CHAPTER V

5. DEVELOPMENT OF THE PROGRAMMED MATERIAL

5.0 INTRODUCTION

The development of the programmed material is generally aimed at producing a measurable and consistent effect on the behaviour of each acceptable student. Therefore the utility of the programmed material depends upon its effectiveness for which efficacy is established by its development and validation.

The present chapter deals with this basic factor. In the introduction chapter a brief account of the principles and different styles of developing programmed instruction was given. For our study the method and procedure adopted are presented below along with the description of major stages of developing.

5.1.0 PHASES FOR DEVELOPING THE PLM

The development of the PLM consists of three phases such as

(i) Specification phase
(ii) Drafting phase and
(iii) Try-out phase.

A brief description of these three phases are given in the following sections.

5.2.0 SPECIFICATION PHASE

The specification phase of the programme is important for the success of the development and validation of the programme.
Various steps, under the specification phase of the programme are described by different authors. The specification phase goes through the following steps.

- Step (1) selection of a topic/unit.
- (2) writing objectives in behavioural terms (task analysis)
- (3) Defining pre-requisite knowledge and skill in behavioural terms.
- (4) Preparing a criterion test.
- (5) Developing specific outlines of content to be programmed.

5.2.1 SELECTION OF THE TOPIC:

The selection of a topic is guided by so many factors. According to Espich and Bill Williams (1967), DeCecco and Crowford (1977), and Chauhan (1978) the selection of a topic is guided by some factors like familiarity of the subject matter to the programmer, the need, utility, divisibility and logical sequence of the subject matter to be programmed. Laybaugh and Williams (1963) have given the following suggestions for the selection of a topic/unit to be programmed.

1) Field of specialisation: The topic to be selected be such that the programmer must have the mastery and from his/her own field of study.

2) Ease: It must be easy to handle. The experience in dealing the easy subject-matter that can be conveniently programmed will
only deliver competency in writing complex matter.

iii) **Length**: The programmed material should be such that the desirable objectives for the subject-matter are achieved and at the same time it does not take long for the students to reach their goal.

iv) **Hard nuts in education**: The subject experts only know the stumbling blocks pausing problems to the learner and how to tackle it.

v) **Logical order of material**: The topic should contain its own inner logical sequence so that the arrangements of items may be simplified.

vi) **Special student needs**: Some topics which are not directly connected to the course but useful to the students also may be selected for specialised knowledge of a topic to advance students.

In the selection of topic a beginner should keep in mind that

1) the subject/topic should be programmed with respect to the above consideration?

2) the objective of the teaching training should be realistic

3) the results should justify the expenses.

4) the desired results be measurable.

5) the burdens of the instructors should be minimum.
For preparing programmed material subject should be selected from new area, because duplication of a PIM already available is a mere waste unless it adds new dimensions. Considering the criteria given above the present programmer had selected the topic "Principles of Education" for B.T. students which is not previously programmed.

5.2.2. DEFINING PRE-REQUISITE KNOWLEDGE AND SKILL IN BEHAVIOURAL TERMS

Pre-requisite knowledge or entering behaviour of the students should be known by the programmer before writing the programmed material. Entering behaviour describes the behaviour that the student has acquired enabling him to acquire particular new terminal behaviour. The pre-requisite behaviour patterns are the bases for indicating the points where a particular programme must begin. This means the essentiality of a careful study of the entering behaviour of the learners for effective teaching and learning. DeCecco and Crawford (1977) have described the effectiveness of entering behaviour to acquire a particular terminal behaviour.

As the programmer took the B.T. course for her programmed material the sample of her study naturally consisted of pupils holding a graduate degree. Although the students came from different disciplines, they had to take this 'Principles of Education' paper as a core paper for their B.T. course. The contents of this course is not uniformly fresh to each of them and therefore the programmer has assumed the necessity of administering an entry
behaviour test with regard to the 'Principles of Education' to measure the preliminary knowledge of education for the whole cluster sample.

5.2.3. INSTRUCTIONAL OBJECTIVES OR TERMINAL BEHAVIOUR

The development phase of a programme involves several activities which are essential for a programmer to formulate these before writing a successful programme. These activities are as follows -

i) formulation of objectives which a programmer wants to accomplish through the programme he/she develops.

ii) deciding the content and the style of programming in which the content is to be presented.

iii) evaluate the performance of the learners and see whether the specified objectives have been accomplished by the students through the programme.

Robert Mager defined instructional objective as "an intent communicated by a statement describing a proposed change in learner". Benjamin Bloom in his 'Taxonomy of Educational Objectives' classified educational goals under three domains namely: Cognitive domain, Affective domain, and Psychomotor domain.

While formulating instructional objectives, the programmer in order to sharpen his objectives must ask the following three questions of Robert Mager.
1) What will the learner be doing when he is demonstrating proficiency? This question throws light on the manifestation of actual behavioural operations through which the learner will demonstrate the behavioural changes installed in his final repertoire after completing a learning experience.

2) The second important question which the programmer should ask pertains to the conditions under which specific behaviour will occur.

3) The third question is regarding the level of acceptable performance. A behavioural objective should specify not only behaviour but also the level of performance required by the learner. The beginner should consider these questions in order to frame worthwhile instructional objectives of a unit or of a course.

Robert Mager (1962), Popham and Eva Baker (1970) are of the view that for effective programmed learning specification of instructional objectives are more useful. Ralph Tyler and Robert Gagne (1965) provide three persuasive reasons for the careful definition of instructional objectives. First, such a definition provides guidance in the planning of instruction. The second reason for making explicit statement of instructional objectives is that they are useful in performance—assessments. The third reason is that the explicit statement of instructional objectives provides motivation to the learner. Most of the educational experts agreed that the analysis of instructional objectives helps the instructor to develop appropriate teaching strategy to bring changes in the behaviour of the learner so that they might
be able to perform a behaviour what is expected to perform after instruction. Definition of instructional objectives helps and guides both the instructor and the learner. Arguments in favour of specifying instructional objectives before instruction are laid down by Mager and McCann (1961). On the other hand Gagne and Blasner and DeCeseo criticised in specifying instructional objectives before instruction. Bloom, Krathwohl, Glazer, Kober, Reynolds, James and Gagne have developed various systems to categorise the educational objectives. But among them the 'Bloom's Taxonomy of Educational Objectives provides more precise and definite system to categorise instructional objectives. Therefore the programme, in this study, followed Bloom's Taxonomy of Educational objectives in describing her objectives. By considering the course content and level of the learner the programmer classified the instructional objectives in the three domains such as those 'cognitive' 'Affective' and the 'psychomotor' mentioned earlier along with the suggestion made by Peter Pipe (1966). The objectives drawn with Bloom's levels are presented in Table 5.1.

5.2.4 WRITING OBJECTIVES IN BEHAVIOURAL TERMS (TASK ANALYSIS)

The success of a self-instructional programmed material depends to a large extent on the proper analysis of the task without which it is not possible to justify what one intends to teach, and it is also not possible to decide on an optional teaching strategy. The term task analysis suggests the breaking down of the task into its constituent parts, and involves detailed
listing of component behavioural elements of a task. According to Popham and Baker (1970) "Among the most serious problem facing an instructor is the decision about what he should do to help his student to achieve his desired objectives." Certainly for planning effective instruction the statement of explicit behavioural goal is a necessary pre-requisite. However, the statement of behavioural objectives does not solve the total requirements for instructional design. The chief purpose of task analysis is to help the teacher to determine the specific tasks the student has failed to perform.

Task analysis includes the analysis of objectives in behavioural terms and the analysis of all the activities the students have to do during instructional processes or programmes. It should also define or describe the sequence of activities and the teaching point taking into account the content and skill involved in them. Analysis of objectives in behavioural terms in the present study are presented in the following table 5.1.

5.1. **ANALYSIS OF OBJECTIVES IN BEHAVIOURAL TERMS : BLOOM'S CLASSIFICATION.**

<table>
<thead>
<tr>
<th>Objectives in behavioural terms</th>
<th>Bloom's level</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIT I.</td>
<td></td>
</tr>
<tr>
<td>1. to recall specific terms of items regarding what is education</td>
<td>Knowledge</td>
</tr>
<tr>
<td>2. to grasp the thought or idea at any desired level of generality</td>
<td>Comprehension</td>
</tr>
<tr>
<td>3. to distinguish various concepts</td>
<td>Comprehension</td>
</tr>
<tr>
<td>Objectives in behavioural terms</td>
<td>Bloom's level</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>4. to select the aims of education which can meet the needs of the learner</td>
<td>Application</td>
</tr>
<tr>
<td>5. to classify the individual and social needs of education</td>
<td>Analysis</td>
</tr>
<tr>
<td>6. to synthesise between various aims of education</td>
<td>Synthesis</td>
</tr>
<tr>
<td>7. to find out proper aim of education suiting to our present condition</td>
<td>evaluation</td>
</tr>
<tr>
<td>8. to discuss how education can provide total life experience to the learner</td>
<td>Affective domain</td>
</tr>
</tbody>
</table>

**UNIT 2**

<p>| 1. to recognise the impact of social change on education | Knowledge |
| 2. to give illustration how social change can effect the education and educational system | Comprehension |
| 3. to select the objective of education on the basis of social needs | Application |
| 4. to recognise that education ensure social change | Knowledge |
| 5. to identify the functions of school in providing social change | Knowledge |
| 6. comparison of the 'school society' with the broad society out-side the school | Comprehension |
| 7. to select some training of work in school so that this can help children # in learning some social values | Application |
| 8. to identify and classify some activities in the school which can provide knowledge on social values | Analysis |
| 9. to organise the idea to provide some school activities which can develop social change | Synthesis |</p>
<table>
<thead>
<tr>
<th>Objectives in behavioural terms</th>
<th>Bloom's level</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. to judge how a subject or experience acquired in the school can help in social adjustment</td>
<td>Evaluation</td>
</tr>
<tr>
<td>11. to predict the influence of some subjects of the school which can provide social change</td>
<td>Affective domain</td>
</tr>
<tr>
<td>12. Preparing real life situation in the school which can help in providing social change</td>
<td>Psychomotor</td>
</tr>
</tbody>
</table>

**UNIT 3**

1. to recall the different definitions of formal, non-formal and informal education | Knowledge |
2. to identify the different types of education by the different educational | Comprehension |
3. to select the different types of education provided by the different institutions to help learner to cope up with the problems of different life situation | Application |
4. to identify the different types of education | Analysis |
5. to assemble the different types of learning provided by the different educational institution | Synthesis |
6. to find out the advantages and limitations of different types of education i.e. formal, non-formal and informal education | Evaluation |
7. To discuss the different patterns of education which can help learner in different life situation | Affective domain |
<table>
<thead>
<tr>
<th>Objectives in behavioural terms</th>
<th>Bloom's level</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. To prepare list of informal education provided by home which can help children in leading a proper life</td>
<td>Psychomotor domain</td>
</tr>
</tbody>
</table>

### UNIT 4

1. to recall the different agencies of education such as family, community, state and religious institution which can provide knowledge to the children

2. to identify the different types of teaching provided by different types of agencies of education

3. to select different types of learning provided by different institutions of society to meet the various needs of the learner.

4. to identify and classify the different activities provided by the different agencies of education

5. to assemble the different types of education provided by the different agencies of education which helps in preparing a harmoniously balanced man

6. to judge the influences of these agencies on the education of children

7. to discuss how these agencies of education can provide knowledge for proper personality development

Affective domain
Objectives in behavioural terms

8. to prepare list of different types of education provided by these agencies

<table>
<thead>
<tr>
<th>Bloom's level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychomotor domain</td>
</tr>
</tbody>
</table>

UNITS 5

1. to recall the specific terms regarding what is curriculum

2. to grasp the thought or idea at any desired level of generality

3. to distinguish various concepts

4. to select subjects for curriculum which can help in meeting the social demand

5. to identify some subjects which can provide life-experience to the children

6. to organise and generalize the ideas for curriculum design from the meaning of behavioural change in the learner

7. to judge or find out the defects of the present system of curriculum

8. to predict the influence of some philosophical guidance which can help in removing the present defects of the curriculum

<table>
<thead>
<tr>
<th>Bloom's level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Comprehension</td>
</tr>
<tr>
<td>Application</td>
</tr>
<tr>
<td>Analysis</td>
</tr>
<tr>
<td>Evaluation</td>
</tr>
<tr>
<td>Affective domain</td>
</tr>
<tr>
<td>Analysis</td>
</tr>
</tbody>
</table>

9. point out some activities, some subjects which are helpful in modifying the behaviour of the learner
5.2.5. PREPARING A CRITERION TEST

The function of a criterion test is to assess whether the behaviour has been modified in the desired or expected direction i.e. in other terms whether the instructional objectives are achieved by the students or not. Frames are prepared only on the basis of the efficiency of that test. Some of the characteristics of the CT pointed out by Peter Pipe are as follows:

1. A criterion test should cover all the teaching points. The number of test items in the CT should be more than the number of frames.

2. It should not include the same examples or the same situations given on the frame.

3. Types of questions asking in the CT should be different from the questions used in the frames.

4. Test items of the CT should not be same with that of frames.

5. Criterion test should be constructed before the programmer should/ to develop the programme.

6. For each objective there should be at least two test items on the CT.

By the CT a programmer tries to measure the mastery level of the student. In this study also the programmer has constructed a CT in "Principles of Education" for B.T. students and also has standardized. The construction and standardization of CT in detail is given in chapter IV. The preliminary and the final form of the CT are annexed in the appendix 'A' and 'B' of this thesis.
5.2.6. **DEVELOPING COURSE OUTLINE**

According to Kalus (1961) outline of a course should cover all the materials the programmer plans to teach. Generally it is done by a careful examination of a number of textbooks and reference sources. The programmer here for her present study consulted many books and took proper guidance of her guide who has vivid experience both in teaching computer science and programming, for preparing the comprehensive content outline covering all the specific objectives according to the level of the learner. The content outline thus prepared is presented in the form of a flow-chart under caption 5.2.6.

5.2.7. **FLOW CHART**

- Concept of education — aim of education — individual and social aim — vocational and cultural aim — complete living and harmonious development aim — self-expression as an aim, development of personality and efficiency — democratic aim, moral aim — impact of social change on education — education as a means of social change — school as an agency of social change — formal education and its drawbacks — non-formal education and its need — Agencies, advantages and limitations of non-formal education — informal education — family and its influence on education — community or society and its influence on education — State as an agency of education — religious institutions and their influence — concept of curriculum — defects of the present system of curriculum — principles of curriculum construction.
5.3. MAKING A PROGRAMME DRAFT

After having done all the above said specifications step of drafting the programme this phase of making a programme draft involves presenting content material in a format. There was no difficulty in choosing the programming model as the programmer had already undergone an extensive course on the theories of programmed learning in her M.Phil degree course. The programme was prepared in skinner’s Linear(or extrinsic) style with overt constructed and multiple choice type of response mode.

5.3.1 PRELIMINARY DRAFT OF THE FRAMES

A frame is a small segment of content materials that calls forth correct responses of the learner. This is the stimulus part of the frame. It is a necessary task for a programmer to provide those stimuli necessary to evoke student’s responses. This is the teaching part of a frame. In this drafting phase, the programmer has divided the whole content of her topic into some small but meaningful segments. In the present study the programmer has followed mainly the linear sequence in which there is single line or path for all students to follow. Below is a diagram of a linear sequence presented by Skinner and his associates(1954).

The frame sequence embodies all the basic learning conditions such as discrimination, generalisation, contiguity, practice and reinforcement. Skinner is of the opinion that sequencing of frame
is important for successful approximation. It also means that all students should read and respond to the same frames. Skinner (1958) is of the opinion that if the frames are too small it can bring the goals within the easy reach of the learner.

The next essential part of the frame is the response part the student is asked to make. The stimulus material of the frame and the response which the student makes to this material constitute an S-R relationship. Here the learner has to give the response overtly either by constructing or by selecting the response. This will reveal the learning.

In each frame the stimulus part and the stimulus context are the words which precede and follow the response blank. Goldbeck and Briggs (1960) are of the opinion that for effective learning and active student response, the response blanks are placed near the end of the frame.

The third part of the frame is the reinforcement part. A reinforcement is any event which changes subsequent behaviour when it follows in time. Reinforcement can be defined as "any environmental event that is programmed as a consequence of a response that can increase the rate of responding. Holland (1959) described that behaviour is best learnt only when it is emitted and reinforced. In this study, for each frame of the PLM the correct response is given at the top of the succeeding frame. The presentation of the correct response in the succeeding frame is known as reinforcement. The learner could verify and refer his response with the correct one given and conform his correctness. On verification if he discovers that he has not responded
correctly he reads the frame again and understands the point of mistake and emits the desired response only when he can go through the next frame.

The fourth important part of frame is the encouragement part. To promote a more active and comprehensive pattern of student's motivation and participation the programmer has chosen an encouragement part in the beginning of the succeeding frame. The technique she has used to encourage and simultaneously confirm the correct responses by statements like "you are right", "if you answer this then you catch the point", etc. or words like 'good', 'correct', 'alright' etc.

Prompts are cues provided in the programme frame to guide the student to the correct response. It raises the probability of correct responding. Prompt are used in the frame for the following functions —

1) for reduction of errors and error-rate and determining correct response.
2) for helping the process of modifying and improving stimulus control.
3) to enrich the student's learning by helping him discover new response.

Prompt should be used only at the introductory and teaching stage and be gradually withdrawn with the development of the programme so that the student can eventually achieve the terminal behaviour without artificial prodding and with only the information and stimuli he will have available when he is to demonstrate subject
mastery. There are some arguments against the using of prompt and cues in programmed learning to guide student's response. But there are some educationists like Oliver Cook and some of his associates (1960) (1963) who are in favour of using prompts and cues in the programme frame to guide the student to the correct response. Chauhan (1978) has described that, a prompt is a device that increases the probability that out of a set of alternatives, a particular response will come to be emitted and it keeps the error-rate of the programme low and save the time of the learner.

According to Skinner mainly there are two types of prompts—formal prompts and the thematic prompt.

**Formal prompt**: It gives an indication of the form the response will take. For example: Elephant is an animal. Response: an

**Thematic prompt**: It depends on the general properties of the prompting stimulus rather than on its exact form. It is better known as a hint. For example: Canis familiaris is a technical term for the animal called ... Response: dog.

The programmer in her present study mainly follows the Skinner style in every aspect, so she has made use of the both formal and thematic prompt. Gradually with the development of the programme content prompts were withdrawn. Gradual withdrawal of the prompt from the frame is known as the fading or vanishing technique which the programmer has followed here sincerely.
By considering all the above mentioned facts, the programmer had constructed the different types of frames of her programmed material. The details about the different types of frames in the programmed material are given in the table 5.2.

**TABLE 5.2. DIFFERENT COMPONENTS INCLUDED IN THE PROGRAMME**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Components in the programme</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Teaching frames</td>
<td>120</td>
</tr>
<tr>
<td>2.</td>
<td>Testing frames</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Prompts</td>
<td>5</td>
</tr>
</tbody>
</table>

5.3.2. **EDITING AND REVIEW OF THE FRAME**

According to Markle (1964), the programmer should make a criterion list for checking the frame materials. As soon as the first draft is over it has to be reviewed and edited. The following principles are to be taken care of in reviewing a frame.

1. Language of the frame should be clear.
2. Expression of the frame should be precise.
3. Response required of the student should be relevant to the frame.
4. In multiple-choice question, the alternatives should be feasible answers.
5. Frame should contain sufficient content to make clear what is being presented and what is wanted.
6. Each frame should include only one point at a time.
7. Irrelevant material should be eliminated.
8. Liberal use of thematic prompt and sparing use of formal prompts should be made.
9. Every teaching point should be accompanied either with an illustrative example or with a counter-example.

After performing the review as above, the programmer next proceeded towards the editing phase. For this, the objectives selected from Kysaught and Williams (1962), and Chauhan. S.S. (1978) were kept in mind by the programmer. The objectives are given:

1. To eliminate the ambiguities and other inadequacies before the programme reaches the students.
2. To improve the logical sequence of the frames.
3. To improve the technical sequential aspect of the programme.
4. To examine the appropriate use of prompts and illustrations in the programme.

The programme is now edited in the following three phases:

a) The material presented in the programme has to be checked by a subject-matter expert to determine if the material presented was technically perfect. This phase of the editing is called 'technical accuracy'. The investigator in this case had to take her guide consulted as an expert programmer.

b) The programme as a whole was edited thoroughly from frame to frame keeping in view the above objectives. The continuity
of the programme, the frame size and the other criterion listed above which were already checked in the review stage has now been administered to materialize it. The programmer performed these effectively with her guide. In technical aspect of editing she also took the help of an expert having experience in university textbook editing. After all it is the guide who was primarily concerned to check the accuracy and relevance of material, style of representation, vocabulary and context interests. We also had to check for editing the rules of construction technique of the programme as a whole. This stage forms the main part of the editing and is known as "programming technique edit".

c) The programme was next checked by a language expert for grammatical and compositional correction — such as, narrations, punctuations etc. This final stage makes the programmed material ready for printing and then for try-out. This stage of editing is known as "composition" (Peter, 1966).

5.4.0 TRY-OUT PHASE

The key to the effectiveness of the final product is the testing procedure. According to Marke (1969) "A programmed material is a reproducible sequence of instructional events designed to produce a measurable and consistent effect on the behaviour of each acceptable student." Therefore the programmer attempted to arrive at an optional sequence of instructional events by trying it out on sample of acceptable student population by going on modifying it until she reached a point, that the programme is successful in importing the intended instruction. According to
Richard Goodman (1967) to find out factual mistakes, inadequacies, and other programming weaknesses the programmed material must be subjected to a number of real-life tests before any operational use. The try-out phase is generally divided into three chronological stages such as:

a) the individual student testing stage
b) the group testing stage
c) the field testing stage

These stages are distinguished on the basis of actions which are taken as a function of the data to finalise a programme.

In this study the programmer has followed the above mentioned three stages of try-out to finalise her programmed material.

In each try-out the programmer has recorded any and every difficulty faced by the students and accordingly she made necessary modification to make her programmed material successful in imparting intended instruction.

5.4.1. INDIVIDUAL TRY-OUT

Individual try-out is the stage in which frames are finalised on the basis of the feedback received from the individual students. There are some rules to be followed while administering the individual try-out with each student. These are —

1. Establishing an effective rapport with the student.

2. The programmer should make it clear to the student that the question in the programmes are not testing his/her but merely helping the programmer to modify the programme. The programmer should tell the student exactly what he wants from the student and
the programmer should be sure that the student has understood his instruction.

3. For systematic sequential arrangement frames should be arranged in cards. If it is better to write the confirmation of each frame at the back of the card.

4. The programmer should give encouragement to the student by appraising him by using some words like 'correct', 'right' etc. when the student comes with the correct response. Much of the motivation of the student depends on the encouragement given by the programmer in the intonation of the words.

5. Student's interaction with the frame should be recorded. For this purpose the programmer should make use of a proforma. The model of the proforma is given on the Table 5.3.

6. For each frame the programmer should record his editing comment.

7. If the student commits an error, the programmer should tell him that his answer is not correct. The programmer should ask him to read the frame again and give a correct response. If the second answer is correct the programmer should ask him why he committed an error in the first time.

8. If the second answer is also wrong the programmer should ask the reason for both the responses. If it suggests any defects in the frame, the programmer should modify this suitably.

9. The programmer should note the time of the beginning and of the end of the try-out.
10. Frame should be revised according to the data gathered from the individual try-out and if necessary in consultation with a subject-matter expert. After this the programmer can be ready for group try-out.

For individual try-out the programmer had selected six students as shown in the Table 3.2.2. The proforma used for the individual try-out is given in Table 5.3.

**TABLE 5.3. PHORHEMA FOR INDIVIDUAL TRY-OUT**

| Title | Programme administered at time---- | Frame to be revised | Mil- | ing | com-
|-------|------------------------------------|-------------------|-----|-----|-----|
|       | Time taken in completion | STUDENT's response | STUDENT's reaction | to | ents
|       | right, wrong, needed explanation of being fired | of | easy |   |   |
| Frame No | | | | | |

According to the feedback received from the first individual student 30 frames had to be revised by the programmer.

The frames were next administered to a second student and frames were again revised on the basis of the feedback received. Successively on the basis of the feedback received. Successively six individual try-outs were carried out and necessary refinement was done. As only one individual was tested at a time the programmer got an opportunity to study the reaction of the learner immediately after the completion of the frame. The table 5.4 below
represents the performance of the individual try-out on the basis of the student selected as was shown by the Table 3.2.

**TABLE 5.4. PERFORMANCE OF INDIVIDUAL TRY-OUT**

<table>
<thead>
<tr>
<th>Sl. Students</th>
<th>Time Taken Hours-minutes</th>
<th>No of right frames</th>
<th>No of wrong responded frames</th>
<th>No of frames revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Below average</td>
<td>4-05</td>
<td>101</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>2. Average</td>
<td>3-30</td>
<td>122</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>3. Above average</td>
<td>2-50</td>
<td>131</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. Below average</td>
<td>4-00</td>
<td>125</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>5. Average</td>
<td>3-30</td>
<td>131</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6. Above average</td>
<td>2-55</td>
<td>131</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Average time = 3 hrs 26 minutes

5.4.2. GROUP TRY-OUT

The programmer made necessary modification of the \( P_{LB} \) after the completion of the individual try-out and made the material ready for group try-out. For group try-out the frames were cyclostyled and presented in the proper format.

For conducting the group try-out the programmer took 20 B.T. students randomly from the Mangaldoi B.T. College. The details about the sample selected for group try-out are given in the table 3.5.

First she prevailed a congenial atmosphere among the students with the help of the Principal and his colleagues.
Then the programmer issued necessary instructions to students (such as not to write anything on the PIM as it is reusable etc.) Other instructions already presented in the PIM itself were also explained by the Principal herself. When the student started working with the programme the programmer was noting down the performance biodata on the proforma used for this. After the programme administration was completed the students were given a chance to critically react to the programme, and these reactionings were considered for revision of the programme. The answer sheets were scored and analysed for finding out the error rate.

5.4.3 Error Rate

The first measure of evaluating a programmed self-instructional material is to calculate its error-rate. Error-rate responses may indicate a poorly designed item which fails to communicate and needs modification.

The error rate of a programme is calculated on the basis of responses given by the learner obtainable on each frame of the programme. If on a particular frame, the learner is not able to respond correctly, it is considered an error. Such analysis is made for each frame and for all the learners who are tested on a PIM. The formula to calculate the error rate is

\[
\text{Error rate} = \frac{\text{Total number of errors} \times 100}{\text{Total number of frames} \times \text{No of individuals}}
\]

Skinner is of the opinion that in the use of self instructional devices, the training should be arranged in such a way so that the number of errors become less. He recommends 5% to 10%
errors for his linear programme. Crowder (1959) on the other hand does not bother about high error rate. He believes that committing errors is basic to learning but errors should be detected and corrected immediately. He recommends 20 errors. Error rate is the percentage of incorrect responses on a frame, a set of frames, or a whole programme tested on a group of students, as indicated by Markle (1969).

By using the above mentioned formula, the programmer in the present study computed the error-rate for each unit of the programmed material and for the whole programme after analyzing the group try-out proforma.

The error-rate computed for the units and the programme as a whole from the group try-out are presented on the Table 5.5 below.

<table>
<thead>
<tr>
<th>Unit No</th>
<th>Total number of frames</th>
<th>Error frequency</th>
<th>Error rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Unit</td>
<td>16</td>
<td>14</td>
<td>75%</td>
</tr>
<tr>
<td>2nd Unit</td>
<td>24</td>
<td>19</td>
<td>79%</td>
</tr>
<tr>
<td>3rd Unit</td>
<td>13</td>
<td>12</td>
<td>92%</td>
</tr>
<tr>
<td>4th Unit</td>
<td>29</td>
<td>21</td>
<td>72%</td>
</tr>
<tr>
<td>5th Unit</td>
<td>28</td>
<td>10</td>
<td>36%</td>
</tr>
<tr>
<td>Whole programme</td>
<td>125</td>
<td>95</td>
<td>76%</td>
</tr>
</tbody>
</table>

As the programmer in this study mainly followed the same style only 5% error rate was allowed. As she got the error rate for each unit below 5%, so there was no need for the revision of the programme.
5.4.4. **Programme Density**

The second measure to evaluate a programme is to calculate its density. It is a term borrowed from Mathematics to see whether the programme is dense or sparse. Difficulty of a programme can be measured through conventional item analysis. The analysis however depends upon the performance of the student. Ideally an independent measure should be used. We have used the type/token ratio as the measure of the density of a programme (Green 1961). Green defined programme density as follows.

a) independent density, and
b) cumulative density.

Independent density is the density of a single strip composing a part of a programme. Cumulative density takes into account the prior appearance of specific terms on preceding frames. Plotting the cumulative density over frames comprising sub-sections of programme gives the picture of the structure of the programme that is useful for experimental purposes (Chauhan 1978).

A programme would have a density of 1.00 if every response required by the programmer was different. The programme would have minimal density if every response that is required of the student consisted of the same word.

In the present study the programmer used the type/token ratio (T.T.r) formula to find out the programme density of her programmed material. The formula to find out programme density is as follows: A tally is made of the number of different responses
required of the student in a section of a programme. The number is divided by the total number of responses required.

\[
T.T.h. = \frac{\text{No of different responses}}{\text{Number of total responses}}
\]

The independent density of each frame is 1. The cumulative density of the programme is shown in the table 5.6 given below.

**TABLE 5.6. TYPE TOKEN RATIO OF THE PROGRAMME AFTER GROUP TRY-OUT**

<table>
<thead>
<tr>
<th>Unit No</th>
<th>Total number of responses</th>
<th>No of different responses</th>
<th>T.T.h. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>46</td>
<td>42</td>
<td>.91</td>
</tr>
<tr>
<td>II.</td>
<td>20</td>
<td>19</td>
<td>.95</td>
</tr>
<tr>
<td>III.</td>
<td>35</td>
<td>32</td>
<td>.91</td>
</tr>
<tr>
<td>IV</td>
<td>26</td>
<td>21</td>
<td>.81</td>
</tr>
<tr>
<td>V.</td>
<td>31</td>
<td>26</td>
<td>.84</td>
</tr>
<tr>
<td>Entire programme</td>
<td>156</td>
<td>141</td>
<td>.90</td>
</tr>
</tbody>
</table>

It is clear from the table that the T.T.h. value of the programme after small group try-out ranges from unit to unit between .81 to .95. The T.T.h. value for the entire programme is .90. This represents the uniform concentration or distribution of responses over the frames.

5.4.6. FIELD TRY-OUT

At the field try-out stage the programmed material obtains the optimum perfection and validation for mass use as a technique of teaching and learning. At the field testing stage, the programmer leaves the programme in a natural situation. The validity
of the PLM can be purely judge by this field testing. This validity is judged by using it whether the students were able to obtain the mastery level i.e. 90 / 90 criterion.

The sample for field try-out were 40 B.T. students out of 100 B.T. students of Nagaon B.T. College. They were randomly selected for the purpose. Table 3 describes the sample selected for field try-out. As the syllabus for the programmed material was to be taught in the class after few days, the programmer found little difficulty in administering the programme. It was not known by the students.

The students went through the programmed text for 2 hours and 30 minutes. After this a separate session was called for administering the criterion test. After explaining the instructions, the final draft of the CT was distributed to the students with answer sheets and answers were collected. The score analysis revealed that 80% of students (i.e. 32 out of 40) secured more than 85% of marks. Table 5.7 presents the analysis of the CT scores.

<table>
<thead>
<tr>
<th>Marks interval</th>
<th>Frequency</th>
<th>Frequency percentage</th>
<th>Cumulative percentage</th>
<th>Cumulative frequency percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-79</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>80-84</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>85-89</td>
<td>12</td>
<td>30</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>90-94</td>
<td>10</td>
<td>25</td>
<td>30</td>
<td>75</td>
</tr>
<tr>
<td>95-99</td>
<td>10</td>
<td>25</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

Therefore the programmed material is deserved as usefulness as a valid instrument to be used for B.T. students. The sequence of contents dealt in this chapter for the process of developing the programmed material is summarised in the following chart.
The sequence of contents dealt in this chapter for the development of the programmed material is summarised in the chart.

<table>
<thead>
<tr>
<th>Selection of the unit/topic</th>
<th>C.B. / pre-test</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task analysis</td>
<td>Flow chart</td>
<td>Examination</td>
</tr>
<tr>
<td>Editing of frames</td>
<td>Individual try-out</td>
<td>Examination</td>
</tr>
<tr>
<td>Group try-out</td>
<td>Mass try-out</td>
<td>Examination</td>
</tr>
</tbody>
</table>