CHAPTER I
INTRODUCTION

1.1 The Teaching -Learning Process

The Central issue in a science of instruction is the process by which the individual student learns. Understanding the process furnishes a basis for its successful monitoring. Each step of this process has potential for instrumentation. When the learner is exposed to some learning material or stimuli, he interacts with that material in some active fashion as writing, talking, thinking or reasoning, or drawing or doing something and the adequacy of the interaction is in some way to be evaluated and reinforced. This learning cycle stands as the basis of such efficient means of regulating behaviour as programmed instruction, and contingency management. This approach has been treated in the literature as behaviour modification.

In the teaching and learning process, communication between a teacher and a student is concerned with the transmission of a message either to increase a student's knowledge or to change his attitudes, his beliefs or his behaviour in some way. Learning can be defined as a process of acquiring knowledge or changing attitudes, behaviour or beliefs by interaction with outside event.

In the past, classrooms have presented subject matter by means of either textbooks and lectures or audiovisual equipment. Traditionally, learning has been viewed as rather a less
specified activity of the student occurring when exposed to the materials. But since Skinner's article 'the Science of Learning and the Art of Teaching' (1954), educators became increasingly aware of the importance of students' responses.

1.2 Nature of Classroom Interaction

Traditionally classroom teaching happened to be teacher dominated with a one way transmission of knowledge. (Ir is Paintal, 1980)

In the classroom, communication between teacher and pupils goes on as initiatory or responsive acts. This communication is called interaction. The interaction is broadly of two types - verbal and nonverbal. The teacher sometimes interacts with the class as a whole, sometimes with subgroups in the class, and at other occasions interacts with individual pupil in the classroom.

It is the teacher pupil interaction that keeps the intended messages conveyed to the pupil. The teacher provides the stimulus and the pupil responds.

In the absence of the teacher and, when the student reads a book, the interaction is with the material he reads. Other conditions, like individual abilities, or mental set remaining same, the strength of interaction, it should be noted, depends on the characteristics of the reading material. When the material enables a very intimate correspondence with the reader, we often say that it is 'interesting'. This is in fact an ordinary reader's comment.
In fact, an adequate formulation of the interaction between an organism and its environment must always specify three things, (1) the occasion upon which a response occurs, (2) the response itself and (3) the reinforcing consequences. Close succession of these events has been termed as contingency of reinforcement (Skinner 1969) Reading or interacting with the reading material is also a process of this kind.

1.3 Nature of Reading Interaction

Reading involves communication. To define reading we must think of what is going on when a person is actually responding to the printed words. Let us take the case of reading a novel. We might experience a 'physical experience' while we are reading an exciting action sequence, or the 'emotional experiences' while we are reading a very moving passage. In addition there is an intellectual or cognitive experience as we comprehend the material at varying levels of understanding (John Merritt, 1975).

In reading either literary or non-literary material, we are really concerned about messages that stimulate some kind of experience or the other which is our mental response to the stimuli. If we do not get such experiences, we are certainly not reading in the sense in which most people would perhaps use the word.

Now we come to understand what really takes places when a student is reading (silently) or when the actual 'eyeball - to - print' exposure happens. Here, the sequence of events vary:
they may slip quickly over the page stopping for closer examination only when specific details or stimuli are faced. This is a 'scanning' process. Sometimes, the eyes may flow fast over the matter but much more uniformly stopping at times to spend a little longer on those lines of a paragraph which gives a good amount of information. This is 'Skimming' process. At other times the reading will be a difficult undertaking. It takes much more time. Details and main ideas are examined from a wide variety of angles. The reader may slightly alter his ideas, attitudes and understandings significantly as he engrosses himself in an 'intensive reading process'; and the pattern is basically guided by the goal. It changes according to the readers plan.

1.4 The Reading Process

In well defined presentations, the characteristics of the material presented almost control the interaction of the reader (learner) with the material. The reading process includes the response of the reader to what he gets from the printed page - the 'reading experience' - and the more permanent changes are brought about within the reader as he reads. All that goes on whilst we are immersed in print may be thought of as the 'reading process'.

The reading 'process' then includes the 'skills' we exercise in responding to the printed word. The reading material provides the stimuli. The learner (i.e. reader) responds (mostly covertly in silent reading) to the stimuli.

As a result of reading, we are necessary changed in some
way however slight. The outcome of a particular reading may be thought of as the difference between the state prior the reading in terms of an enriched (or debased) experience store, as well as improved (or impaired) skills.

1.5 Types of Reading Materials

A well equipped classroom will have a substantial inflow and availability of basal readers, supplementary readers, workbooks, dictionaries, reference materials, children's magazines and newspapers, content area textbooks and supplementary reading aids, trade books (library books), charts, graphs, maps, films, filmstrips, study aids, programmed materials, etc. (Clifford and Mildred, 1970) Some of these materials can be used in group instruction, others as supplementary material to be read independently, and still others for browsing. Besides the above, the classroom that is organized for individualized learning will need programmed learning materials and those books which are based on programmed learning principles, like instructional modules and suitable texts. It is for this reason interest in this study is centered around programmed learning materials. And of all the reading materials programmed learning material are so structured as to exert control over the learning behaviour most. Relevant developments in the field which have some bearing on the problem chosen are discussed in a passing manner in the following section.

1.6 Programmed Instruction
Until the 1960's the major media of instruction in the schools were the books, the workbook, the chalkboard, charts, and maps; films; slides and filmstrips and various classroom materials. It was in the early 50's that skinner's classic paper ' The Science of learning and the Art of Teaching ' (Skinner, 1954) appeared. It focussed attention on what is known today as programmed instruction.

The term 'programmed learning' is as old as Socrates. Its origin cannot be traced from just one discipline. Programmed instruction came up from a puzzling complex of ideas and research ventures in many different disciplines. The names commonly linked with programmed learning are those of Thorndike, Pressey, Skinner, Crowder, Lumsdaine, Tyler, Gagne and others. What is now called programmed instruction has many forerunners, quite apart of B.F.Skinner's work (Lumsdaine and Glaser, 1960; Stolurov, 1961; Dale, 1967).

Thorndike (1912) while studying stimulus response relationships held the often quoted view of his that if by a miracle of mechanical ingenuity, a book could be so arranged that only he who had done what was directed on one page one would pass to page two, and so on, much that now required personal instruction could be managed by print.

Fourteen years had to pass for Pressey to come up with his machine. Pressey (1926) developed the first teaching machine for scoring multiple choice tests and for making the student move ahead on the basis of immediate performance.
As a result of a series of papers written around 1937 (Skinner, 1938), Skinner deviated from the established SR theory and began to emphasize his theory of 'Operant Conditioning'.

Skinner (1954) also materialized the idea in developing self-instruction programme. On the basis of his experiments with the pigeons, he gave the first and the most common type of programming viz - 'step by step Linear Programming'. His major contribution to instructional programming is the principle of reinforcement. This principle is the founding stone of programmed instruction technique.

Deviating from the 'step to step' path, Crowder (1959) came out with the branching programme.

The appearance of programmed instruction in the 1950's was neither the direct result of a continuous evolutionary development in education, nor the sole product of psychology (Ebel, 1969).

Several psychologists and educators wrote about elements of what today has become the set of ideas constituting programmed instruction. For example, both knowledge of results and reinforcement were well established by Pavlov, Thorndike, and Hull as important, if not necessary and sufficient condition of learning.

1.61 Definition of Programmed Instruction

A recent definition of programmed instruction in terms of either the product or the process has been given by
Sivasailam Thiagarajan (1976) Process oriented definition identifies a programme as an 'instructional sequence.' In this sequence the learner is presented with small units of content, kept actively involved in making frequent responses, reinforced with immediate knowledge of the correct response and led to the mastery of the instructional objectives through successively closer approximations. This definition is no longer in vogue, because it is too constraining with its reference to a particular medium (print), a particular method of programming (linear), and a particular model (operant conditioning). More recent 'Product Oriented' approaches offer a 'Black box' definition which identifies a programme as an instructional material which enables any learner from a defined target population to attain reliably a prespecified set of objectives. In the more popular process oriented approach programming instruction is defined as the process of analyzing an instructional task, deriving behavioural objectives, designing prototype materials, and modifying the materials repeatedly on the basis of expert opinions and student feedback until reliable results are demonstrable.

1.62 Characteristic Features of Programmed Materials

Programmed materials have four basic characteristics in common - First, they enable the students to focus attention on a small amount of material at one time. This is usually called a frame or step. Second, they demand a response (or answer) to each segment of material. Third, they provide the student immediate knowledge of results (feedback) often after every response. These
three features, in sequence, constitute the learning cycle. (Jacobs and others, 1966). Followed in immediate succession frame, response and knowledge of results represent a contingency of reinforcement. Fourth, they permit each student to respond at his own pace thereby providing for a degree of individualized instruction.

While Skinner invented one type of programmed instruction, he did not create all of its elements. Also, other types have been described like Crowder's intrinsic programming and Gilbert's mathetics.

1.63 Variation Attempted in Programmed Instruction

Adjunct Programmes

In the early 1920's, Sidney L. Pressey of Ohio State University noticed the drawback of question and answer sessions in the classroom. Only one student could answer a question at a time, and other students became bored and restless. To overcome this Pressey built mechanical devices to administer and score the test question. When provided with a machine each student in the classroom could be made to attend to questions, actively respond, and then receive immediate confirmation as to the correctness of these responses. Since the basic purpose of these materials was to make the student realise whether or not he was learning, multiple choice responding was inevitably used. Pressey later found that this procedure served the dual purpose of testing and making the students learn from the experience. In effect, the
objective style tests were implementing E.L. Thorndike's so-called Laws of Learning. Skinner later developed and made a more precise use of Thorndike's Law of Effect (which deals with the tendency for behaviour to be 'stamped in' when followed by certain satisfying consequences) on the other hand, Pressey utilized the Law of frequency (which states that the more frequently a response is made the more likely it will be repeated) and the Law of Recency (which implies that the more recent a response, the more likely it will be made again).

To begin with, the impact of these ideas and findings was limited. There was a spurt of interest in programmed learning in the late 1950's. Since then, Pressey developed this technique into a type of programme which he called 'adjunct auto-instruction' (Pressey, 1963). In essence, Pressey argues that response centered programmes tend to ruin meaningful structure by dividing the material into a set of serially presented frames. Whereas adjunct programmes not only keep but also build the subject matter into increased meaningfulness. In adjunct programmes the student first gets a brief learning experience by reading a short chapter or section of a chapter in a book, seeing a film or going on a field trip. He then reviews the experience choosing for important or difficult point, before he answers a chain of questions devised to enhance the clarity and stability of cognitive structures by rectifying misconception and defining the instruction of new matter until there has been such clarification and elucidation.

This method has an advantage over other forms of
programming. It is the fact that it can be prepared comparatively easily and quickly. It can make use of textual presentation readily available to student and teacher.

Linear Programmes:

Linear programmes are essentially response centered. This approach to programming is based on the now famous and much accepted analysis of learning made by B.F. Skinner. Essentially Skinner's work centres around the effect of reinforcement. This includes what the layman refers to as 'rewards'. In the process of programming, complex, overt and observable behaviour is broken down into sets of responses called 'operants'. Conditions are then made to work on with the effect that a particular set of responses are made by the subject. Every response that adds towards the predetermined terminal behaviour is reinforced; responses that do not are ignored. In this way the behaviour of the subject is shaped towards the objective.

In the linear programme, the student progresses at his own rate through a series of small steps. Each step leads logically through the subject matter. Since it is necessary that the student should make least number of errors, the increments of information which he is to acquire are essentially small. The student starts from frame one, and then proceeds to frame two, and so on.

Since operant conditioning places its emphasis on the observable or overt response of the learner, to be sure in
measurable terms, frames normally demand a 'constructed' type of response such as filling in a missing word or phrase, answering a question, or solving a problem.

**Branching Programmes:**

In Crowderian or branching programmes the student's response is used (1) in judging whether the communication process has been effective and (2) at the same time in allowing appropriate corrective action to be taken when the communication has become ineffective. Crowder's approach caters essentially to the expectations of the psychology of individual differences.

In branching programmes material is presented to the student on the basis of his performance. Multiple choice question is asked in order to decide what piece of information the student should see next.

In many ways the technique of branching programming is particularly suitable for dealing with material that involves complex problem solving strategies.

**Mathetics Programmes:**

Historically, linear programmes are considered as direct descendents of B.F. Skinner's method of instrumental conditioning. However, a study of them will establish that only some use the Skinnerian model. Their stress on learner responses, their attachment to cues and prompts, and their acceptance of fading procedure are all in one way or the other representations of Guthrie's position of contiguous conditioning. Skinner on the
other hand, gives importance to successive approximations towards mastery, differential reinforcement and precise shaping of behaviour. As such Mathetics appears to be the only sure example of a Skinnerian position in educational or training philosophy today.

Gilbert's Mathetics is the systematic application of reinforcement theory to the analysis and reconstruction of those complex behaviour repertoires usually known as 'subject-matter mastery', 'knowledge' and 'skills' (Gilbert 1962). According to Gilbert there are no 'instructional objectives' as such; there are only operating objectives. These can be accomplished, in whole or part, by designing training in the terminal behaviour first.

A Matheticist sees the basic principle of programme writing as -
(a) Determining what steps a student must take in order to master the subject.
(b) Arranging conditions so as to ensure that he will take these steps (i.e., how to motivate or reinforce him).

Modular Materials:

Instructional packages have many names—learning activity packages (LAPS), Weber state individualized learning kit (WILKIT), individualized packets (IPAC), unified packet (uniPac), and so forth. The general term for instructional packages is 'Modules'. A module is a learning unit with stated
objectives, a pre-test, and learning activities to enable students to acquire competencies. The learner usually works through modules individually or in small groups and at his own speed. Thus a module can be considered a near relative of both styles of programming - linear and branching in that certain principles are enumerated.

According to Hall et al., (1973) 'A module is a self contained set of learning experience intended to facilitate the students attainment of a stated set of objectives'.

In general a module has the following five parts (Hall and Jones, 1976):
(1) Prospectus - which gives a rationale on the matter to be studied.
(2) Statement of Objectives - which gives the most important learning outcomes in behavioural terms.
(3) Preassessment - which is a test for judging the learner's need and readiness for the activities in the module.
(4) Alternative Enabling Activities - which constitute a multipath set of learning activities, devised to aid learning of the behaviours stated in the objectives.
(5) Post assessment - which is a test for judging the learner's terminal performance of the behaviours stated in the objectives.

Kenneth Richmond (1970) had the following things to say over the change sweeping over in programming technique - "Reinforcement theory, is one of the oldest red herrings in the
business and the totems and taboos 'erected around it need not
detain us. Mercifully, programming techniques have become a good
deal more flexible than they were ten years ago when the
proslytes of the gospel according to Skinner were as slavish as
they were doctrinaire. Healthy rivalry has come from the
Crowderians, the Gilbertian, and the Mager-men, and flagging
endeavour has been revived by talk of dramatic break-through in
computer-asisted instruction. The initial emphasis on fixed
sequencing and meticulous frame-writing has given way to a
growing recognition of the importance of defining learning
objectives and analyzing the structure of subject matters and
skills".

1.7 Need for Evolving the Technology Further

Thus we can see from the previous paragraphs that in the
effort to develop better programmes that cater to individual
learning speed, ability, need etc. Several distinct styles in
instructional programming have come into existence. Programmed
materials are not limited to pure linear or branching style.
There are even discovery programmes which present experiment or
problem followed by multiple choice questions that call for the
student to derive a conclusion. Thus in the course of
development of this technology of programmed instruction, work
on improving the effectiveness tended to operate through
variations attempted mostly along some variables like stepsize
response mode, reinforcement, pacing control, presentation means
etc.
Under the step size issue - what exactly is meant by small steps? How does one distinguish 'small steps' from 'large steps'? How does one measure the size of a step? What should be the nature of steps? etc., These are interesting and challenging questions. In the next chapter, the review of related literature indicates widely differing opinions on how to assess step-size.

Under the response mode issue considerable attention has been given to the question of superiority of a particular type of response mode or the other. Majority of the studies reviewed deal with overt vs covert response mode, and responses to be constructed or to be choosen from multiple choice.

Apart from 'reinforcement' or 'effect' in the sphere of human learning, there is another very important motivating agent called 'Knowledge of results' employed invariably in self instructional programmes. Studies located under this variable deal with frequency of KCR, precision of KCR, delay of KCR etc.

The investigator has come across numerous studies experimenting on the variables noted above. However there has been no study located by her on transformations effected on response mode, reinforcement and stepsize simultaneously resulting in the creation of different forms of programmes. Hence the study of the kind undertaken by this investigator is with the hope that it would yield information on learner reading material interaction, aiding finally in pinpointing those combination which, if used, possibly result in learning at least equally if not better than linear programmes. This would have direct or
indirect bearing on preparation of programmed learning materials and variety in the creation of such materials.

1.8 Statement of the Problem

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

Reading material to begin with, as made out in the preceding introductory write up, meant programmed learning material in the study.

1.9 Objectives of the Study

The problem taken up for the study reduces itself to the fulfillment of the following objectives.

(1) To create different forms of reading materials (referred to as programmed learning material in the study) by duly effecting transformations at certain fixed points along the variables chosen viz., Steps in, Reinforcement and Response Mode.

(2) To analyze and interpret the effect of transformations made in the materials along the variables of stepsize, reinforcement and response mode of the learner reading material interaction on learner performance.

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

In this study learner reading material interaction refers to
interaction identified specifically in terms of variations in (1) stepsize (2) reinforcement and (3) response mode effected at certain fixed points. In simple words it means a sequence of stimulus (step), response (overt-covert) and reinforcement (extrinsic - intrinsic) types employed in any programme form to be created.

Reading material refers to programmed learning material which the learner peruses by reading. Specific types under each variable to be included in this study will be decided after necessary review of related literature.

1.10 Hypothesis of the study

Major Hypothesis:

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

Component Hypothesis:

The above hypothesis will be separately considered as follows:

In linear programmed learning -
(1) Transformations made along step size into certain previously fixed types do not cause significant difference in student gain.

(2) Transformations made along reinforcement into certain previously fixed types do not cause significant difference in student gain.

(3) Transformations made along response mode into certain previously fixed types do not cause significant difference in student gain.

(4) Interaction between stepsize and reinforcement (resulting from transformations) is not significant in terms of effect on student gain.

(5) Interaction between stepsize and response mode (resulting from transformations) is not significant in terms of effect on student gain.

(6) Interaction between response mode and reinforcement (resulting from transformations) is not significant in terms of effect on student gain.

(7) Interaction among stepsize, response mode and reinforcement, (resulting from transformations) is not significant in terms of effect on student gain.

In the case of rejection of above null hypothesis all essential differences will be tested for significance and superiority of particular combinations of variable types will be accepted.

1.11 Limitations of the Study
Of the several types of reading materials, the study is confined to dealing with learner-material interaction in linear programmed instructional materials. The programmed instruction, specially the linear style, has relatively well defined sequence of events defining learner-material interaction.

The present study takes into consideration only three variables of interaction already noted and assumes certain points along the variables fixed taking previous research, certain theoretical concepts, notions and practical exigencies into considerations.

1.12 Definition of Terms

Step size: Magnitude of the advance made in learning from one frame to another in programmed instruction sequence (Page and Thomas, 1979). A small step usually consists of one or two sentences, didules/chunks whereas, a large step consists of more sentences didules/chunks. The assumption is that large step hence contains more information, and advance made is large. To be brief, 'Step' in this study means small step and 'Para' stands for a large step approximately containing 7-8 sentences/chunks/didules, and may serve as equivalent to 7-8 small steps.

Didule: The basic instructional unit in a programmed instruction sequence. It constitutes one of the two components of a frame which consists of an instructional element (the didule) and the method by which it is presented (Ellington and Duncan, 1986). Frame in this definition is with respect to small step.
Chunk. A chunk can be one or more words presented to enable the reader to reconstruct after single exposure (Furukawa, 1970).

Reinforcement. In behavioural psychology and programmed instruction a process in which a stimulus presented immediately following a correct response increases the likelihood of the response being repeated when the same situation recurs (Erllington and Duncan, 1986).

Intrinsic. That which is inward, fixed in the nature of the person or thing, and therefore not dependent on external influences or accident (Eysenck, Arnold and Meili, (Ed), 1972).

Intrinsic reinforcement. In programmed instruction reinforcement not deliberately built in or provided by the designer of a programme but occurring purely due to a feeling of satisfaction or achievement experienced by a learner while going through the programme. (see Reward - Ellington and Duncan, 1980).

Extrinsic. That which is outward and does not belong to the essential nature of the person or thing (Eysneck, Arnold and Meili (Ed), 1972).

Extrinsic reinforcement: In programmed instruction reinforcement deliberately built in or provided by the designer of a programme. This reinforcement to be contingent upon a response called for may be due to knowledge of correct responses (See Reward - Ellington and Duncan, 1986).

Response overt mode. A response that takes the form of an oral,
written, manipulative or other act on the part of a learner which can be directly observed and/or recorded by an observer (Ellington and Duncan, 1986).

**Response covert mode** - An internalized response which a learner is assumed to make, but which is neither recorded by, nor otherwise apparent to, an observer (Ellington and Duncan, 1980).

**Reading Material** - For the present study it stands for programmed learning material on different science topics included in the Xth standard syllabus.

**Student gain** - Improvement in student (or learner) performance and/or knowledge attributed to a particular course, a programme lesson etc (Page and Thomas, 1979)