UNIT 11 APPLICATION TO COMPUTER PROGRAMMES

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11.1 INTRODUCTION

You have read about Computers earlier in Unit 8 of Block 2. Briefly, computer is an electronic device that solves problems by applying prescribed operations on data entered into it. Functions of computers in different areas can be categorised as control, communication, simulation, designing and artificial intelligence. Teaching-learning process is at the heart of any educational system and the process is basically a communication process. If function of a computer are utilised its full extent, it can help a teacher in making the teaching-learning process more effective than with the use of any other media. For this, a lot of educational courseware for students is needed to be developed.

Educational coursewares entail CAL activity. CAL is a self-instructional activity in which the computer is used as a medium. However CAL is one of the approaches to the use of computers in education. These approaches are named CBI, CML, CAI, CAL. The same are discussed in the following paragraphs:
11.2 OBJECTIVES

After going through this unit, you will be able to:

- explain what is CAL;
- discuss approaches to the use of Computers in Education i.e. CBT, CML, CAL;
- describe various modes of CAL;
- state advantages, limitations and problems related to CAL;
- discuss the steps involved in the development of a CAL package;
- prepare an instructional design for CAL.

11.3 APPROACHES TO THE USE OF COMPUTERS IN EDUCATION

11.3.1 Computer Based Training (CBT)

CBT is concerned with the training, which aims at achieving various skills. Teaching is not necessarily directly related to vocational requirements, whereas training relates to specific tasks within the real world. Hence, CBT mainly relates to any job performance.

11.3.2 Computer Managed Learning (CML)

CML implies the role of computer in education as management-aids. Since computers have been used mainly in commercial applications, educational institutions also started using computers for management functions. CML systems are usually conceptualised and implemented as aids to the teachers in their task of controlling and managing the content, pace, sequences and method of learning by the students. As with many computer applications, the data recorded in CML for one purpose can also be used for other purposes. Records of students' performance can be used as a base for career and further educational counselling; and can be summarised into reports from one school to governmental bodies on subjects studied, pass rates, etc.

11.3.3 Computer Assisted Learning (CAL) and Computer Assisted Instruction (CAI)

CAI or CAL implies the situation in which the learner generally is engaged in two-way interaction with the computer via terminal.

CAL is the activity where teaching and learning in any part of the curriculum are aided by some application of the computer. The role of the computer can be as a teaching aid, or it can be more student-centered.

Barker P. (1988) has suggested the following functions of CAL:

1. Management of learning,
2. Testing,
3. Tutoring,
4. Exercising,
5. Use of a computer as a calculator,
6. Use of a computer as a laboratory,
7. Use of a computer for producing technical materials,
8. Dissemination of material,
9. Archival of material,
10. Medium of expression.
11.4 Modes of CAL

The scope of CAL includes a wide variety of functions. These functions are usually realised in terms of a limited number of CAL modes. The major modes of CAL can be noted as follows:

1. Drill and Practice
2. Tutorial
3. Dialogue/Conversational
4. Games
5. Simulation
6. Databases
7. Narrative/Presentational

11.4.1 Drill and Practice

Drill and Practice is the simplest form of CAL. A series of exercises is presented to a student by the computer. The student gives a response. The response is processed by the computer and accordingly new activity is designed. Exercises can be created by the computer by avoiding repetition. The items can be selected randomly from the list and presented. Sometimes the series is presented as it is. Also endless exercises can be provided. As a response to the exercise, the programme either asks the student to try again till it is right or provides a chance or just states the right answer. The responses are also analysed to mark the success or to assert the need of more study. The questions in the drill and practice are of these types: fill in the blanks, which is the odd man out, correct or wrong, answer in a word/sentence, multiple choice. Activities like drawing, measuring and arranging objects are also possible on computer. Generally, typing of long answers is avoided in CAL.

11.4.2 Tutorial

In tutorial the topic to be studied is divided into a sequence of short sections called frames. It bears a close resemblance to the programmed learning sequences found in print and in teaching machines in 1960's. The programmed text presents a number of problems, particularly in determining whether the student has really mastered the current step and in deciding how to branch to the next step. The computer can be used to determine students' needs and preferences and to decide how to branch through material. The material can be more complex without adding to the students' burden. Thus in the field of branching, the computer opens up a range of possible branching which would have been difficult to arrange in the scrambled text or primitive teaching machine. The computer can be programmed to branch any number of alternative pages in text where there are many different routes. In tutorial, each learner can be diagnosed at every small stage and be led to a new path according to his/her need.

11.4.3 Conversation or Dialogue

These are based on the teaching learning method used by 'Socrates'. Both the teacher and the learner take an initiative to start the teaching learning process. They can ask each other questions and answer them. These types of tutorials are based upon models of teaching-learning process and require very complicated and time-consuming programming. Hence, writing most of these systems are research laboratory work and they are not widely used. Also these are not practically cost-effective instruction systems.

In dialogue tutorials the computer is engaged in learning about the learner. Thus they try to improve and further individualise the instructional strategy being used. Deep questioning techniques and multifaceted analyses of the responses given by the student can help in building complex interactive dialogues.
11.4.4 Games

The modes discussed earlier provide information in a structured way, according to rules specified by the author. Gaming involved with a dimension of competition motivates learners to approach the given situation with enthusiasm. If learning concepts are taught or given for practice through games, learners generally tend to stick to it regardless of the time it consumes. Video games as well as computer games, without any educational input, are very popular with children who have access to a computer. If they are provided with instructional games, they will certainly acquire new concepts and skills.

11.4.5 Simulation

A few real life systems and phenomena cannot be directly learnt. The experiments may be time-consuming, expensive, difficult or sometimes dangerous too (e.g. fission of atom).

Computer can be used to simulate a real life system by following a set of rules, which approximate the behaviour of the real system. The rules specified for simulation may be simple or complex and quality of approximation can be governed. Various levels of approximation can be provided in the same simulation courseware. It allows effects of increasing experimental error or to give a feeling for the accuracy of the simulation.

Simulation offers flexibility and control. In simulation, the particular feature of the computer as an ultra rapid calculating and data processing machine is used to its best advantage.

Simulation can provide the following advantages:

1. It avoids the difficulties and complexities of real by using idealised conditions. e.g. changing demands and supplies of commodities to see its effect on the market economy.
2. It overcomes the prohibitive costs of laboratory or field-work based experiments. e.g. providing variety of acids with different densities in a lab for one single experiment.
3. The time normally demanded by an experiment can be foreshortened.
4. Dangerous experiments can be experienced in safety. e.g. increasing proportion of pollutants in the environment to see the consequences.
5. Experiment, which would normally be impractical, can be attempted. e.g. creation of civilisation on a different planet.
6. The level of complexity can be increased slowly. Variables can be added at every stage.

11.4.6 Databases

One of the modes of learning is learning through exploration of resource material and library utilisation. The power of a computer to store, retrieve and process information is used to help the student as s/he browses through the material. One can respond to the questions about the related information and retrieve an item which one needed, summarise statistical data, suggest possible times of investigation that may be of interest.

As in the library a book or a resource material can be found using subject code, author index or title index. One can provide such key works to the computer to find resource material. Unlike books, material stored in a main-frame computer can be made available at all the terminals at a time.
11.4.7 Narrative/Presentational

Here the computer screen is used to present material to the student in a form sometimes referred to as an electronic blackboard. Along with normal verbal approach, movement and animation can be used with colours and music. Simple presentations can easily be developed by teachers to introduce learners to a new information. e.g. a teacher can develop slide shows using MS-Power Point or even develop web-pages using Front-Page.

<table>
<thead>
<tr>
<th>Check Your Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Match the learning points from column A with the appropriate CAL mode from column B.</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>1. Intensity of earthquake</td>
</tr>
<tr>
<td>2. Forming groups of students according to parents' occupations</td>
</tr>
<tr>
<td>3. Problems on division of numbers</td>
</tr>
<tr>
<td>4. Information about parts of body</td>
</tr>
</tbody>
</table>

11.5 ADVANTAGES OF CAL

The learning process could be strengthened more in many ways through these modes. Advantages of the CAL approach are mentioned below:

1. CAL is individualised, that is each student is free to work at his own pace, totally unaffected by the performance of any other students. Since it can provide a method of instruction designed for self-directive study, it helps in improving skills or achieving objectives at all difficulty levels.

2. Information is presented in a structured form. It proves useful in the study of a subject where there is hierarchy of facts and rules.

3. CAL forces active participation on the part of the student, which contrasts with the more passive role in reading a book or attending a lecture.

4. Partly as a result of interactive student participation, it provides immediate feedback. The feedback may be remedial in nature or it may direct the student to a certain path depending on its response.

5. CAL utilises a reporting system that provides the student with a clear picture of his progress. Thus students can identify the subject areas in which they have improved and in which they need improve.

6. By enabling students to manipulate concepts directly, and explore the results of such manipulation, it reduces the time taken to comprehend difficult concepts.

7. CAL also saves the unauthentic labour of teachers as well as students. Teachers need not waste their time and labour in arranging same instructional experiences, forming questions for every student, evaluating them at every learning stage, as all these are carried out by the computer programme.

8. CAL offers a wide range of experiences that are otherwise not available to the student. It works as multimedia providing audio as well as visual inputs. It enables the student to understand concepts clearly with the use of stimulating techniques such as animation, blinking, graphical displays, etc.

9. Where a conventional practical demonstration is extremely difficult, impossible or dangerous, where the apparatus is not readily available, when a real situation would take an impossibly long time to investigate or where manipulation of different variables may prove useful, simulation is of tremendous significance.
10. Learners can be provided any number of options in multiple-choice questions. Also a series of responses may be provided where some are better than others, with each response providing feedback on each of the options.

11. CAL provides a lot of drilling which can prove useful for low aptitude students and through which high-aptitude students can be escaped.

12. CAL can enhance reasoning and decision-making abilities.

13. Students who use CAL become increasingly self-directed in their learning style. They become more responsible for learning and less dependent on teachers. They consider themselves capable learners.

### 11.6 LIMITATIONS OF CAL

Though CAL has a number of advantages, it has some limitations also. Some of these are as follows:

1. A CAL package may be regarded simply as a novelty, rather than an integral part of the educational process. It may threaten the objectives of the package.

2. Though simulation permits execution of chemical and biological experiments, hands-on experience is missing. Moreover, CAL packages cannot develop manual skills such as handling an apparatus, working with a machine, etc.

3. There are real costs associated with the development of CAL systems. It is expensive in terms of staff time to devise and programme effective CAL.

4. Content covered by a certain CAL package may become outdated. A very high cost is involved in the development of these packages. If the course is outdated, the resources involved in its development will be a waste.

### 11.7 PROBLEMS RELATED TO THE USE OF CAL APPROACH

1. Motivating and training teachers to make use of computers in education is a challenging task. They may have fear of this new device. They may be unwilling to spend extra time for preparation, selection and use of CAL packages. It may also be perceived as a threat to their job.

2. CAL packages may not fulfil expectations of teachers. Objectives and methods decided by the CAL author and of a teacher may differ.

3. There are administrative problems associated with computer installation. The problems particularly related to the physical location of the computer resources, the cost of hardware maintenance and insurance and time-tableing.

4. Quality courseware demands a team approach. Expertise required for developmental process is from different fields such as teaching, programming, hardware engineering, subject expertise, etc. They may face problems in coming together for a long time.

5. The rapid development of hardware makes it difficult to select a system before it becomes obsolete. If a new system is installed by a maximum number of institutions, they may not get courseware required for the system and courseware developed so far may become useless.

To overcome many of the problems related to CAL a lot of educational software has to be developed. A number of such software is being prepared by experts in various fields. For their wider use, they should be validated.
11.8 STEPS INVOLVED IN DEVELOPMENT OF CAL PACKAGE

The sequence of the steps involved in the development of instructional materials may change according to the nature of the problem. The general steps involved in the development of software can be discussed as below:

11.8.1 Analysis Phase

Selection of a unit

Though computer is one of the most effective media, it demands more money resource than any other media. The computer therefore should be used creatively and judiciously. Assuming that a teacher has decided to write a programme for CAL, the first question that she should bear in mind is: why use a computer (CAL) approach. There should be a rationale for the use of a computer.

Before you start to develop a CAL package consider the following questions:

- Is my learner going to gain something more than s/he will gain by using other media/innovative methods? Does my topic involve such objectives which can be achieved fully only if I use CAL?
- Will my package provide individual learning experience to the learner?
- Will the package provide interactivity with the learner, user control and scope for self-evaluation?

Content analysis

To develop any self-learning programme, we need to analyse the content properly. The teacher should know each and every teaching point from the selected topic. The process of dividing the topic into sub-topics or sub-points is called Content Analysis. Content analysis helps the teacher in identifying all the concepts, definitions, information points, rules, examples, formulae, diagrams, illustrative graphics, etc. related to the content.

Entry behaviour

Along with the content analysis, analysis of the target group is very essential. Before developing any educational software, vocabulary, learning style, needs, conceptual level, comprehension level of the learners should be analysed.

Once the content and target group are analysed, a teacher can sequence the concepts so that they are logically arranged. Here the teacher can identify the prerequisite to learn the topic. If some basic concepts are not clear to the learner, s/he will not be able to use the learning material of your topic. Hence the specifications of the learner's entry behaviour are to be finalised.

Specification of objectives

After selecting a suitable topic, and analysing it, the instructional objectives can be determined keeping in mind the earlier learnt capabilities of the learner group both in terms of their previous knowledge and other competencies. Preparing statements of learning objectives for a programme is like preparing a summary of the learning process in terms of the competencies to be learnt.
Development of evaluation measures

A statement of objectives describes the capability to be developed. If this description is clear, it helps us to design a test to assess how well the learner has acquired that capability. A well-written objective immediately suggests relevant post-test items.

Self-learning material also demands a pre-test to decide whether there is a need on the part of a learner to go through the material or a sub-unit or whether he can skip it. So far we have experienced that the teacher decides what s/he wants her/his students to learn irrespective of what they all know or wish to know. Self-learning material provides facility to each individual learner to check what s/he knows and what s/he can learn.

11.8.2 Design Phase

The analysis phase is then followed by a creative phase, that is the design phase.

Development of modular structure

Since CAL is a self-instructional approach, individual differences should be taken into account. Large-scale learning processes are more easily handled in a segmented or modular format. In this approach clearly defined areas of activity may be learnt only by those learners for whom they are suitable. Thus, a particular learner will concentrate only on a particular sub-topic which he wants to master. In developing a modular structure, the course designer should identify the title of each module, objectives and the combination of presentation methods most suitable. Thus, the whole package would be a set of various interrelated modules. Though they are interrelated, one can select modules to be learnt or the pre-test may help the learner in selecting appropriate modules.

Development of flowchart

The flowchart is an important piece of documentation needed when developing courseware. Once all the information that is required to be included in the course has been identified and the rule set has been constructed, the flowchart becomes the link between this information and the screen-presentation.

"A flow-chart is a chart showing the flow - the relationships between events, activities, concepts. The relationship may be temporal (in time order) or non-temporal but there is always a certain sequential order." (Kulkarni, S.S. 1986)
Unlike study texts and structured texts, which follow one major route through a course, CAL enables appropriate feedback to be given to the learners in response to their answers. These anticipated wrong answers could lead to remedial loops containing material, which is designed to clear up serious misunderstandings. To avoid confusions in the branching, the programme flowchart is necessary.

The flowchart shows the quickest route through the course. It shows the frame numbers and the count loops. It helps prevent the course getting muddled and clearly shows the branching. The flowchart can be used by later authors to amend or edit the course. It is also important in validations, that is checking back to what the author wanted to happen.

**Designing frames**

One of the advantages of CAL is that information can be broken down into quite small packages. A module consists of a series of frames. Some of these will be criterion frames, teaching frames and some testing frames.

**Criterion frames**

These should be written first before the teaching frames, also acting as a check that the teaching frames achieve their objectives. It should be noted that a criterion frame tests a teaching point and no reference material is used in the frame. This is a test of the learner's knowledge. Therefore, a criterion frame on the flowchart should be clear of loops guiding the student to get correct answers to questions raised in frame.

**Teaching frames**

Teaching frames contain all the information needed to complete the course.

**Testing frames**

Teaching frames are also associated with questioning frames, since there are few better ways of learning information than by using it. Testing frames can have help and hint frames with them. These can be in the form of a prompt or a clue. Anticipated wrong answers must be handled properly in the answer analysis, which requires a lot of imagination on the part of designer.

Once the frames are designed, they should be converted in a manner useful for screen display. Therefore, screen layout forms are designed at this stage.

**Preparing screens with reference to actual programming**

At the programming stage, the roles, which the computer can play, should be appreciated. A number of characteristics of computer display are discussed by field experts and also some guidelines for their effective use are defined. Some important points are discussed in the following paragraphs. They are discussed under the following headings:

a) Screen layouts,
b) Text,
c) Graphics,
d) Timing,
e) Animation,
f) Sound,
g) User control.
a) Screen layouts

This refers to what is displayed on the screen of the terminal. A few simple rules for good design are stated by Woodhouse David and Mc Dougal Anne (1986). They are as follows:

1. be consistent from one screen to the next;
2. arrange statements in the same order as actions to be carried out;
3. avoid excessive abbreviation;
4. use spacing generously and wisely;
5. allow adjustment of the level of helpful prompting information to the level wanted by the operator;
6. do not clutter the screen with too much information, or too great a variety of symbols, colour or scripts or inverse colour blocks;
7. do not overuse the facility for blinking as it may reduce concentration. If a blink is used, it should be at the rate of 3-5 per second.

In general, the minimum amount of information necessary to achieve the purpose should be displayed. A small amount of graphical or textual information clearly and effectively presented is more likely to promote understanding.

Information to be displayed should be presented one key point at a time. An effective way of doing this is to reveal new images on the screen or to change all or part of an existing display. But care should be taken while changing part of an existing display so that the change is noted by the learner. The change should be eye-catching. Two or more changes at a time are not advisable. For example, if a new text and graphical movement are displayed at the same time, the graphical movement obviously distracts the attention and the new text is not attended to. Use of pauses between two actions is helpful in such cases.

It is sensible to place titles at the top of the screen and prompts for action should appear at the bottom after the screen has been assimilated.

The technique of blinking can be used to catch the learner's eye towards an important concept.

<table>
<thead>
<tr>
<th>Triangle</th>
<th>Rectangle</th>
<th>Ellipse</th>
<th>Quiz</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Triangle Diagram" /></td>
<td></td>
<td></td>
<td><img src="image" alt="Quiz" /></td>
<td><img src="image" alt="Help" /></td>
</tr>
</tbody>
</table>

Total of all the three angles of triangles is 180.

The designer may wish to retain some text or a diagram while displaying additional information. The use of windows to display information in a box that overlays part of the existing screen can be very effective to emphasise points, for help, information etc. Windowing may also be effective for error messages.

Constant change can make the activity more interesting, avoiding visual boredom and retaining attentiveness. Alternatively, visual consistency might be more important to keep users confident and comfortable with the conventions adopted, that is where to look for new information, how to answer questions, etc. Buttons like 'HELP', 'QUIT', 'TEST', 'MAIN MENU', should be the same throughout the package.
b) Text

The rule “The programme should say just what is required and no more” stated by Marshall David (1988) is an important point of consideration. Visual display units are not suited to large amount of text. Text should only appear when essential. In general, text should be summarised. Paragraphs should be no more than three lines in extent and should have space between them. If possible, form a meaningful group of words to make the perception of the content easier.

The screen format should always adopt the conventions that lines do not end in the middle of words, and that paragraphs should not start on the last line of a page display. Text should be distributed over the whole screen or centered. Characters in lower case are assimilated more quickly than just upper case, which may be reserved for headings and other emphasis. Text should be grammatically consistent.

Check Your Progress

3. Select appropriate screen layout.

   a)  
   
   b)  
   
   c) Graphics and colours

   The graphics capabilities of screens can be used in two ways. Graphics can be used to display pictures and diagrams. They can also be used to enhance a text display by drawing boxes and borders, shading etc. The use of boxes, borders, shading etc. is important in enhancing screen presentations.

   By making display more attractive, colour helps motivate learners. The range of colours available is very restricted. Therefore, items in different colours stand out and the eye tries to give significance to the colour chosen. This can be distracting but it can be used to focus attention.

   Elements of a display, which appear in the same colour, give the impression of being related in some way. Conversely, elements in different colours are seen as separate. This coding can be used deliberately to relate different parts of a display. e.g. Good and bad habits of a child can be shown in two different colours throughout the package.

   It is advisable to be consistent with the use of colour throughout a piece of software. For example, heading should be in the same colours unless there is a special reason for a change.

   Blocks of colour behind part of a display can be used for emphasis. Attractive informative displays can be created using just one background and one foreground colour. Not all colour of combinations of foreground and background colours give legible displays. It is essential to select colours, which contrast in brightness. Placement of blocks of colour of similar brightness next to each other should be avoided (e.g. red and blue). They tend to merge and look fuzzy. Also large solid blocks of white and yellow should be avoided since they give an irritating flicker. Too much contrast or very bright colours should be avoided. Dull colours make learners disinterested.
d) Timing

Changes to the display resulting from a learner's input should be clearly visible. They should be completed at a speed, which neither keeps the learner waiting nor is too fast for the learner to see what has changed. Allowing the user to control when changes to the screen display take place, and at what speed, makes a programme more flexible for use with a wide range of learners of different abilities.

e) Animation

The illusion of movement is a powerful feature that can focus attention dynamically. It can visualise processes of change that the programme is illustrating. Too many and speedy animations may create confusion.

Keeping objects animating without reason, along with other important matter on the screen should be avoided. There should be a provision to stop animation by the user. Allowing the user to control animations may increase learner-participation and interactivity of the media to a great extent.

f) Sound

Nowadays, sound effects are being used in many programmes. These sounds are either whizzes or bangs or tones to reflect success or failure, or sometimes even appropriate ditties or comments that relate to the content. Buzzers used to reflect failure are proved effective in decreasing the chances of failure.

Use of sounds have led to the development of CAL packages in phonetics and also for developing listening as well as reading skills.

The learner should also have control over the use and volume of sound.

Sounds may distract the learner from the important message. Hence it is advisable not to use sounds where they are not essential. Verbal repetition of text written on the screen should be avoided.

To conclude, all sort of documentation and ideas should be ready before the programming phase. At this stage, the task of preparing the module is complete.

g) User control

Interactivity is the keyword in learner-centred activities. If a learner is in the interactive situation, where a learner can experience and get feedback at every stage, learning becomes more effective and long-lasting. The computer can provide this facility which is missing in any other media. CAL should never be mere presentation with screens advancing and allowing a learner to just watch. A learner should have control over the parameters like sound, animation as well as the content variables. Learners should be able to decide which modules to learn, to open again if needed and close if tired.

11.8.3 Programming Phase

Once the screen layout is ready, the next stage is to get the CAL running on the computer. This can be done in two ways. The instructional designer, that is the courseware author, may himself or herself perform the programming task on his own by utilising his/her programming expertise; or the whole task of programming can be performed by another programmer or a team of programmers. If the CAL is a multimedia package, it certainly requires teamwork.

Generally, a teacher who does the instructional design of the CAL package, may not possess programming expertise. Such a teacher is provided programming facility by special tools. These tools are called authoring tools.
These are the tools that are designed to minimise the actual amount of programming expertise required by a teacher in the creating of educational software.

Authoring systems are software packages that guide the author through the process—eliminating the need to know how to programme. From the point of view of an end-user, authoring systems provide more facilities than authoring languages and support most of the aspects of the CAL package producing process.

Dean Christopher and Whitlock Quentin (1988) state that some fundamental features must be provided by any authoring system:

1. present text and questions on a screen;
2. accept responses entered using a keyboard;
3. analyse the responses;
4. store details of responses and values of counters on a file;
5. branch to other parts of the learning programme;
6. provide feedback;
7. interface with subroutes written in computer programming languages.

The authoring systems do make the computer friendlier. It leads the author through the authoring process one at a time with all control function being executed automatically by the system.

11.8.4 Validation Phase

Evaluation by experts

When an author has completed a section of the course, it is ready for peer evaluation, the reviewing and assessing of a course. Since CAL involves higher technology and a high cost, if quality ought to be approved by applying some criteria. Once the CAL package is ready for usage, it is expected to be used by a wide range of learners. That is the reason why it requires testing.

According to Dean Christopher and Whitlock Quentin (1988), the following factors should be considered while evaluating a package:

1. Content: The course must teach the subject matter that has been specified in the initial objectives.
2. Accuracy: The internal assessment verifies that the subject matter taught is accurate and sufficient.
3. Presentation: The quality of the presentation on the screen must be consistently high. The usage of the area must be effective and uncluttered.
4. Adherence to presentation standards and guidelines: The purpose of presentation standards is to make the medium as unobtrusive and sympathetic to the user as possible. The author should not be permitted to use different screen layouts according to whim. Peer evaluation should pick up occasions where the standards have not been adhered to. This will cover such items as:
   a) Yes/No responses;
   b) Multiple choice question;
   c) Instructions for continuing to next screen;
   d) Headings;
   e) Highlighting;
   f) Use of capital letters, etc.
5. Use of the authoring language: Just as there should be a set of standards and guidelines for course presentation, there must be standards for using the authoring language if the writing and the amendment of the course is to be efficient. These standards cover such items as labelling, branching, response analysis and use of counters.
6. Statistics: Statistics are kept for two main reasons: to measure student performance and to aid validation of the course. The detailed statistics of the exact path that each student has taken through the course, and the answer to each question, are important during the testing phase.

Peer evaluation will lead to a course review that decides the changes that should be made and may, if the evaluation has covered an early section of a course, lead to revised objectives or a new approach to subsequent parts of the course. Any revisions as a result of peer evaluation must be completed before the stage of course validation.

Testing

Validation should only be carried out on courses or sections where the programming part is complete. The course author can hope to get the following data when the sample has completed the course:

1. pre-test and post-test results:
2. the time spent by each student on the computer and on the overall course;
3. the responses of all the students;
4. the students’ evaluation of the course;
5. any difficulties the students may have faced.

The subjective information needed by the author is:

1. suitability of the language used
2. subject matter:
3. questions:
4. presentations:
5. enjoyment.

The process of testing includes two stages:

a) Working with small group of learners i.e. Pilot Study
b) Experimenting with a sample of learners from target group.

a) Pilot Study

The Programme is tested on a small group of learners (5-10). The process of learning is discussed with them. Detail comparative study is done with reference to the learners’ entry behaviour, time taken for learning, their learning habits, attitudes and results of post-tests. Thus, there is a scope for revising the programme before its implementation.

b) Field try-out

The study is conducted by the experimental research. The data obtained from the learners is analysed by applying statistical measures. This is called validation testing. At this stage, the learners go through the programme without the aid of a programme designer. In validation testing also learners should be requested to give overt responses and comments regarding why, according to them, their responses were considered wrong by the computer. The designer can revise the programme in such situations. Data regarding the performance of individual learners from the validation sample should be recorded in a table. After studying the table tentative hypotheses regarding effectiveness, utility, the feasibility of the CAL package can be tested.

Information of this kind regarding characteristic of the target group of learners which after the performance in the programme would be helpful both in revising or preparing supplementary material and in devising remedial instruction where necessary.

Once the validation is over, there is a temptation and likelihood that the project will be regarded as complete. However, with some courses, revision may be forced by changes...
to the subject being taught. A regular review should be done to consider the status of the course, its usage, relevance, need for improvement, etc. This follow-up process should lead to detailed refinement of the product.

### 11.9 LET US SUM UP

Computer technology has reached the schools. As a teacher you will be required to use the computer as a teaching learning tool. If a teacher walks parallel to technology and tries to develop software, technology will be a boon to education. In this unit, we have discussed various modes of Computer Assisted Learning e.g. Drill and Practice, Tutorial etc.

While developing any software, a teacher should follow a certain procedure. In this unit we have discussed these steps of developing a CAL package. It is important that at every step of the developmental process, one has to be resourceful. The whole process of development of Computer Software is a teamwork. You as a teacher, designer of the software must play a lead role.

### 11.10 UNIT-END ACTIVITY

1. Select a small unit from your subject. Try to develop a design for CAL. Discuss it with your friends.

### 11.11 ANSWERS TO CHECK YOUR PROGRESS

1. 1 — c  
   2 — d  
   3 — b  
   4 — a

2. ii), iii), v).

3. e)

### 11.12 SUGGESTED READINGS


