Instructional System

Introduction
The primary objective of higher education is to make the students reach the frontier of knowledge. Therefore, teaching them is the main job of teachers of higher education. The universities and colleges, therefore, have different instructional processes involving different materials; styles approaches. These processes are developed by teachers themselves to make the students learn. To make the students learn in a better way, there is a need of materials, gadgets, personnel, time, and space, etc. The scientific arrangement of all these components in proper order and their implementation only will cause effective learning. The proper arrangement of components to make the students learn and teachers teach is instructional system.

The present unit presents the various aspects of instruction, supported by suitable illustrations and the development of the instructional system. The unit also presents the introductory framework or perspective for the subsequent units of this course.

Learning outcomes
At the end of this unit, you will be able to:

- state the meaning of instruction and instructional system;
- interpret the concept of a system as an aggregation or assemblage of elements united by their interaction and interdependence, to form a whole;
- interpret the instructional system using the input-output model;
- describe the meaning of systems approach with illustrations;
- enumerate the various stages involved in the systems approach to instruction;
- identify the elements of a given instructional system;
- state the various considerations for selection of instructional inputs;
- explain the concepts of effectiveness and efficiency in the context of instruction;
- describe the roles of a teacher in instruction as that of an input and a systemist;
- apply the concepts of systems approach to instruction, to improve on the existing systems and evolve new systems; and
- identify the inadequacies/inefficiencies/ineffectiveness in a system.

Learning and instruction
Learning and Instruction are terms used commonly in classroom situations. Let us see what these mean.

Learning
Learning is a term we use quite often to express varied things. We, as teachers, are interested to see that all students learn well. You may be a teacher in a college or university.
Or, you may be one who is interested in entering the teaching profession. In any case, all of us have the experience of learning. You would surely have our own understanding about learning. Why don't you try to express your own definition of learning?

**Activity**

1. What is learning?

You might have defined learning as one or more of the following or something similar to any of these:

- knowing laws and definitions;
- being able to perform certain things such as experiments, calculations etc.;
- being able to read, write, speak and comprehend a language;
- being able to solve problems or make decisions applying knowledge;
- memorization.

Yes, you are in the right direction. All these and many more, take place due to learning.

What is learning? How does it take place? What are the conditions required for learning? These questions are discussed in detail in Course 3 or in any book on psychology of learning. In this Unit we may not discuss these issues in such detailed manner; however, some clarification in this regard may be necessary. There are different schools of psychology looking at the learning process differently. The Behaviourists’ School of Psychology explains learning as a change in the behaviour of individuals. The Cognitivists’ School of Psychology considers learning as a change in cognitive structure of the individual. The constructivists view learning as the construction of new learning experiences by the learner which is a result of the interplay between cognition and the social context in which the learner is situated. We may not debate on this issue here, but will consider both the views for giving a simple definition for learning. Learning may be regarded as a 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 corresponding behaviour, to a different cognitive structure and its corresponding behaviour.

Suppose a student understands the reasons for the spread of a contagious disease and the need of taking precaution against the disease which he did not understand earlier. Now that he understands, he will take all the precautions for that disease. This will, therefore, be reflected in his behaviour. Further, when certain acts are performed, he will know and understand certain other aspects of the phenomenon. So change in cognitive structure and change in behaviour of individual are complementary to each other.

The second question still remains. How does learning take place? Let us see what explanation the Behaviourists’ School of Psychology has, for this question. Learning in
an individual does not take place in isolation. The individual interacts with one or more components in the environment which result in learning. Let us now examine this process of learning in more detail.

**Figure 1: Learning in natural environment**

As you know, environment consists of living and non-living things. For an individual, everything other than him/her is part of the environment such as air, water, food, light, wind, plants, animals, other human beings, and many more. Take the example of a child. He interacts with various sounds existing in the environment, and tries to imitate and utter similar sounds. He learns many things through the interaction. While he learns many new things from his elders; his elders also learn by interacting with the child. Hence, when an individual interacts with another individual in his environment and learns, for the second individual, the first one is part of the environment.

**Figure 2:** That boy Isaac Newton will never learn! He sits under that tree every day and gets hit by falling apples!

*Courtesy: R.K. Laxman*

In college and university also the students learn by interacting with teachers, classmates, equipments, chemicals and other such components that are designed purposely to cause students' learning. This type of learning generally happen in a formal way and, therefore, many experts called it as formal learning.

**Instruction**

In a natural environment an individual interacts with the components of the environment in an informal and unorganised manner, leading to unanticipated or unspecified learning. However, attaining pre-specified and desired learning would depend upon the provision of a controlled environment for the individual to interact with. Instruction involves the provision of a controlled environment with which the individual will interact leading towards the attainment of certain pre-specified learning outcomes or instructional objectives.
Hence, instruction may be considered as a process of providing a controlled environment consisting of various components with which an individual/individuals interact and gain experience, leading to their attaining certain pre-specified learning outcomes.

Instructional Objectives Individual in Close interaction --------------- Attainment of Instructional objectives.

![Diagram of controlled environment with individual in the center, interacting with the environment to achieve prespecified learning outcomes.](image)

**Figure 3: Learning in controlled environment**

The main contention is that an interaction between an organism and its environment changes not only its outward (overt) behaviour but also the internal cognitive structure. And this change may affect the present response as well as the future orientation to the environment. This implies that this process has led to development or modification in the conceptual structure. The organism (learner) 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 schemes and logical structures. (Refer Course 3 for more details on concept of learning)

We discussed a lot about controlled environment. One may accept the Behaviourists' explanation of learning or that of the Constructivists or the Constructivists. In all cases, for learning to take place organisation of an environment becomes essential. As a teacher how would you organise this environment?

**Activity**

2. List the specific things you will include in your learning environment for teaching any topic from the subject of your choice.

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You might have listed so many things. Some of you may like to give a lecture, organise a discussion on certain major issues, give a demonstration of an experiment, assign an activity for the students, and suggest a couple of books for them to read from the library and so on. Others might have also similar things. But, why you think these different activities are to be organised for the students at all?

You may say that all these are needed for learning. Each of them has its own function and thus all are useful. The lecture will give them some information, the discussion will help in clarifying the issues and developing a higher level of thinking, the library reading will provide additional information and so on. It is also obvious that the points clarified in the discussion are related to the information given in the lecture and additional information that obtained through the library reading. Such relationships would be there among other components too. Hence, you may find that the various activities you decide to organise have interrelationships and interdependence. This controlled environment which you have tried to generate for the learning of students, is attaining the form of a system. Let us discuss more about systems in the next section.

Self-assessment

1. Encircle the most appropriate answer.
   i) Learning takes place in an individual in
      a) only natural environment
      b) controlled environment
      c) both natural and controlled environments
   
   ii) Both Cognitivists’ and Behaviourists’ 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) In college and university, teachers mostly provide
      a) nothing and the students learn anything in any manner.
      b) a controlled environment for students’ learning.
      c) natural environment for students’ learning

2. Assume that you are preparing to teach a unit from your subject to undergraduate students. List at least 5 components you would include in the controlled environment that you would organise.

Concept of System

Let us try to understand what is meant by a ‘system’. For this we may take the example of a car. What are the different parts of a car? The brake, steering and clutch are three parts.
Activity

3. List a few more parts of a car.

Yes, there are many more parts. The gear, the radiator, the battery, the wheels, the carburetor, and the ignition are a few more. There are some more parts and, all these together become a car. One may ask that why we need all these parts. All these parts are required for the car to perform various functions. And hence, all these are ‘components’ of the car.

Suppose the gear is not working properly or, suppose the break is not working, in either cases the car will not be able to perform its functions properly. Thus, it is clear that if any component of the car does not function properly, it affects the functioning of all the other components and that of the whole car. This shows that the components are interrelated and interdependent operating towards the car’s effective functioning.

Figure 4: Components of a car — Not a system, A complete car — A system

It may be seen that we are slowly developing the concept of a system with the example of a car.
Yes, most of you must have mentioned the following:

A car has certain functions to perform.

It has a number of components which operate together.

The components operate in an interrelated and interdependent manner towards the effective functioning of the car.

With all these characteristics, a car becomes a system. Thus, a system has a number of components operating together in an interrelated and interdependent manner towards the attainment of certain functions.

Suppose we start a car and set it into motion by suitably fixing the gear and adjusting the accelerator at the beginning and allow it to move in without the driver. Yes, if it is a straight road, it will go on moving. But will it be able to react to any thing that happens outside it, such as another car coming, a person walking in the front or a turning in the road? No, it will not. The car without a driver as part of the system cannot take in any information from outside and adjust it accordingly. Thus, it may be called a closed system.

A closed system is one which does not accept new information and which has become detached from interfacing with other systems outside.

Now, let us consider the car along with the driver as one system. In this case, the system becomes better suited for turning the car when the road has a turn, or stopping the car when there is an obstacle of some sort. Thus the system, consisting of the car and the driver, together becomes an open system. An open system is one which accepts information from its interfacing systems and is capable of adapting to new circumstances.

From the above discussion it may be clear that a system does not work in a vacuum. It is surrounded by other systems with which it has to interact. These form the environment of the system or system environment. There is flow of information between an open system and the environment and it adapts itself to the needs generated by the environment. On the other hand the closed system does not accept new information from the environment and thus remains detached to it.

We saw earlier that in the case of the car as a system there are many constituting components viz. gear, carburetor, brake, etc. Each of these components, by itself, has separate functions to perform and consists of various parts within it. A gear for example has a gear handle, different teeth wheels for different gears, etc. This means that the gear also has the characteristics of a system. And, hence the different components may be seen as the sub-systems of the main system. Each of them on its own may be considered as systems such as the gear system, oil flow system, and the brake system.

Hence, for an integrated set of components, to be considered as a system or a subsystem, is a relative matter. If one considers the car as a system, the gear, brake, etc. become sub-systems. But, if one considers the gear chamber as a system by itself, then the other components of the car become the environment of the gear system.
The whole operation of the car is to attain certain objectives, viz. environment, change of speed, stopping, etc. These are some of the system goals of the car. All systems come into existence for achieving some goals. The performance of the system is judged by seeing of the achievement of the system goals.

The human body is a complex system. It constitutes sub-systems such as digestive system, circulatory system, skeletal system, nervous system, etc. Each of these sub-systems has well defined parts which are related. The collective functioning of these systems keeps the human body fit and healthy. So also is the case with an orchestra party. If each component of the party does not function, it becomes an incomplete system.

Figure 5: An incomplete system

Whether a car or a human body, if a system has to function effectively, it should achieve its pre-determined goals.

Let us take a look at a new example of system - a cloth mill. What is expected of a cloth mill? We all know that the cloth mill produces cloth. So, cloth is the product from the cloth mill. As the product comes out of the system, we may call it as the output. We know (even if we are not textile engineers), that to produce finished cloth one requires some raw material, machines and chemicals. These are put into the system and hence these may be called the Input. The required raw material and chemicals are processed in the machines and later they weave the cloth.

$$\text{INPUT} \rightarrow \text{PROCESS} \rightarrow \text{OUTPUT}$$

How does one decide the input material and design the process of manufacture of cotton cloth? Naturally, the nature and type of the input material would depend upon the type of cloth one wants to produce. But, if the expected type of cloth is not produced even after the inputs are put through the process, what does this show? It shows that the design of the process is not proper. Hence, the expected output is the main criterion in deciding the nature of the input material and the design of the process. The selected input material goes through the designed process to produce the actual output. The actual output need not always be exactly same as the expected output. The difference between the two
provides information for either the modification in the selection of inputs, or the designing of the process. In other words, this information is the feedback provided to the selection of inputs and the designing of the process.

The following diagram attempts to consolidate the various aspects of the cloth manufacturing system with the help of the Input-output model.

![Diagram of cloth manufacturing system](image_url)

Figure 6: Input-output model

In the preceding section we had a discussion on the systems approach to an industrial situation with the example of a cloth manufacturing system.

### Self-assessment

3. A few statements are given in the following. Put a tick (✓) against those statements which are true of the concept of system and put a cross (×) against those which are not true.

   i) Every system consists of interrelated interdependent components.
   ii) The open system is an unchangeable entity.
   iii) Closed system interacts with the environment.
   iv) A system is surrounded by the environment with which it interacts.
   v) System works with definite set of goals.
   vi) When inputs are processed outputs are expected to be produced.
   vii) Driver in a car changes the nature of the system.

4. Complete the gaps in the following system model using the terms given here:

   Expected output Actual output

   ![System model](image_url)
Instructional system

Students in the educational system are subjected to many situations to learn various things. These situations are developed deliberately by the teacher. Even before thinking about the topic to be learned and how the students will learn, the teachers think as to what will be the objectives that should be attended by the students. Then only the teacher may think as to what should be the topic/learning experiences that should be organised. To make the students learn, the teachers, therefore, scientifically select the methods and approaches to teaching, different materials needed for interacting, manipulating/studying by students and teachers. Teacher also thinks about the sequencing of the materials and methods to make the students learn in a scientific process. This scientific process is called the instructional system. If we think that certain cognitive changes or behavioural changes shall take place in our students, it is imperative that we design instructional system.

Systems approach to instruction

Let us now try to study the input-output model with reference to the instructional system.

The meanings of instruction and learning are mentioned at the beginning of this module. Instruction involves the interaction of an individual with the organised environment leading towards the attainment of certain instructional objectives. In other words, when students with a certain type of behavioural pattern (and cognitive structure) go through the instructional system, they come out with a changed pattern of behaviours (and cognitive structure). Quite simply, we can say that the students enter the instructional process with certain behaviours. These behaviours can be termed as entry behaviours. They are expected to achieve certain terminal behaviours which can be termed as expected terminal behaviours. The instructional process is designed in such a manner as to achieve the expected terminal behaviours. We may, thus, say that the expected terminal behaviours are what we intend to achieve in students through an instructional process and that the actual terminal behaviours are what they actually achieve. The difference between the expected and actual terminal behaviours is due to the lack of effectiveness in the instructional process. Thus, the difference between the expected and the actual terminal behaviours would act as feedback. In this model, the entry behaviour is the input and the actual terminal behaviour is the output of the instructional system.

Activity

5. Identify the inputs, outputs and the process in an instructional system.

Outputs:

Inputs:

Process:

Let us study in detail the different steps involved in the systems approach to instruction towards the development of an instructional system. Let us suppose that we are now interested in understanding and improving an Engineering programme towards B.E. Degree by applying concepts related to the input-process-output model. The various steps involved in this endeavour are given below:

Formulation of output specifications

An undergraduate programme in Engineering is supposed to produce an Engineer in Civil Engineering or Electronics or Computer, etc., to carry out certain job requirements in actual work situations. Can all these requirements be catered to by an undergraduate
programme? Surely not. Training in certain areas of the job such as those involving very new technologies could be mastered only in the actual job situation. However, the majority of the job requirements have to be catered to by the engineering programme and thus should be reflected in the output specifications. But, one need not necessarily start right from scratch as the students enrolled to the programme might have already attained some knowledge and competencies through their formal education up to the higher secondary level and also through informal learning. Hence while formulating the output specifications for the engineering programme, the level of the students or their entry behaviour at the time of enrollment, has to be kept in view.

Once the task to be achieved by the students is decided, analysis of the task should be done in terms of concrete changes in behaviour. This process of analysing the task involves, defining specifically, the instructional objectives into observable terminal behaviours. These terminal behaviours which are expected from the students after going through the instructional systems are the output specifications of the system. As mentioned earlier, these output specifications help to design the instructional system for the engineering course. Thus, in the development of an instructional system, the first step is task analysis with which to formulate the expected terminal behaviours.

**Preparation of the criterion test**

How will we know, after going through the instructional process, whether the students have achieved the expected terminal behaviours or not? Yes, the students will have to be tested for it. For this, tests have to be prepared with items representing the expected terminal behaviours right at the beginning, just after the terminal behaviours have been formulated. You may wonder why this is necessary; this is because each terminal behaviour should be represented by an item in the prepared test. It is to be ascertained that these tests contain items which represent all the terminal behaviours. As these items in the test form the criteria of understanding whether all expected terminal behaviours have been achieved or not, the test can be called a criterion test. Hence, the second step in the development of an instructional system is the preparation of criterion test.

**Formulation of instructional input alternatives**

Now, that we have formulated the objectives and proposed the criterion test we should think of the inputs. A teacher in an engineering programme can think of large number of methods, media and material to achieve the objectives visualised. Many of these may be available to the teacher. But how does one go about it?

Let us try to identify the different inputs which can provide the suitable learning experiences towards the achievement of instructional objectives. This may lead to a lot of overlapping and repetition in the sense, that more than one may be identified in the achievement of a single objective. In other words, there may be instructional input alternatives identified. But this is not to be avoided; rather, it is necessary to have these alternatives which form the alternative inputs for the instructional system. Let us take an example. A lecture and a well prepared written material of the type you are going through are both found to be having the potential to impart knowledge in the concerned engineering subject to the students. Hence, both these techniques are alternative ways of imparting knowledge. Or in other words, they are alternative instructional inputs to achieve the same instructional objective. There are also other instructional objectives to achieve in an engineering course such as, the development of application ability, and the inculcation of skills. There could also be alternative instructional inputs identified for each of the other instructional objectives. Thus the third step to be followed in developing an instructional system is the formulation of instructional input alternatives.
Selection of the ‘best’ set of inputs

It is obvious that, in a given instructional situation, we cannot or need not, use all these alternative inputs. For example, why should we have long lectures when the same thing is provided as written material and the very same material narrated in an audio cassette? Yes, one need not have all these in the system. One should select the best set of instructional inputs from the alternatives available, so that after formulating the input alternatives, the selection of the ‘best’ set of inputs should be carried out. Thus the fourth step involved in the development of an instructional systems is the selection of the ‘best’, or the most suitable instructional inputs. The considerations for selection of instructional inputs are discussed in a separate section.

Preparation of learning material

Let us suppose that you have selected lecture, discussion, assignment and practical work for your instructional situation. Each of these would require some material to be used when it is organised. Once the ‘best’ instructional inputs are selected, the learning materials should be prepared considering the terminal behaviours and the nature of the selected input. These learning materials should be very comprehensive. These go into the specific situations of learning and hence, their development should take into account, their terminal behaviours. Proper care is to be taken to ensure that learning activities are developed and presented in suitable sequences, facilitating effective learning. Logical continuity can be attained by proper sequencing of the learning experiences. Thereby, the fifth step in the development of an instructional system, is the preparation of learning material.

Laboratory tryout

Now, we have decided the components of the system and 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 achievement of objectives. Details about the effectiveness and efficiency are discussed in a separate section. Effectiveness of the developed instructional system should be determined by testing it in a manner similar to that of the laboratory. This forms the first step in the testing phase in the developmental process of an instructional strategy. Thus the initial testing of the system is known as the laboratory testing or laboratory tryout. Laboratory tryout being the initial tryout, the sample may be small. But, this sample should be a representative one of the population of persons for whom the strategy is developed.

Field tryout

After the tryout on a small sample and subsequent revisions, the system should be tried out on a large sample. We are now taking the instructional system from the laboratory to the field. This is known as field tryout. It is possible that a few mistakes are identified after the field tryout. These mistakes are to be rectified and thus the system has to be revised.

Revision and outcome

Revision takes us to the final form of the instructional system. But this does not mean that the system is now perfect. However, as far as the developmental process is concerned, this revision, after the field tryout, leads to the final form of the instructional system. However, after every implementation of the system, as per the information obtained from its functioning, the system is modified. This is a continuous process.

We may here list the various steps involved in the development of the instructional system involving a systems approach showing its sequence and cyclic nature:
Figure 8: Steps involved in the development of instructional system

Self-assessment

5. For the subject you are teaching can you apply the systems approach to improve the situation? Give your reasons in about 10 lines.

Yes/No.

Reasons.

Selection of instructional inputs

Various alternative instructional inputs are available from which the teacher has to select the best set of inputs. The selection process is a matching between the characteristics and potential of each and every instructional input alternative and the instructional context. Keeping in view the relevant factors of the instructional context, a few considerations become significant. These may be borne in mind by teacher, while selecting suitable instructional inputs. There are five major selection considerations discussed hereunder:

Instructional objectives

Let us consider one example. There are two passengers beginning their journey from Mumbai. The destination of one is Chennai and the other is Delhi. Hence, naturally they cannot take the same route. The route to reach Chennai from Mumbai would be different from that to Delhi. That is to say, that when destinations are different, the route too would be different. Similarly, if the instructional objectives are different, the instructional inputs to achieve these objectives, are likely to be different too.

Let us suppose that a teacher wants to provide some basic information to the students. For fulfilling this objective, the teacher can very well use the method of lecture. But, can a teacher develop the critical thinking and the skills of experimentation through a lecture? No, he may not be able to do so. The teacher may have to adopt a method where, more of interaction and exchange of views between the learner and the teacher and among learners, is possible for developing critical thinking in them. The method of discussion could, perhaps, be a choice here. And, for developing skills of experimentation, laboratory work may be the most suitable instructional input. One naturally cannot develop the skills of cycling by listening to a lecture on cycling!
Thus, we have arrived at one consideration that has to be borne in mind while selecting suitable instructional inputs. This consideration is the **Instruction objective/objectives** that a teacher wishes to achieve through his teaching.

**Learners' characteristics**

As a higher education teacher, you may feel that the learners at under-graduation level would benefit, if you provide them with a written material which is self-instructional in nature (like the material you are going through in this course). Yes, you can rightly say that such materials may be of use in providing basic information to students in the undergraduate class. But, if such a written material is being used by a primary class teacher for the learners of standard I, will you consider it to be an appropriate selection? Obviously not. It would be highly improbable that learners at that level would be in a position to engage in the act of reading by themselves for a long time. This is due to lack of maturity with regard to language ability and other mental abilities. There are many other student characteristics too, such as previous knowledge, socio-economic conditions, home background and study habits, which may vary even within a single age group. These characteristics also may have to be considered while selecting instructional inputs. The instructional inputs adopted must take into account the influence all these factors have on the mental and emotional conditions of the learner. For a group like yours which is expected to have independent study habits and self-initiated motivation, instructional inputs such as self-instructional material, library reading and project work may be chosen as the instructional inputs. From the above discussion, it is clear that the **learners' characteristics** are an important consideration for the selection of instructional inputs.

**Nature of the discipline**

It is true that the various instructional inputs, viz. lecture, self-learning material, discussion, audio-visual presentations, etc., are the methods and media through which the subject matter is presented. The subject matter may differ according to the discipline to which they belong. Every discipline has its own characteristics and structure. For example, for a teacher who wants to teach a topic in Chemistry to the students, a lecture with discussion may not be enough to achieve all the instructional objectives as far as Chemistry is concerned. The teacher may have to demonstrate experiments and organise laboratory sessions where the students get the opportunity to perform practicals where they can experiment with what they have learnt in the class. Similarly, the variations in the structure of discipline also decide what sort of approach is to be followed in the treatment of the subject matter, in the sequencing of experiences, etc. And, therefore, the **nature of the discipline** is an important consideration in the selection of instructional inputs.

**Availability or resources**

Closed circuit television is very effectively used in classrooms in western countries, and instruction with the help of computers is not new to these countries either. In India too, television has been brought to use in the instructional process to some extent. But, in most Indian classrooms, it is evident that one cannot use too many gadgets or instruments due to their non-availability and the expenses involved. Although employment of modern media like: TV, computers, etc., makes teaching more effective, it is the teacher's resourcefulness which is more important. Other, less sophisticated and easily available, media may have to be used as second alternatives to the more sophisticated ones. And hence, the availability of these infrastructural facilities would form an important consideration. Time is also another resource which has to be kept in mind while making the selection of inputs. The instructional time available is another resource consideration which is very significant. **Availability of resources** such as infrastructural facilities and time, is an important consideration for the teacher while he is selecting the most suitable set of inputs for his instructional situation.
Size of group

The number of students in a class in our universities and colleges may vary from as small as 5 or 10 students in a post-graduate class, to as large as 100 or 150 (or even more!) in an undergraduate class. A teacher may think it necessary to conduct group discussion in a class of 100 students. However, the largeness of the class may not be conducive for a discussion session. Instead, it may be preferable to have a question-answer session or a panel discussion by a few students. He may, also, if possible, divide the large group into smaller groups and organise discussions separately. On the other hand, a group discussion session would be very useful and feasible in a group of 20-30 students. Similarly, a teacher may employ the lecture as a major technique in a large group. However, in a small group of about 5 post-graduate students, it is waste of time as well as energy, on the part of the teacher to deliver lecture after lecture. He should instead, try to make use of self-study in the library as an important instructional input. Thus, it is evident that the size of the learner group is an important consideration for the selection of instructional inputs.

Ability of the teacher

There are large number of instructional input alternatives available for the teacher to utilize in the classroom. Each of these requires or demands certain types of skills to be possessed by the teacher for effective organisation. For example, a lecture to be delivered effectively by a teacher would require a number of skills, viz. introducing, explaining, describing, narrating, etc. Very different sets of skills are required on the part of the teacher to conduct discussions or seminars or to develop good self-learning material. Though may be desirable, it is too much to expect that every teacher be proficient in all required skills relating to all alternative instructional inputs. Some teachers may present lectures very effectively, while others may be less proficient in it. Hence, the abilities and skills possessed by a teacher should also be taken into consideration when he selects the instructional inputs for his own teaching.

Self-assessment

6. List the various considerations to be kept in view while selecting instructional inputs for your class:

7. The teacher's ability is one consideration while selecting instructional inputs. Do you think it is a very important criterion? If a teacher lacks the skills to conduct a discussion, can anything be done to overcome this? Give your answer in six lines.

Effectiveness and efficiency

The effectiveness and efficiency are the two indicators of the functioning of any system including instruction. Let us try to understand the meaning of each of these terms in the context of the instructional system.

Effectiveness

Let us recall the process of development of an instructional system discussed, with the help of an input-output model.

![Input-output model](https://via.placeholder.com/150)

Figure 9: Input-output model
We saw that instructional inputs are selected and integrated mainly in consideration to the expected learning outcomes. When the system is organised and the criterion tests are administered, we will be in a position to measure the actual learning outcomes. In most of the occasions, the actual learning outcomes do not coincide fully with the expected learning outcomes, thus creating a gap between the two. This gap shows the difference between the learning expected from the students, and the learning that actually takes place. The effectiveness of an instructional system is the extent to which the actual learning outcome (actual terminal behaviour) approximates the expected learning outcomes (expected terminal behaviour). The lower is the gap between the two, the higher the effectiveness of the system. The higher the gap between the two, the lower the effectiveness of the system. The approach of the teacher should be to continually improve the system so that the gap between the expected learning outcome and actual learning outcome is reduced to the minimum or ideally speaking, removed entirely and thus increasing the effectiveness of the system to the maximum.

**Efficiency**

Efficiency depends on the cost and the time involved in the organisation of an effective instructional system. Let us take an example. If one wants to travel from Delhi to Chennai, one can have three alternatives, viz., travel by train, take a flight or travel by car. All the three are effective ways of reaching one’s destination. But, what about their relative efficiencies. Travelling by an aeroplane is very efficient in terms of the time involved in reaching the destination while it may be the least efficient as far as cost is concerned. On the other hand, travelling by train is more efficient in terms of the cost incurred but much less efficient regarding the time taken in reaching the destination. Travelling by car may probably be the relatively least efficient in terms of the time taken for travel as well as in terms of the cost involved when compared to that of train travel.

Similarly, in an instructional situation, efficiency of the system can be seen both in terms of the time and the cost involved. Decision, with regard to which aspect is to be given more consideration, depends on the infrastructural, financial and time conditions.

<table>
<thead>
<tr>
<th>Self-assessment</th>
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<td><strong>8. Effectiveness of instruction is</strong></td>
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<tr>
<td>a) the extent to which the instructional objectives are achieved.</td>
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<tr>
<td>b) the time involved in achieving the objectives.</td>
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<tr>
<td>c) the cost involved in achieving the objectives.</td>
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<tr>
<td>d) the favourable reaction shown by the students.</td>
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<tr>
<td><strong>9. Efficiency of instruction is</strong></td>
</tr>
<tr>
<td>a) the instructional objectives achieved.</td>
</tr>
<tr>
<td>b) the time and cost involved in its operation</td>
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<tr>
<td>c) the time and cost involved in the effective achievement of objectives</td>
</tr>
<tr>
<td>d) mainly the cost involved in the effective achievement of objectives.</td>
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</table>

**Role of the teacher in the instructional system**

We have seen in the preceding sections, that the development of an instructional system involves broadly, the selection and the integration of instructional inputs according to certain scientific considerations and the establishment of the effectiveness and the efficiency of the system through tryout. The teachers’ involvement in this context can be
perceived in two different ways and accordingly, he performs two different roles. These roles are discussed below:

**Teacher-as an input**

The teacher’s role as an input is a traditional one. We all know that he delivers a lecture or guides the students in a tutorial, or conducts a discussion session. For performing these activities, he manifests the required skills in the classroom situation, and thus becomes part and parcel of the system. In this role, he can be compared to any other instructional input such as the self-instructional print material, audio & video programmes, projectors and the computer-assisted learning. In some cases his role can be replaced by other instructional inputs. A well prepared self-instructional print material can be an effective alternative to the teacher’s lecture.

A teacher has to manifest different skills for organising other instructional inputs. The skills associated with delivering a lecture would naturally be different from those for conducting a discussion or demonstrating an experiment, and so on. And hence the teacher is expected to be versatile in performing the role of an input in the instructional context.

**Teacher as a systemist**

A modern teacher depends on various other instructional inputs for making the instructional process effective. For this, he selects the most suitable instructional inputs from the available alternatives and evolves an instructional system. In this role, the teacher is a decision-maker with regard to the inputs to be used for a particular instructional context and how those are to be sequenced and integrated. Here, the teacher’s role can be compared to a conductor of an orchestra. The conductor not only decides the number of the various musical instruments to be incorporated in the orchestra, but also decides the extent and time of involvement of each of the instruments, which together, generate harmonious music. A teacher performs a similar role in the instructional context. We may name this role of the teacher as that of a systemist. While performing this role he goes through a scientific process wherein he makes several decisions with regard to the selection and integration of instructional inputs (including himself as an input) and synthesises an instructional system. In the role of a systemist, the teacher is outside the system boundaries. His role is that of one who creates and improves the system rather than a participant or a sub-system within the instructional system.

**Self-assessment**

10. Given below, are a few activities of the teacher. Mention against each whether the activity pertains to its function as an input or as a systemist.

   a) conducting a discussion (input/systemist)
   b) deciding what methods are to be adopted for teaching a subject (input/systemist)
   c) obtaining the reaction of students about the teaching (input/systemist)
   d) giving a demonstration in the class (input/systemist).

**Summary**

The present unit attempted to provide the basic concepts of a teacher’s dual role in the whole process of systematisation of instruction. As a systemist, the teacher takes into consideration the potential and characteristics including the organisational details of each and every instructional input alternative available to him. According to the needs of the instructional situation, the teacher selects the most suitable set of inputs and integrates them into an instructional strategy. And as an input, the teacher conducts the selected
Instruction in a Systemic Perspective

inputs manifesting the required skills. The subsequent units of this course present the potential and characteristics of the various instructional input alternatives available for the teacher and also the related skills he has to manifest in organising them in the instructional situation. The present unit hence provides the necessary perspective for the rest of the units in this course.

**Unit-end activities**

1. Take an instructional situation of your choice. Describe it as a system. Point out possible defects in such a system. And, then explain how in a systematic way, you would find suitable solutions to improve the system. (You may not be able to complete in one sitting. You may have to collect data from more than one them on paper and then discuss these with your friends/tutors, etc.)

**Points for discussions**

1. Will too much structuring of teaching through the application of systems approach affect the creativity of teachers and learners?
2. Is systems approach an attitude or a way of thinking and action, or is it a set of mechanical steps?
3. After going through this unit, do you have a different perspective on your teaching function?

**Suggested readings**


**Answers to self-assessment**

1. i) c ii) d iii) b
2. You may give five components similar to the following:
   - Lecture, Demonstration, Discussion, Seminar, Practical experiences, Field work, etc.
3. i) ✓ ii) x iii) x iv) ✓ v) ✓ vi) ✓ vii) ✓
4. [Diagram of the input, process, feedback, expected output, actual output]
5. Yes, Systems approach is a key to solve any problem situation including those in teaching. Through the application of this approach one can modify one or more of the various steps involved in the planning and organisation of the teaching process such as the formulation of objectives, analysis of teaching tasks, selection of the inputs, development of instructional material and organisation of learning experiences. These steps do not differ what ever be the subject being taught.

6. a) Instructional objectives
   b) Learners' characteristics
   c) Nature of the discipline
   d) Availability of resources
   e) Size of the group
   f) Ability of the teacher.

7. Yes, teacher's ability is an important criterion. If a teacher lacks the skills to conduct a discussion, there are training methods to develop these skills. These skills can be developed to a great extent by practice.

8. a)

9. c)

10. a) input  b) systemist  c) systemist  d) input