:

A William's definition of programmed learning material is, "The arrangement of material to be learnt into orderly series of learning experience, in each of which material is presented and feedback given."

A Layman's definition, - is that it is a printed discussion between an instructor and an individual student; in which both the student and the teacher, take an active part. Learning stops when the student becomes inactive and again resumed, when his attention returns. It is highly personalized, and it can assist the student to teach himself at his own speed. Hence, it is called a 'go-at your-own pace course'. George L. Geis. Professor of Psychology at the University of Michigan has chosen the phrase 'Validated Instruction' because the programmed learning is the student oriented design to produce terminal behaviour which is consistent with the objectives of the programmed learning material.

G.O.M. Leith from University of Birmingham has described programmed learning as 'a process of analysis and synthesis'. The subject matter to be taught is carefully defined and synthesized and ordered according to a logical sequence. An examination of some of the definition would prove useful.

"Programmed learning refers to a well disciplined and experimental approach to the development of instances of systems of instruction". 7

---------------------

Programming is a process of determining empirically a sequence of actions or operations that follow a present order to assure a dependable performance at an established standard. 8

"Instructional programme is a reproduceable sequence of instructional events to produce a measurable and consistent effect on the behaviour of each and every acceptable student". 9

"Programmed learning is the application of behavioural technology to education". 10

"By programmed instruction. I mean the kind of learning experience in which a 'program' takes the place of a tutor for the student, and lends him through a set of specified behaviours designed and sequenced to make it more probable that he will behave in a given desired way in the future". 11

--------------------------


Programmed Instruction is an auto-instructional approach to teaching which is changing to role of the classroom.*

From the above stated definitions, it can be concluded that the essential characteristics of programmed learning are as follows:

1. Subject matter is analysed into well ordered sequence of stimulus items.

2. The student responds to each stimulus item, in the same specified way.

3. The student's response is reinforced immediately, by supplying feedback, whether he is right or wrong.

4. The student commits few errors.

5. The student proceeds in small steps.

6. The student reaches the terminal objective, by successive approximation from what he was knowing and what he has to know, by going through the programme.

Recently, programmed learning is considered to be the first step towards educational technology. It considers

teaching as an act or input and learning on the part of student as an output. The above mentioned view develops education as a science.

Programmed learning is a beginning of such a science. It can also be considered as a beginning of educational technology as it attempts to apply the laws of behavioural science to teaching learning process.13

2.3 New Trends in Educational Technology:

Educational technology is that essential part of the educational revolution that will lift our schools into twentieth century enlightenment. Technology is the application of science to the art of teaching. It is our hope that educational technology will give us the power to develop the art of teaching into an applied science like medicine or architecture.

So educational technology is the application of educational science to the art of teaching but twenty years ago, programmed learning was introduced as the application of psychology of learning to the act of teaching. What is so new? Why is it called an educational technology? There are two reasons for that. One is that the term "Educational Technology" is more comprehensive when thinking about

educational technology, more than traditional programmes, and teaching machines are considered.

The second reason is that many of the early axioms of programmed learning as established by B.F. Skinner and Holland and their colleagues, did not stand up to critical examination and experimental investigation. A new name helps us to dissociate ourselves from embarrassing associations.

2.4 Meaning of Educational Technology

There are of course, two meanings of educational technology. Lumsdaine first pointed it out as back as 1964, but we still do not seem to have got this point over to the educational world at large. One meaning refers to the application of engineering principles to the development of equipment for educational purposes. This means film projector, tape recorders and language laboratories; teaching machines and computers. What we refer to as the educational 'hardwares'. This is the meaning the orthodox educationists will watch on to. They will not change their traditional methods of teaching; but will just choose presentation devices that they can use to fit in with their established lessons. They have no desire to change their ideas of teacher's role. The other meaning of the educational technology is the application of the psychology of learning to practical teaching problems. This will generate the 'software' that we shall present, perhaps through the new 'hardware' that we now have but not necessarily so.
This may be a conventional programme. It may be a carefully constructed television programme or a language tape, having the essential properties of a programme.

2.5 Contribution of the prominent thinkers:

There are some who have worked in associated fields, such as mental testing and curriculum reform, film and television research and in military and industrial training, rather than in the main stream of programmed learning. They have contributed as much if not more to our current ideas than the thinkers. These workers deserve special mention here.

One of the outstanding persons examining the effectiveness of instructional films was Hay. He found that films could be made which combine the advantages of demonstration and feedback when teaching skills.

Gropper and Lumsdaine have done important work in this field. Not only have they shown the advantage of having students respond to questions posed within the television film; but they have shown the need to apply the same sort of preliminary analysis to a television film as a conventional programme.

Then there is the work of Tyler and Gagne and Nagor, who emphasised the necessity of objectives of teaching; and their relation to evaluation of course, content and teaching method. They insisted on the need for explicit objectives; for without them it is impossible to tell whether the teaching has been successful or not.
Tyler shows that pupils do not always achieve the things they are expected to learn. He says that objectives should state the concrete behaviour the teacher wants the student to acquire. Objective tests make it possible to find out what is learnt and what is not and to revise the contents and the methods of instruction.

It is Pressey's idea of immediate feedback to learners that has made it possible to find defects in teaching and learning as it is taking place. There are two aspects of the use of feedback. One is that we can assess students' readiness for each stage and it is known from his command over each preceding stage. And the other is that the very provision of feedback is motivating and it improves learning.

So ideas of active involvement in learning, immediate knowledge of results and feedback to the students are not used in situations other than programmed learning field.

Gagne was concerned with military training while Skinner was applying his theories of operant conditioning which he had derived from animal learning laboratory to the human situation. One of the students Susan Meyer Markle, doubted the validity of this approach. But as she said, Skinner had succeeded in teaching seriously disturbed psychotic patients; and anybody who succeeded in teaching these two forms of life could claim to teach almost anything.
Gagne suggested an empirical approach, which he had developed with his colleagues associated with the Maryland Mathematics Project and which is now referred to as task analysis. It involves an exact specification of the principles which are to be taught, and an analysis of the subject matter to determine the subordinate principles which must be mastered on the way to the final task.

2.6 Essential Features of Programmed Learning

The essential features of programmed learning as we understand them today are: mapping out objectives, task analysis, and the selection of appropriate instructional media. These are also the features of programming that have survived; so it is no longer just a novel and effective form of self-instruction; but it is the essential spirit of a new approach to education.

It is yet not mentioned the celebrated prescription for programmed learning, established by Skinner as an infallible cure for the bad teaching practices of the past, rules such as:

• There shall be no more than fifteen words per frame—responses must be overtly made, the responses of the students should be practically free from errors, programmed learning is essentially self-pacing. These dogmatic pronouncements have not survived the scrutiny of research. Let us consider some of these ideas, and consider where the concept
2.7 Special features of the programmes:

All programmed materials have certain features in common. First they require the student to focus his attention on a limited amount of material at one time. Second, they require him to respond in some way to each segment of material. Third, they give him immediate knowledge of results after every response. These three features in sequence constitute what is here called the learning cycle. The learning cycle is repeated many times in a programmed. Fourth, programmes permit each student to work at his own pace.

2.8 Psychological Foundation of Programmed Learning:

Skinner and Gilbert (1958) have summarized the principles of learning worked out by Gagne (1958). These principles have led a number of workers to consider seriously the development of automatic teaching devices for use in the classroom. A rephrasing of these principles put in nontechnical terms might take the following form:

---


a. Learning takes place most rapidly if the student is actively engaged with the subject matter.

b. Learning is most effective, if the student develops the skills and knowledge in a form which will readily generalise to the life situation for which they are intended.

c. Learning takes place most rapidly if immediate 'knowledge of result' is given for each response.

d. Learning takes place most rapidly if the subject matter is organised in a hierarchic form.

e. Receiving frequent 'knowledge of result' keeps students working at the assigned task.

f. Since learning takes place in individuals, the learning situation should be designed in such a manner that each student may proceed at his own pace.

Programmed learning is making all instruction goal oriented. It also organizes instruction into an effective sequence. Here steps are carefully planned. The programme focusses the student's attention on a single point and the learner proceeds through the programme taking one step at a time. In programmed learning the learner is actively involved in the learning process. "The faster students are not held back, nor are the slower ones rushed through the material they do not understand".
2.9 Need of Programmed Learning:

One of the important distinguishing features of the 20th century is the application of scientific approach in solving behaviour problems. This has an impact on the field of education. The literal meaning of the term education is to draw something out.

The behaviour may be overt or covert. It is in the 20th century especially after the Second World War, that behavioural scientists practically have started looking at education as an empirical problem of human behaviour. One of the early efforts was in the field of examination. Educators with a more scientific outlook started emphasising that the examination system should be reformed in order to make it more objective based and objectively scored. In India too, the first impact of the scientific approach came in the field of examinations. Side by side with these efforts some educationists perceived that individuals are not alike. Individuals have different interest and they learn things at different rates. We also see many factors affecting the rate of learning. In order to eliminate them we should individualize instruction.

The need to educate the masses and fast increasing quantum of information have created the need to know more economic and effective ways of learning and teaching.

The factors, such as an exploding population, the exponential rate of increase in new knowledge being created and
the effects on our society of rapid technological change, all of these create overwhelming pressure for quicker and more efficient and economical ways of implementing more education. We must note that teachers and class rooms increase only arithmetically while the numbers of people demanding education and the amount of education that must be given to each of them increase geometrically. To meet this deficit, it is stated by Stolurow that up till now educators have tended to treat only the symptoms through manipulating student-teacher ratio, length of school year; increasing class rooms, assignments of home work and teaching aids, etc., that we have been patching up supporting activities and concentrating upon methods, and that we have not looked squarely at the basic problem, viz. instruction itself. In view of this Stolurow soundly justifies aims at continuous communication and control between the teacher and every learner, can replace more economically and more appropriately the occasional communication and control characteristic of present mass instructions without having to provide each learner with a live teacher, and at the same time this system serves most satisfactorily the critical functions of instruction.

2.10 Type of programmed learning:

There are two main schools of programming that is the linear style of programming and branching style of programming. Linear style is the result of thinking of connectionists. Connectionists' assumptions have considered linear programme as
the response centred programme. The response centred programmers pay attention to the responses and thus think of controlling and thereby strengthening them. Branching style has the root in the differential psychology. They consider the branching programme as the automated programme. Configurationists consider the linear as an organizing mechanism that selects and extracts the information from the environment.

The above stated assumptions are opposite to each other and are seen in the two different techniques of programming i.e. linear and branching. In fact, some programmes are designed for use without hardware and, instead, employ special sort of text books formats. The most accurate description of the total process here treated as "self instructional programming", in which the reference is to the body of instructional materials so constructed and manipulated (with or without devices) as to bring about learning without the intermediation of the live teacher.

In preparing self instructional materials for automatic devices, the subject matter to the learnt is broken down into a series of steps. This is accomplished differently depending linear or branch. A self-instructional programme, in either form, is an organized sequence of carefully constructed steps which are designed to teach something. The steps are in a prose form that require the learner to respond, usually there is included in the step some supporting information that prompts or "divides" the learner so that in making his response
he is usually correct. The learner reads each step and either (a) composes and answers or (b) selects one from a series of options. In either case he completes a sentence, works out a problem or answers a question. Steps are so designed that the student makes correct responses as he moves through his copy of the programme at his own rate making correct responses while also progressing toward more and more complex skills or concepts. The step is a self contained question or statement which may or may not present new information and it may call for one or more than one response. It may be more than a sentence long. Its length is determined by the objective of the programme it is designed to accomplish, by the capacities of the students, and the nature of the subject matter.

In a linear programme, each step can be proceeded on a separate 8 cms x 13 cms card with a blank in the appropriate place with a line drawn at the bottom of the card; or drawn on a separate answer sheet; for the student to record his answer (response). The correct response can be placed on the reverse side of the card and the procedure would then be for the student to read the step on one side of the card and then turn the card over to check the answer against the correct one.

By typing the items as shown, however, and spacing them properly on a sheet of paper, it is possible to use a card or a file-folder that has been properly cut-out as a mask to slide over the material. This might be called an economical teaching-machine. The cut out permits the display of one step at a time.
and the separate display of the correct answer immediately afterwards. The student can write his answer directly either on the programme or on a separate answer sheet. Once he records his answer he pulls the sheet through to the next step and in so doing he first exposes the correct response so that he can compare his with it.

Another style of linear programming has been suggested by John Barlow and it is called "conversational chaining" of the two basic forms of response. It uses a constructed response rather than selection. In it the response that is for the immediately proceeding frame is printed in letters, in the next frame CAPITAL letters are used to make it easy for the student to identify the response and to provide reinforcement. The CORRECT response need not be made, however, in order to have the student go on to the next step, for this type of programming is linear.

Programming which is not linear type is called the branching programming. In Linear Type Programming it is necessary for the student to make the response before he goes on to the next item. If he errs the next frame attempts to correct the student before allowing him to go to the next item.

Linear programme is derived from B.F. Skinner's views on learning. This procedure aims to 'shape' the learner's behaviour very gradually by requiring him to make a series of responses, for each of which he has been prepared as fully as possible, both by responses he has previously made and by
various prompts and cues. The correctness of each response can be ascertained by the learner after it has been made, but since the step between each response and the next is very small, very few errors occur. No provision is made for modification of the sequence in the light of the learner's success or failure. Usually, the learner must "construct" a response rather than merely select from a choice of answer, for example, he might have to write down a word.

Branching programme is developed by Norman Crowder. Here the learning sequence depends upon the learner's response. Usually the response is in the form of a choice. Depending on the choice made, the learner can be referred to any of a variety of different learning sequences. If his choice is correct, he will be allowed to proceed to the next stage, but if his choice betrays a particular kind of failure to learn, he might be required to repeat the part of the problem or to undergo a special remedial sequence appropriate to this kind of failure. Since error is thus accommodated, the learning steps used in branching programmes can be much larger than those used in linear programmes.

S.L. Presssy the first investigator of the possibilities of the teaching machine recommends that programmed learning sequences be used as an adjunct to instruction that is effected primarily by other means. The programme would then function to test the learner (for the instructional devices can easily record errors made), to help him to consolidate
knowledge or skills that had previously been learnt by more suitable means, or to present him with only limited kinds of information. The kinds of programme developed for this purpose can require a multiple-choice response and do not usually keep step size to a minimum, as do those of Skinner.

2.11 Preparation of programmes:

A programmer needs extensive training and practice in the philosophy and techniques of programming before he can be considered skilled. One cannot become a programmer by reading few pages. Programmed instructional crystallizes what a good teacher should be able to do in the classroom as a part of good teaching procedure. It calls for the highest order of planning. Until recently, most programming was done by experimental psychologists, but the programmes often lacked content suitable for classroom use. Therefore, efforts are now being made to teach programming to experienced teachers—teachers who can communicate with children and who know language levels and the curricula.

Perhaps an even better approach might be that of a team composed of the psychologist to help with cuing and reinforcement techniques and the teacher who would be responsible for the content and the sequence of the frames.

For teachers: Learning to programme can be a valuable experience for any teacher. It is through the experience of constructing frames for programmed instruction that the teacher
becomes aware of the very thought processes by which a student learns a concept. In programming, one must place each step in proper sequence in order to elicit the desired response. The technique of careful sequencing is a discipline, which every teacher should have, for it is one of the more creative aspects of planning when a faulty frame is constructed (one that produces undesirable or incorrect response) the teacher must examine the question and reword it to include the proper cues so that the correct response is more probable. The frames which elicit wrong answers from any significant portion of the students are by definition poorly constructed frames.

If teachers were to examine every learning experience by first identifying the objective (terminal behaviour) and then proceed to plan each step by breaking it down to its stimulus response elements and then to include steps to ensure the use of the information (application), he would be analysing the test rather than "presenting a lesson".

In programming both the inductive and deductive sequences are effective. Both can be used within the same programme. In inductive sequences the principle is the response; in deductive programming the principle is the cue-stimulus. Both these approaches are meaningful to the learner since the principle is reinforced by both a response and a cue-stimulus.
2.12 How should a programme be developed:

The careful development of a programme involves many technical aspects. There are four basic stages to be developed.

1. **Specific goals**: The goals or objectives of the programme should be clearly specified, in terms of behavioural changes. The terminal behaviour that you expect from the students should be enlisted. Thus task analysis is the first step to prepare the programme.

2. **Write frames**: The material is broken down into logically ordered small units or frames, each of which demands a response from the student. The student may be able to respond correctly only if he understands the frame.

3. **Try out and revise**: This step is the heart of programme writing. The first version of the programme is tried out on students and then revised on the basis of their comments and errors. The programmer continues to make revisions until he is confident that the students are learning satisfactorily. The try out on students indicates

---

to him how the organization of the subject matter might be modified and what steps need revision. He frequently finds that the final product is considerably different from the original version.

4. Validate: The programme should be validated, or tested before it is released for general school use. In validation one determines how much students learn from the programme.

A standardized test, or a test especially constructed for the purpose, is used to assess learning. Students reactions to the programme, as well as the learning scores should be reported. The relationships among academic ability, learning scores, learning time, and students' attitude are also determined.

2.13 The Task Analysis:

Task analysis is the determination of what a person does, how he does it, why he does it and the skills involved in doing the work. Actually describing task analysis in this way relates the subject to the whole dimension of training. It is, in fact an important part of an evolving training-technology. It is a base on which a training programme should be built, regardless of whether that training programme is of a conventional type or a programmed instructional test. 15

-------------------

From task analysis one can easily establish meaning to the objectives, one can correctly delineate the threshold knowledge required in the student; one can accurately determine the behavioural changes to be brought about in the trainee, one can select proper subject matter for programming, one can determine correct sequencing for teaching, one can specify programming techniques and one can establish real criteria for evaluation.

The task analysis involves four elements: the what, the how, the why and the skills involved. In finding out what a worker does, an analyst must consider two types of activity: physical responses and mental responses. Physical responses required of a worker in a job situation include such things as grinding or polishing materials: inserting, soldering, wiring, or performing a multiple of other physical activities. On the other hand, a worker may mentally plan, compute, judge, direct or otherwise govern the expenditure of his own physical activity, or that of others by corresponding exercise of mental effort.

In a job, a person may expend any combination of physical and mental effort required by the job to be performed. In finding out what the worker does, the analyst establishes the complete scope of the job by considering the total universe of responses demanded by the tasks to be performed. All the physical, mental activities involved in the job as a whole, as well as in the individual steps that constitute the
whole job, must be carefully considered. There is seldom a job consisting of only one act, be it physical or mental. Most jobs consist of more than one act, or task, but even one task may involve different physical and mental activities on the part of the worker. It is up to the analyst to discover these tasks and report them in the most direct terms so as to develop a clear, concise, coherent and complete description of the job.

In order that the trained worker performs his job satisfactorily, it is essential that various steps be taken in the appropriate sequence on the job. At this point it is well to note that when training materials are prepared, the sequence of presentation may well shift. It does not necessarily follow that the correct educational sequence is the same as the sequence followed on the job. However, at this point in the preparation of a task analysis, the investigator is not necessarily interested in reporting the job that the worker does so that when a programme is prepared all the data will be available in clearly understandable terms.

Having determined what the worker will be expected to do as a result of complying with the demands of the job, the investigator should next turn his attention to how the worker will respond. How the work is done concerns the methods used by the worker in accomplishing the assigned tasks. As in the case of delineating what the worker does the analyst should consider both the physical and mental responses required.
Physically the performance of a task may involve the use of machinery or tools, measuring instruments or devices, other related equipment following routines and procedures, and the movements of the worker himself. Mental responses to the demands of the job lie chiefly in the "know how" that must be applied to the tasks. This may involve the use of calculation, formula, application of judgement, or making decisions.

The investigator should assure himself that he has complete grasp of how the job is done so that when the time comes to prepare the programme nothing will be overlooked or ignored.

The analyst must consider the skills involved in the performance of a task or a job. Defining the skills involved consists of listing and explaining the basic factors that must be considered. These elements bring out the manual skills, knowledge, abilities and other characteristics required of the part of a worker, whether that job is manual, craft, professional, clerical or any other type. The recitation of the skills required in successful job performance consists of all the information necessary to discriminate between jobs and to establish the degree of difficulty of any job or task. Generally, an analyst will concern himself with accurate reporting on certain elements, among which are responsibility, job knowledge, mental application, dexterity and accuracy required. The skills required in a job have a direct and potent application in the preparation of a training programme.
2.14 **Evaluating programmed materials**:

In the next few years the market will be flooded with programmes. These programmes will doubtlessly range from very poor to excellent. It will be the responsibility of the school head, and the classroom teacher to review these programmes and determine which, if any, should be purchased. Then too, programmes developed within the school system should also be subjected to careful appraisal.

Perhaps the greatest training for evaluating programmes is the experience of programming. Even a little actual programming experience can help the programme evaluator to know what to look for. The following questions suggest criteria for evaluating programmed materials.18

1. **Is the subject matter in the programme correct and adequately covered?** The teacher and the curriculum expert are the best judges of this. Inaccuracies or omissions in content would invalidate the results.

2. **Has sufficient research on the programme been conducted?**

   a. **On what pupil population has the programme been developed?**

b. What is the intellectual, socio-economic and ethnic complexion of the test population?

c. How many revisions have been made before the final printing?

d. Has the publisher published a summary of the results of pretests indicating the extent of revisions?

e. How many students were involved in the experiment?

3. What is the error rate?

a. Are the number of errors during the experimental stages fewer than 5 per cent?

Lower error rate is but one criterion of programme quality. Low-error rates can be obtained with very simple items. If the item can be easily answered without the student learning what the item is supposed to teach, the programme does not control behaviour.

4. What does the programme propose to teach? What are the objectives of the programme?

5. Does the subject matter meet the curriculum requirements?
a. Does the programme meet present course requirements?

b. Does the programme provide for enriching the curriculum content?

6. Are the items or frames in logical sequence?
   a. Does the programme start with a simple concept and build toward a generalization?
   b. Does it include a review of earlier frames?
   c. Are the frames so constructed that these are natural stopping places?

7. Does the programme provide for frame format variation?
   a. Does the information presented vary in length from frame to frame?
   b. Do frames vary in the pattern of development?
   c. Are the pictures on the frames interesting and appropriate?
   d. Does the programme provide for humour? Wherever possible?
   e. If there is an audio portion of the programme, is it clear in tone and properly synchronised with the written material?
   f. Is there a variety of vocabulary when the same thought must be repeated in a number of frames?
8. Does the programme make use of the effective techniques of programming?
   a. Is there sufficient cuing? Are the clues clear but not overdone?
   b. Is there a limit to the number of possible responses to a frame?
   c. Does the programme move to final uncued "terminal response"? Can the student make his own synthesis of the information in the programme through which he has proceeded?

9. How is the programme written?
   a. Is the vocabulary appropriate to the interest and achievement of the students?
   b. Are the sentences well constructed in a clear and concise manner?

10. What is the total length of the programme?
    a. Is the programme divided into sections? Can a pupil stop after a period of time and pick up the programme with interest?
    b. How long is the average work period of learning session?

After a programme has been carefully examined by the faculty, applying the criteria suggested above, the programme should then be given to a group of students - a sample that
represents the ability and interest levels of the students who will eventually use the programmed material. This experimental group should be observed to note the following:

1. Do they seem interested in the content?
2. Can they proceed without help?
3. How long is their effective attention span?
4. How many errors were made by each student?
5. What was the quality of the students' discussion after they completed a section of frames?
6. What was their performance on a test constructed by the programmer and given after the programme was completed?
7. What was their performance on a standardized test?

If the programme meets with the approval of all who will be using it and students have had a successful learning experience then it should be recommended for purchase.

2.15 Teaching machines versus programmed text-books:

Presently there are machines on the market which cost between $30 and $30,000. They range from simple metal mechanical machines to electronic machines which use microfilm and audio tape. The production and design of machines has proceeded at a much more rapid pace than has the development of carefully planned and tested programmes.
The important thing for the programmer to remember is that machines should be built to fit variation in the programme. Most of the machines now being marketed will accommodate only one type of programme which greatly limits instructional potential of the machines. For example, if a machine is built to accommodate only multiple choice items, a programmer is limited to writing only such items, whereas in order to produce a good programme, he might wish to include write in items as well as multiple-choice items. No machine has been built to accommodate every type and variation of the programmes.

Machines, however, have the advantage of being 'cheat-proof' since the correct answer to a question is exposed only after the student has given his response. Apparently this feature is not too important because present research shows that the use of machines produces no better results than a series of questions and explanations in the form of a programmed text-book. Booklets and text-books have the advantage of being portable. A student can work from a text book whenever he has free time but he can use a machine only when it is available. Teachers may assign materials in programmed text books as home work.

In this way, students prepare themselves outside the class-hours. This procedure makes it possible to spend class

hours in discussing other facts of the subject matter.

2.16 Programming versus conventional methods:

Good reading practices have always included elements of programming. For example, most of the better-reading series used in the schools start in the first grade with small steps and a controlled vocabulary, proceeding gradually to larger steps and more difficult reading selections. Careful sequencing is inherent in a good reading series.

Moreover, much of the reading curriculum is broken into small units similar to the method used in programming. Elementary reading text books have short stories, poems and sometimes, just a few sentences in which students apply their recently learned skills. Reading laboratories such as the S.R.A. multi level materials, present short units of work with immediate opportunity for application and reinforcement. Thus the concept of breaking down material into small units is not unique to programming.

Teachers have long known the value of rewarding students when they are right. One of the advantages of small group, which allows a teacher to individualize instruction, is that there is more opportunity for the teacher to encourage the student each time he is right perhaps that is one of the reasons why children with serious disabilities usually have more successful learning experiences on small groups rather than in regular class rooms.
The programming seems to be a part of any good instructional method, then what are the essential differences between programming and the conventional methods of teaching?

2.17 Difference between programmed text book and a work book:

A work book usually does not teach, it contains practice experience for drill. If the pupil has not learned from the teacher's presentation of the lesson or from the text book, the work book serves no purpose, since a work book depends upon the teacher to correct the answers. An incorrect response repeated many times may become the behaviour pattern. The pupil who makes a correct response may have to wait for a day or even weeks to learn that he is right. By then the feedback may come too late to reinforce the correct answer because, as psychologists have found, only when a student's correct answer is confirmed immediately, he is likely to give the correct answer again.

2.18 Difference between the programmed text book and a text book:

A student reading a text book may or may not become involved with its content. The information is presented on the page and it is assumed by the author that the student understands what he is reading, rarely does the author require a response from the reader. A programme, on the other hand, does require a response from the learner.
A text book does not reinforce learning at each step. It presents a concept, gives examples and asks questions at the end of the chapter (which in a sense is a testing rather than a teaching procedure). In programmed instruction, the student is involved in every step of the procedure. He must respond to each frame and check his response before moving on to the next frame.

A text book teaches by way of broad concepts as seen by the author (with limited trials with students), and assumes that the student understands these concepts. By contrast, the programmer in developing a programme actually involves the student in the writing of the text by giving him each set of frames to read and respond to, and so learns from the student the number and order of steps he requires to fully understand the concept. The programmer, on the basis of the student's responses, revises the programme.

2.19 Difference between the programmed text book and a test:

A test asks a question to which the student gives the answer, it does not teach. When a child answers a question on a test incorrectly, he learns only that he has been wrong. Sometimes test papers are not returned, and a student is never made aware of the fact that he has made a mistake. He, therefore, continues to make the same mistake until it is detected by some other hand, gives the learner immediate information as to the correctness of a response.
Another important difference is that test items are
designed to differentiate or measure. In programming, the
object is to construct all items so that the student is
taught by answering each item correctly (linear programming).
Each item or question tests his learning, each correct answer
reinforces his learning; teaching and testing are interwoven.

2.20 Possible advantages and disadvantages of using
programmed learning materials:

The evidences from a large number of research studies
is that programmed learning typically teaches at least as much
as other methods and in less time. Here the learning is more
effective. More of the teacher's time is available for
individualizing instruction. The teacher can use the time
freed by the programmes to hold class discussions, to help
students organize their information, to hold individual
conferences with students, to give them experiences in asking
intelligent questions; and to develop their skills in applying
what they have learnt. In these ways the teacher can more
effectively organize the educational experiences around the
needs and interests of each individual student. Students
can correct their own work. The programmed instruction itself
enables the students to know whether he is right or wrong, that
is, it gives him immediate knowledge of results.

Holland and Skinner list seven advantages:

1. Each student advances at his own rate, the faster
   learner moving ahead rapidly while the slower
   learner moves at a speed convenient to him.
2. The student moves on to advanced materials only after he has thoroughly mastered earlier stages.

3. Because of his gradual progression and with the help of certain techniques of hinting and prompting the student is almost right.

4. The student is continuously active and receives immediate confirmation of his success.

5. Items are so constructed that the student comprehends the critical point in order to supply the answer.

6. 'Concept' is represented in the programme by many examples and synthetical arrangements, in an effort to maximize generalization to other situations.

7. A record of students' response furnishes the programmer with valuable information for future revisions.

Other uses of programmed instruction:

Programmed instruction is useful to the student who is absent in a regular classroom for one reason or the other.

Since programmed instruction is self instruction, it has vast possibilities for home bound students. The home bound student may become his own instructor with periodic lessons.

and cumulative evaluation by visiting teachers.

In some schools students work at home with programmed materials. School hours are then devoted to discussion and further exploration of the subject matter presented in the programme.

With the advantages of programmed learning material the opposite side of it should also be seen. It is rightly said that in a poor country like India luxurious aids to education are not possible. Programmed learning is not a luxurious aid to education. It is a must. Programmed book can be used again and again; with the help of separate answer sheet. Sufficient numbers of programmed books are not available in our regional languages. So only translation of programmed learning material will not help in an effective way. Learning through programmes meets with number of gaps. There are a number of topics which cannot be effectively learnt through programmed learning because it is very difficult to develop suitable programmes. There will be a lack of human touch with the teacher. The teacher will be a guard.

All the disadvantages which we have seen above may or may not be the real disadvantages of programmed learning material. If we deal with the new method very carefully and critically we shall certainly overcome such minor so-called disadvantages.
The programmed learning material is the teachers' servant or side. It is not autonomous. The programmed learning material is no more likely to replace the teacher. The programmed learning material will simply lead to a redefinition of some of the teacher's tasks and in doing so it will make the job less clerical and less routine. The teacher will be freed of the role and repetitious aspects of his job. In addition, he will be free to do all the things he would like to do now.

Since the programmed learning material is a door, the teacher will become more of a thinker, a decision maker, a programme planner, a group leader.

The third chapter deals with the review of the past studies and work done in the field.