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# UNIT 5 SYSTEMS APPROACH

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## 5.1 INTRODUCTION

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In Block 1 we presented a detailed discussion on curriculum design and development; we also discussed evaluation of a curriculum. In other words, by now you have a fair idea of the concept of curriculum planning, curriculum development and curriculum evaluation. Blocks 2, 3 and 4 deal with transaction of curriculum. And, you as a teacher, have to play an important role in effective transaction of the curriculum.

In this unit we examine the concept of systems approach in detail. The systems approach, which is a means to looking at a problem in a holistic way, helps solve problems and improve the working of existing systems. We shall, therefore, discuss in this unit the applications of systems approach to education in general and instruction in particular.

The word 'system' is used by scientists from various fields such as Sociology, Polity, Management, Communication, etc., and it is also used by a layman. While using the term all of them refer to the 'wholeness' aspect of something. When a layman comments that the transport system in a city is good, he does not refer to only one particular bus route; he refers to the entire transport arrangement. The same applies to caste system studied by a sociologist or ecosystem studied by a biologist.

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## 5.2 OBJECTIVES

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After studying this unit you should be able to :

- state various characteristics of a system;
- define an instructional system;
- relate the process of instruction with that of learning;
- describe the components and subsystems of a given instructional system and explain their interdependence;

- identify causes for inefficiency of a given system; and
- describe the input-process-output model of a system as applicable to any instructional system.

### 5.3 LEARNING AND INSTRUCTION

'Learning' and 'Instruction' are two terms used very frequently in all the courses of the B.Ed. programme. These terms are being used interchangeably in this programme as well. However, both these expressions have specific meanings and hence functions. Let us clarify both the terms before we proceed further and study the concept and applications of the systems approach to the teaching-learning process.

What is learning and how does it take place? These questions and the entire process of learning have been discussed in detail in Course ES-332. Here we shall just present in a nutshell two broad views about learning.

Different schools of thought look at the learning process differently. The behaviourist school of thought explains learning as change in behaviour of individuals. The cognitivist school of thought considers learning as a change in the **cognitive structure** of the individual. Using both the views about learning, we may define it as change in behaviour and in the cognitive structure of an individual. In other words, when an individual learns, he shifts from an initial cognitive structure with its own corresponding behaviour, to a different cognitive structure and its corresponding behaviour.

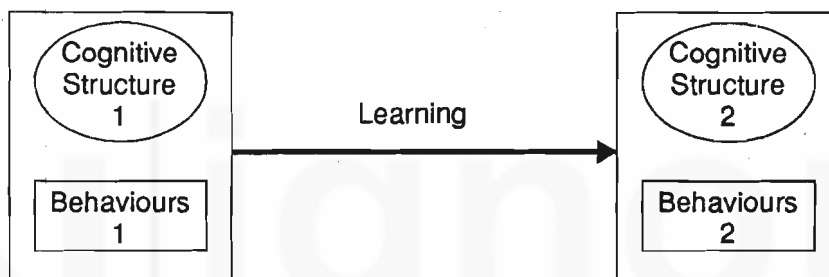


Fig. 5.1 : Process of Learning.

Now let us consider the question 'how does learning take place?' According to the behaviourists learning does not take place in an individual in isolation. The individual interacts with one or more components in the environment which results in some learning. This environment may be natural or specially created for learning to take place. Instruction refers to learning in specially created environment.

A child or a learner interacts with his environment. He learns many things through his interaction with the environment he lives in. Learning also can be brought about in a pre-specified manner. One has to organise various components in a desired way so as to provide an opportunity to the learner to interact.

Hence instruction may be considered as a process of providing a controlled environment consisting of various components with which an individual interacts and gains experience, leading to the attainment of certain pre-specified learning outcomes.

According to the cognitivists, an interaction between an organism and its environment changes not only the organisms outward (overt) behaviour but also internal cognitive structure. And this change may affect the present response as well as the future orientation to the environment. This implies that the process has led to the development of or some modification in the organisms conceptual structure. The organism (the learner in our case) assumes an active role in its interaction with the environment. And, hence, the controlled environment provides a congenial and facilitating influence on the learner to develop within his cognition, his own unique conceptual schemas and logical structures.

Whether we accept a behaviouristic or cognitivistic explanation of learning, the organisation of an effective environment that promotes and supports learning becomes essential for learning.

This organisation of the environment may be in terms of activities such as giving a lecture,

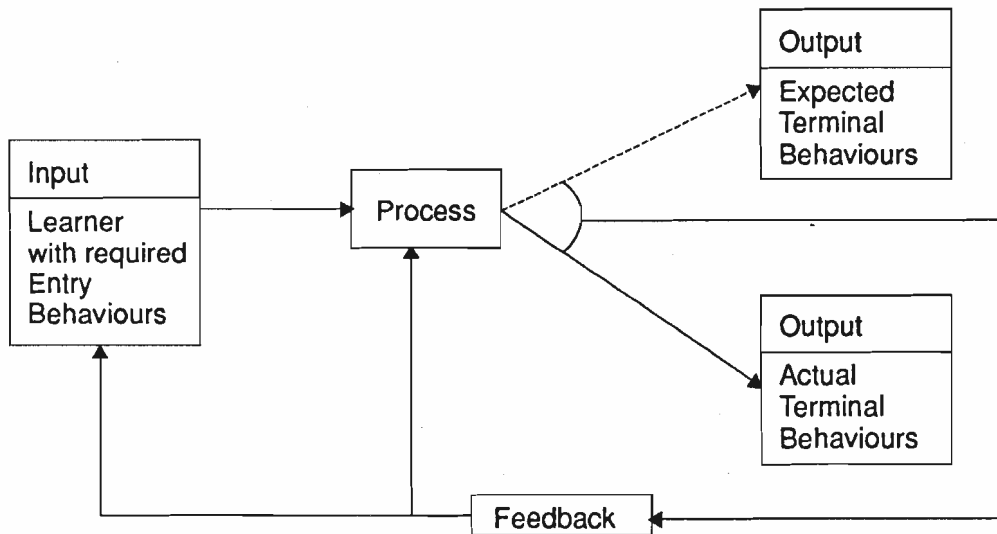


Fig. 5.2 : Model of an Instructional System.

demonstrating an experiment, organising a field visit or showing a film. But why do we have to organise these different activities? Certainly they are needed so that learning takes place. Now let us take a look at the activities suggested above. Every activity has a specific function to perform e.g. a lecture presents information in a systematic manner, a demonstration encourages learners to develop the skill of observation and an attitude of enquiry, a field visit will give them first-hand experience of various processes while showing a film e.g. on the Polar Satellite Launching Vehicle (PSLV) Project of India may create interest in the learners about the new technological developments in our country. You must have observed that though these various activities are used for achieving different objectives, they are interrelated and interdependent so long as they aim at a learner's development. Then these activities do not remain discrete events, they become meaningful components of your controlled environment. This controlled environment and its various components constitute a 'system'.

Let us study in detail the concepts related to 'system' and 'systems approach' in the next section.

**Check Your Progress 1**

- i) Encircle the most appropriate answer.  
Learning takes place in an individual in
  - a) only natural environment
  - b) controlled environment
  - c) both natural as well as controlled environment.
- ii) Encircle the most appropriate answer.  
Both Cognitivist's and Behaviourist's schools agree on
  - a) changes in the cognitive structure
  - b) the learner being a passive organism
  - c) behaviour change as the most significant aspect in learning
  - d) provision of suitable environment for learning.
- iii) List 5 activities a teacher may use to create a controlled environment.

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The term "system" means systematic analysis and development of any task/activity to take appropriate decision. Systems approach brings to the teaching-learning process a scientific approach for solving instructional problems and accomplishing desired objectives. In other words, systems approach is a problem-solving method of analysing the educational process and making it more effective.

### 5.4.1 System : Meaning and Concept

Let us try to understand the concept of a system with the help of some concrete examples. A watch is a system but the parts of the watch separated and kept in a tray do not constitute a system. Similarly, the human body has a digestive system for digesting the food and converting it into nutrients. Various parts of the digestive system put separately do not constitute the digestive system.

Let us study various characteristics of system with the help of these two examples. You must have studied various those parts of the digestive system. They are also called components of the digestive system. You are aware that every part i.e. component of the digestive system contributes to and supports the functioning of the digestive system as a whole. Thus one may say that a system consists of some components; each of these components contributes to and supports the functioning of the system.

If one is suffering from toothache, the mouth component will not function properly which in turn will affect the functioning of other body systems including the digestive system. Or, if all the components are working in unison, the efficiency of the digestive system will increase. This happens because all the components of digestive system are interrelated. Change in one component in its structure or function-affects the functioning of all other components directly or indirectly and of the system as a whole. This means that various components of a system are interdependent. If one component of a system is affected the whole system gets affected. The components come together to form a whole.

A car, a school library, a grinder are some other examples of system. The digestive system is geared to digest the food, the school library system creates interest in the students about reading and provides information, a grinder grinds the grains into flour.

From the above discussion, three main characteristics of a system emerge. These are as follows :

- A system has certain functions to perform.
- A system has many components/parts each of these may have a different function to perform but all of these together contribute to the function(s) of the system.
- The components of a system are interrelated and interdependent.

Thus a system may be defined as an entity which consists of interrelated and interdependent components, and works towards the attainment of certain functions.

We have seen above that a system is made up of various components, e.g. a mouth is a component of a digestive system. But the mouth itself constitutes many other components such as teeth, tongue, salivary glands and so on. Hence the mouth can be called a subsystem of the digestive system. Every system consists of subsystems. Fig. 5.3 illustrates the relative nature of a system.

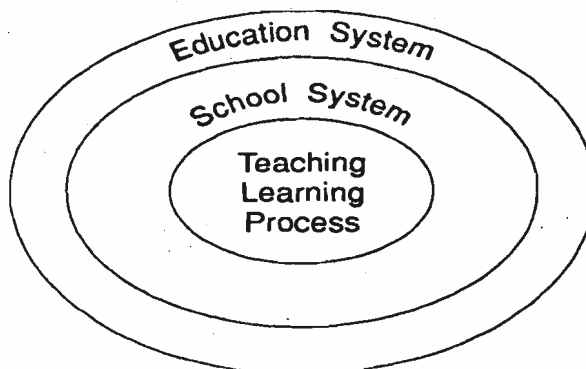


Fig. 5.3 : Relative Nature of System.

A human being is a super system whereas the digestive system is a subsystem of humanbeing. The term 'system' is therefore relative. Any system, except the largest one and the smallest one, can be viewed as a subsystem, or a super system of some other system. The relative nature of a system implies that the system does not work in vacuum or isolation. It is surrounded by other systems which form its environment. The system may or may not interact with its environment but the environment continuously influences the system. There is a flow of information from the environment to the system. It is up to the system to accept or reject this information and to make appropriate changes in itself if necessary. Let us take the example of a pendulum clock. The temperature in the environment has an effect on the length of the pendulum — during winter the length will decrease and during summer it will increase as the pendulum is made of a metal. This increase or decrease in the length of the pendulum will affect the functioning of the clock (it will not show correct time), in winter it will go a little faster and in summer it will slow down a bit. If the clock system does not recognise the changes in temperature and make appropriate changes in itself, it may be called a closed system, but if there is an inbuilt mechanism to control these temperature fluctuations and make changes in the system so that it shows accurate time the clock system may be called as an open system. The excretory system in the human body is an example of an open system. When it interacts with its environment, it makes appropriate changes in the functioning of its various components to maintain body temperature constant.

### Check Your Progress 2

State whether true or false.

- i) Primary education system is a sub-system of higher education system
- ii) School system is a super system of school library system
- iii) A closed system can achieve its goals more efficiently
- iv) A system must have components
- v) All the parts of the system may not interact with each other directly


### 5.4.2 Input-Process-Output Model of a System

The system that we are concerned with includes the aspects and components of the educational process, viz., students, teachers, curriculum/syllabus, teaching methods and media, school/classroom environment, and evaluation procedures. The systems approach helps both the teacher and the students to achieve terminal objectives in the most effective way.

Let us now study how a system works. You have seen that every system has specific functions to perform or goals to achieve. These can be termed as outputs. In the case of a clock, the function or the goal is to show time accurately. Similarly, the school library may aim at providing its students one book per week.

Now, in order to achieve this output the school library, for example, requires some input such as certain minimum number of books. This relationship of input and output is shown in Fig. 5.4 (a).



Fig. 5.4 (a) : Input-Output Model of a System.

But by just possessing a requisite number of books, the output will not be achieved. The librarian will have to plan and develop certain procedures for storing, issuing and returning books (and also for motivating users). These procedures form a part of the process. Now the above relationship of input and output is modified as shown in Fig. 5.4 (b).



Fig. 5.4 (b) : Input-Process-Output Model of a System.

The librarian would also like to know whether the goal (output) of issuing at least one book per student per week is achieved or not. This implies that the librarian would have to compare the actual output with the expected output. If the difference between the expected and actual output is minimal, the system is effective and efficient. If this gap widens, the system becomes less effective and less efficient. If the gap widens a little more, the librarian would have to study the problem area. He therefore, has to develop a feedback system which would give him information about this gap between the expected output and the actual output. This may be represented as shown in Fig. 5.5.

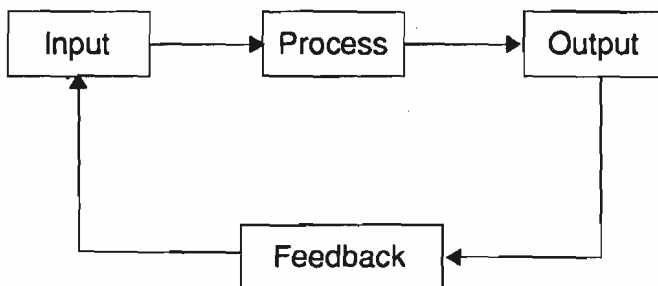


Fig. 5.5 : Feedback-based Model of a System.

One may have to modify the procedure (process) or the inputs (number of books, number of cupboards, number of library assistants, etc.) to achieve the expected output/goal. Or one may even like to rethink the expected output considering the constraints on the inputs.

In the educational system, the planned input (learning material) and process (learning strategies) are organised to cater to the needs of the students. The learning material is sequenced in such a way that it leads the student to achieve the desired standard of output i.e. terminal performance. Monitoring the system through feedback help improve, revise and evaluate each component of the system. This discussion shows that the system can be represented as an input-process-output model.

### 5.4.3 Systems Approach

The input-process-output model of a system also brings out another dimension of the systems approach. It is a way of looking at things, processes or problems. Instead of attacking the problem in an arbitrary manner, the systems approach helps solve the problem systematically. So the systems approach is a tool to be used for solving educational problems more efficiently and effectively. Systems approach can also be looked upon as a mode of thinking that emphasises problem identification and problem resolution. It enables an individual to define the problem precisely, consider the alternatives available and to choose the most efficient alternative (on the basis of the performance criteria) to solve the problem and achieve the goal(s).

As systems approach is basically a process of problem solving, it can be applied to many areas in the field of education, such as instruction, research, management of educational institutions, curriculum development and so on. One may apply it to any problem situation as the process and the mode of thinking remains the same.

Though systems approach can be used in solving educational problems, we will study the application of the systems approach specifically to the area of instruction.

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## 5.5 SYSTEMS APPROACH TO INSTRUCTION

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Educationists define the systems approach as an approach which aims at finding the most efficient and economically cost-effective methods for solving educational problems scientifically. The systems approach provides a framework for all the factors that influence the solution of educational problems or the achievement of objectives. In the teaching-learning process, the systems approach takes into consideration all available learning resources, content, learning experiences, methods and media to achieve the given set of learning objectives. Thus the systems approach focuses on the student and the performance required by him/her.

In order to use the systems approach the instructional system designer has to go through following stages:

- **Specifying the output**
- **Preparation of evaluation procedures**
- **Identifying input specifications**
- **Designing the process alternatives**
- **Selection of the best alternative**
- **Planning for learning experiences**
- **Tryout, and**
- **Revision and implementation of the system.**

Let us discuss each of these stages in detail.

### 5.5.1 Specifying the Output

If we consider a macro level example (e.g. implementation of new curriculums of Grade IX), the broad and specific objectives of the curriculum become the stated expected outputs. These may have been expressed in terms of cognitive, affective as well as psychomotor development. While formulating these objectives, the learners' entry behaviour has to be taken into consideration.

The specific instructional objectives are stated in terms of observable and measurable terminal behaviours. These terminal behaviours which are expected from the students after going through the instructional system are the output specifications of the system. These output specifications help design the instructional system of course implementation for Grade IX. Then the whole process of system development gets geared to achieve these objectives. The first step in the development of an instructional system, therefore, is to specify the expected terminal behaviours.

### 5.5.2 Preparation of Evaluation Procedure

How does a system designer know that the learners have achieved the expected terminal behaviours after going through the instructional process? Obviously, some evaluation procedure has to be developed for this.

The performance of the students is tested at the end of the process. For this purpose, the system designer has to prepare test items representing the expected terminal behaviour. As these items in the test form the criteria for understanding whether all expected terminal behaviours have been achieved or not, the test can be called a "criterion test". Results on the criterion test provide feedback to the system designer at the end of the process.

As an instructional system designer, you should be interested in getting feedback, not only at the end of the instructional process but also during the process. For this one has to develop tests with items representing behaviours expected at various stages of the process. These tests are called "formative tests". Results on formative tests provide feedback to the system designer even during the process and hence desired changes can be made in the process to make it more effective and efficient. Annual school examinations can be termed "terminal tests" whereas the unit-end tests can be termed as "formative tests".

### 5.5.3 Identifying Input Specifications

In order to achieve the specified outcomes, the students are expected to have certain entry behaviours (pre-requisite knowledge). The system designer may like to specify the same and prepare a test to ensure that the student possesses the necessary input specifications. The same can be stated in terms of knowledge, skills as well as attitudes.

### 5.5.4 Designing the Process Alternatives

Once the expected objectives (terminal behaviours) have been specified and the required entry behaviour ensured, the system designer can plan the process necessary for achieving those objectives. In the case of an instructional system, the teacher-designer of a system should think of a variety of teaching-learning methods and media which can be employed for achieving the desired objectives.

The selection of methods and media may vary according to the type of objectives e.g. if our objective is that the student will be able to state reasons for the spread of a disease, a set of lectures and some supplementary charts could be used and the terminal objective achieved. But if the objective is that the student will be able to classify the animals on the basis of their characteristics, the use of lectures alone will not be adequate. The teacher needs to show actual specimens, use questioning technique and group assignment, etc., for this objective. Thus if the educational objectives differ, the method and media used for achieving them will also differ. But even for achieving one set of objectives, there may be a variety of methods and media, e.g. in order to develop observational skills in the learners, you may arrange a visit to a botanical garden or an exhibition of variety of plants available in the vicinity or even use small group techniques giving specific specimens to different groups of students. This shows that various process alternatives can be identified and used depending upon the objectives.

### 5.5.5 Selection of the Best Alternative

After preparing various alternative processes, the best among them or the most suitable alternative(s) should be selected. Criteria for selection of the same can be as follows:

- i) **Nature of the subject (discipline) :** Every discipline has its own characteristics and methods of study e.g. the natural sciences, such as Physics, Chemistry, Biology, etc., demand experimentation, demonstration, field visits and observations to be used as instructional techniques to achieve the desired objectives whereas objectives in disciplines such as History can be achieved through lecture, narration, debates, group discussion, etc. The methods and the appropriate media have, therefore, to be selected keeping in mind the nature of the discipline and the topic being taught.
- ii) **Availability of resources :** For using any particular set of method and media certain infrastructural facilities such as space, electricity, seating arrangement, furniture, etc., are needed. One can select a process keeping in mind the availability of necessary resources.  
Availability of time and financial resources are two other criteria which determine the selection of the most suitable process.
- iii) **Size of the class :** Generally the class size ranges from 40 to 80. If there are 80 students in the class, using a 21" TV is not advisable. Media such as slides, OHP transparencies (refer Unit 17, Block 4 of this course) can be used very effectively in such a situation. One may use question-answer session or a panel discussion for a large class whereas small group discussion can be used for a smaller class. Hence, the size of the group of students in a class also determines the selection of suitable techniques and alternatives.
- iv) **Human resources :** Most of the methods and media demand certain types of skills from their users, the teachers in this case. If the teacher lacks the necessary skill of using an OHP or the skills of conducting group discussion, s/he may hesitate to select and use these techniques. And in such a case s/he may not succeed at achieving the objectives.

In order to use team teaching, the teacher must possess different sets of skills, and also must get co-operation from the colleagues.

Teachers trained in various skills are the resources for an instructional system. The availability of such resources is also a very important determinant of the selection of the best alternative.

### 5.5.6 Planning for Learning Experiences

Once a suitable alternative has been selected, the next step is to prepare the material needed for providing appropriate learning experiences. For example, one may decide to use the lecture method supplemented by other media, like chalkboard, charts, models and techniques such as questioning. One then has to prepare/select the charts needed for giving the intended messages, prepare a model or a chalkboard summary (points to be written on the chalkboard), and also list questions to be asked. These activities then can be logically arranged in order to facilitate effective learning.

### 5.5.7 Tryout

Now we have decided about the components of the system and prepared the necessary material. But how do we know that it would work? After the development of the instructional system, one should find out whether the system is effective in terms of attainment of objectives. For this we have to test the system on a small group of students in a controlled situation.



After the tryout on a small sample and its subsequent revisions, the system should be tried out on a large sample. We are now taking the instructional system from the laboratory situation to the field. This is known as **field tryout**. It is possible that a few mistakes may be identified through the tryout. These mistakes or the weaknesses of the instructional system have to be rectified and thus the system has to be improved.

### 5.5.8 Revision and Implementation of the System

The task of revision takes us to the final stage of an instructional system. But this does not mean that the system is now perfect. As far as the developmental process is concerned, the revision based on the field tryout, leads to the final form of the instructional system. However, during and after every implementation of the system, we collect some information about its functioning; this help us modify and improve the instructional system. Revision is thus a continuous process.

Fig. 5.6 lists the various steps involved in the development of the instructional system using the systems approach and the sequence of activities:

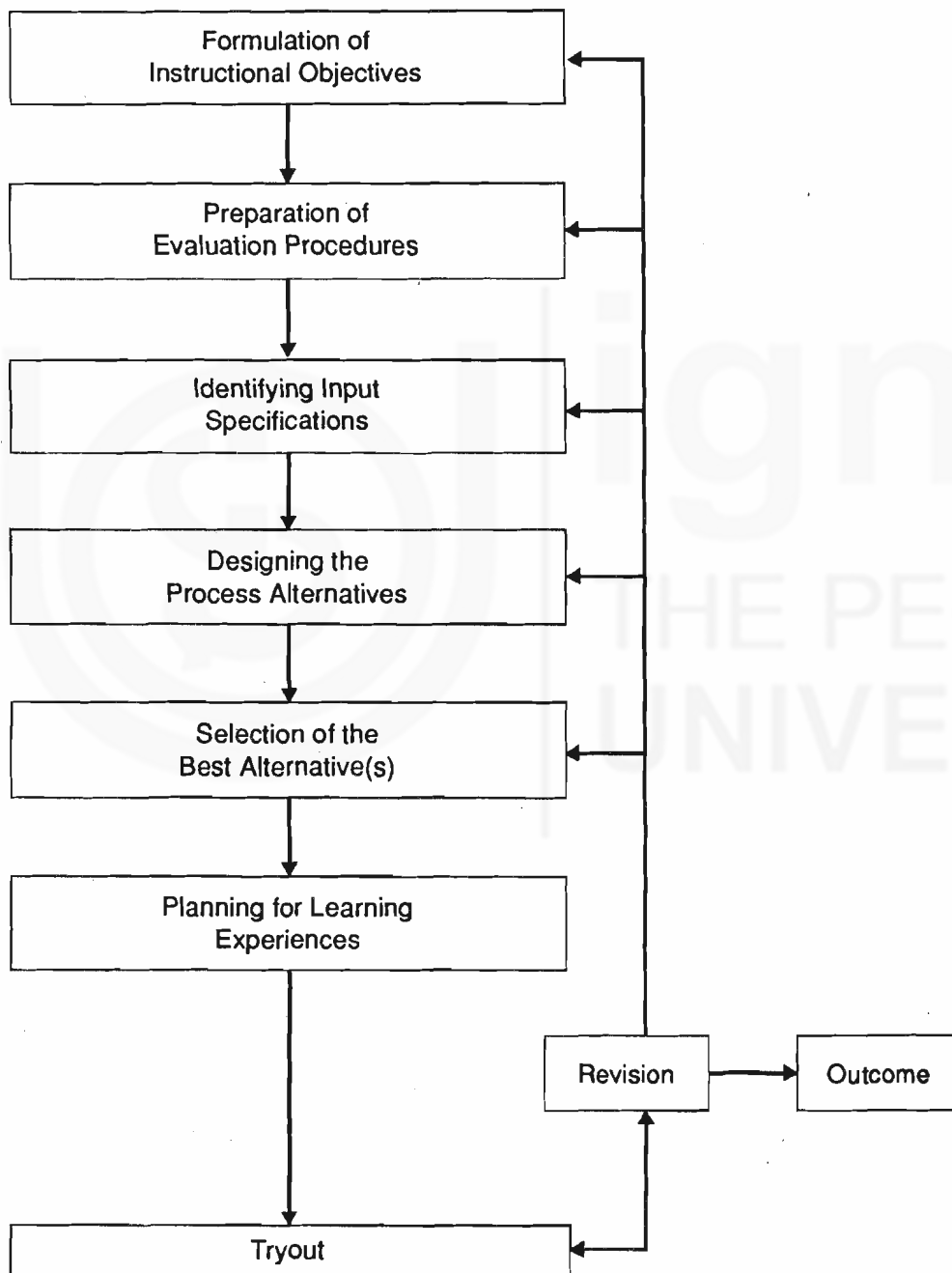


Fig. 5.6 : Steps Involved in the Development of Instruction System .

**Check Your Progress 3**

**Notes:** a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the unit.

i) List any three criteria for selecting the best alternative for instructional process.

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ii) Give two examples of feedback which can help system designer modify the instructional system and make it more effective.

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iii) In what respect does information provided by a formative test differ from that provided by a terminal test?

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**5.6 ROLE OF TEACHER IN INSTRUCTION SYSTEM**

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We have discussed above the input-process-output model of an instructional system. Where would you put teacher in this model? If one visualizes the teacher's role as an "input" one may be labelled a "traditionalist". Yes, the teacher can be considered as one of the instructional inputs. Other such inputs may be self-learning material or media such as computer.

Now consider the teacher's role in an instructional system where he/she is deciding instructional methods and media to be used for effective learning (for achieving desired outputs) e.g. using tape-slide programme for a seminar method. In such a situation, the teacher's role can be visualized as a **systemist** or a **system designer** and not just as an 'input'. She/he decides which methods are to be used in combination, which media/material are to be used and to what extent. In fact she/he designs a new system (or improve upon an existing system, if need be). In the role of a systemist or system designer, the teacher is outside boundaries of the system. His/her job is to create and improve the system rather than be a mere participant of a sub-system within the instructional system.

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**5.7 LET US SUM UP**

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The major responsibility of a teacher is to plan and carry out instructional activities taking into account the needs and capabilities of the students, resources available at his/her disposal and the constraints operating on him. He should be interested in assessing how far he has been successful in this process. In order to do this he can use various tools, one of which is the systems approach.

In this unit we have attempted to acquaint you with this approach. Systems approach is useful not only in developing an instructional system but also in solving many other problem in the field of education. Systems approach should ideally be part of our problem-solving process.

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## 5.8 UNIT-END EXERCISES

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Select any existing system in your school which you wish to improve or a system that you wish to develop (e.g. school library, teaching aids room, school office, a particular teaching unit in your subject, the school museum, etc.).

Analyse this system into its components or sub-systems. Show their relationships with each other through a diagram. Identify resources and constraints.

Also identify processes required to be instituted in this system for effective functioning. Suggest a feedback mechanism. (You may not be able to complete the exercise in one sitting.) Discuss with your colleagues and friends various stages of analysing and developing the system.

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## 5.9 ANSWERS TO CHECK YOUR PROGRESS

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1. i) c  
ii) d  
iii) These activities may include use of lecture, a film show, demonstration, a group discussion, use of charts and posters, etc.
2. True statements : (ii), (iv), (v)  
False statements: (i), (iii).
3. i) You may include the following: Nature of the subject to be taught, availability of resources, class size, teacher and other experts also have mastery over the knowledge and skills related to the desired instructional objectives. (Refer Section 5.5.5)  
ii) Your examples are correct if they resemble  
(a) A particular objective is achieved only by 40% students in the class or  
(b) Out of 10 instructional objectives only 3 are achieved in a specified time.  
(c) A student could solve only 5 examples out of 10 correctly.  
iii) Information provided by the formative test can be immediately used before going to the next step. It helps the teacher diagnose the weaknesses in the learners or in the process and rectify them. The terminal test on the other hand provides information about the attainment of terminal objectives. The feedback received from terminal test can be used for modifying/improving the system.

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## 5.10 SUGGESTED READINGS

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