

Unit 1: Nature and Objective of Physics, Instruction and Role of Teachers in instruction

Introduction

The course is methodology of teaching, which gives you the basic knowledge needed to ensure proper dissemination of knowledge to your students as a professional physics teacher. Study unit 1 introduces you to the nature and objectives of Physics as your teaching subject. It is important to know what physics nature is about in order to be able to approach your teaching with understanding. Other points to be considered in this unit are, objectives of teaching physics, impact and position of physics in the society and Bloom's Taxonomy of Learning.

Learning Outcome of Study Unit 1:

At the end of this unit, students should be able to:

- 1.1 Understand the nature of physics so that they can use appropriate approaches
- 1.2 State and explain the need to study physics
- 1.3 Explain different recommendations about physics curricula
- 1.4 Explain the criterion of selecting aims and state aims of teaching physics
- 1.5 Explain detailed Bloom's taxonomy of objectives
- 1.6 Discuss the concept of instruction
- 1.7 Explain role teachers and learners in instruction

1.1 Nature of Physics

What is Physics?

To answer the query let us start from the origin of the word 'physics'. 'Physics' originated from the Greek word that means 'Nature'. It thus points out to the fact that *physics* is the branch of science that deals with the study of Nature and Natural phenomenon. Some of the important definitions of physics are: "It is a branch of science that deals with that phenomenon which is related to matter and energy." "It represents an accumulative and systematic learning of the natural phenomenon related with matter and energy". "It is a systematized accumulation of knowledge about matter and energy through a scientific method of enquiry based on some science related values and attitudes."

From these definitions we conclude that physics is a branch of knowledge related to matter and energy but it is almost impossible to give an exact definition of physics. As a matter of fact, physics starts with the study of basic properties of matter and radiations and makes an effort to explain various natural phenomenon in terms of these properties.

1.1.2 IMPACT OF PHYSICS

In the present age called "age of science" knowledge of physics is essential to take up certain professional and applied courses. The knowledge of physics is essential for much courses as engineering, medicines, technology, space etc. The knowledge of physics is essential, for everybody, because of its immense value in our everyday life. Importance of physics can be summarized as under:

1. **Interest in Wonders of Physics.** Physics teaching-learning process provides more possibilities of involving children in such activities as are liked by the students. Physics teaching provides more opportunities of carrying out practical work in comparison to social sciences which are less practical in nature. We can say that basically physics is a very interesting subject and teaching physics

- involves a lot of fun.
2. **Help in developing Critical Thinking.** Physics is one of those subjects which help in the improvement of the thinking skills in the students. This development of thinking skill takes place because of the fact that in physics, students come across a large number of problems which provide them opportunities for thinking. Thus physics has an immense educational value.
 3. **Application in Life.** Knowledge of physics is applied in various ways in our daily life. You can look around yourself and you will find a very large number of electrical and electronic goods which all utilize one or the other principle or law of physics. For example, Radio, T.V., V.C.R., Electronic watches, washing machines, mixers and juicers etc. all utilize the knowledge of physics. Thus physics has a utilitarian value in life.
 4. **Development of Intellectual Honesty.** The study of physics not only improves the academic knowledge of the student but also develops an intellectual honesty in the student. Since it is a subject which involves a lot of practical work so the students acquire the habit of making reports without bias and thus it develops in them the habit of intellectual honesty.
 5. **Helps Develop Positive Attitude.** A proper teaching of physics develops in the student not only the scientific attitude and scientific temper but also certain positive attitudes such as open mindedness, unbiased thinking, power of reasoning etc.
 6. **Satisfaction of Curiosity and Creativity.** Physics is a highly activity oriented subject and these activities taken up by the students in learning physics help a lot to satisfy the basic human desire of knowledge about the wonders of nature. It helps develop a creative thinking in them.
 7. **Insight into Scientific Processes.** Students learn a lot, knowledge by the study of physics and this knowledge becomes a very valuable tool for him in acquisition of new knowledge. Most of the knowledge of physics is gained by students while passing through various steps of acquisition of scientific knowledge i.e. statement of problem, performance of experiments, developing a hypothesis and testing the hypothesis. Thus he gets an insight into the scientific process.
 8. **Trains for Adjustment in Modern Life.** The present day life as pointed out earlier is highly dependent on various instruments, appliances which are based on one or the other principle of physics. To work with these appliances and to make a proper use of these a basic knowledge of physics is essential for every one of us. It is only such knowledge of physics that will make us less dependent on others for proper functioning of these items of daily use. Thus it is only by acquiring a basic knowledge of physics that we can adjust ourselves to the modern style of living.
 9. **Development of Social Skills.** The discoveries of telephone, Fax, Telex etc. can be attributed to the knowledge of certain branch of physics. All such discoveries which have made the life comfortable have decreased the distance between nations and thus they have provided the basis for a corporate living, co-existence and better human relations. All these lead to development of social standards both in personal and professional life.
 10. **Vocational Value. Like any other field of knowledge,** knowledge of physics forms the basis of some vocational and professional courses. For example, computers, electronics, space science etc.

1.1. 3 PLACE OF PHYSICS

1. The purpose of physics teaching in secondary schools is to enable students to grasp systematically the basic knowledge of physics needed for the further study of

modern science and technology and to understand its applications. The scope and excitement of physics as given in NCERT text book (senior secondary physics text book). In physics, we deal with many physical phenomena and experiences. They are not only exciting but also educative. The fall of an apple leads us to gravitation. A spherical liquid drop helps us to understand surface tension. Beating of the drum causes vibration producing sound. The light from stars implies something about the stars themselves. The study of electricity helps us in the design of dynamos and motors.

2. We come across diverse physical phenomenon which is quite exciting and educative. All these phenomena which apparently are so diverse and complex can be easily explained on the basis of certain laws of physics. Thus there is a lot of excitement in physics. From the above we can easily conclude that physics occupies an important and unparalleled place in our school curriculum.

1.2. The Aims and Objectives of Teaching Physics

The purpose of physics teaching in secondary schools is to enable students to grasp systematically the basic knowledge of physics needed for the further study of modern science and technology and to understand its applications. In addition, it should help them to acquire experiment skills, develop the ability to think and to use mathematics to solve physical problems, cultivate a dialectical materialist view point and make them aware of need to study hard and to struggle for the modernization, along socialist lines, of industry, agriculture, national defence and science and technology. For clarity of purpose of physics teaching an emphasis have been placed by many educational reform committees to spell out the aims and objectives of a course of study.

AIMS OF TEACHING PHYSICS

Physics can claim an honourable place in school curriculum if it can produce desirable changes in students. The specific objectives of teaching physics must be based on some criterion in any society.

Criteria for Selection of Aims

Thurber and Collette have proposed the following criteria for selection of aims.

- i. *Usefulness*. The knowledge gained should be useful to the students in their lives.
- ii. *Timeliness*. The knowledge given should be concerned with materials/objects with which student is familiar.
- iii. *Fitness*. The knowledge must fit into a sequence that leads him to broad objectives.
- iv. *Appropriateness*. The learning should be appropriate for maturity and background of the students
- v. *Practicability*. It means that experiences required for the development of learning should be possible

Aims of physics curriculum should be as follows

- i. To arouse students interest in physics.
- ii. To familiarize the students with the important role played by physics in their daily life.
- iii. To develop in students a scientific culture.
- iv. To provide a training to students in methods of science.
- v. To emphasize the important role of physics on social behavior.
- vi. To prepare students for those vocations which require a sound knowledge of physics.
- vii. To increase students understanding to such level that he can understand various concepts which unify various branches of physics.

1.2.2 OBJECTIVES OF TEACHING PHYSICS

By educational objectives, we mean explicit formulation of the ways in which students are expected to be changed by educative process.

Objectives are not only the goals towards curriculum are shaped and towards which instruction is guided but they are also the goals that provide the detailed specification for the construction and use of evaluative techniques.

Probably the most common educational objective is the *acquisition of knowledge*. By knowledge, we mean that students can give evidence that he remembers, either by recall of recognizing, some idea or phenomenon which he has had experience in the educational process. Knowledge may also involve more complex processes of relating and judging.

Another important objective is development of *intellectual abilities and skills*. This has been labelled as *critical thinking* by some, *problem solving* by others

‘Arts and skills’ refer to modes of operation and generalized technique for dealing with problem. The arts and skills emphasize the mental processes of organizing and reorganizing material to achieve a particular purpose. *Intellectual abilities* refer to situations in which the individual is expected to bring specific technical information to bear on a new problem.

Objectives are the specific and precise behavioural outcomes of teaching a particular topic or lesson of physics. Objectives actually control other factors of physics teaching to a great extent, therefore more emphasis be laid on writing the objectives in behavioural terms for each unit of class room instructions in physics.

A further discussion of the objectives is given below.

Knowledge: The basic aim of teaching of any subject including physics. By imparting knowledge of physics to the student it is expected that he acquires the knowledge of:

- i. Natural phenomenon
- ii. Terminology in physics.
- iii. Scientific concepts and formulae
- iv. Modern inventions of physics
- v. Importance of physics for animal life and plant life
- vi. Manipulation of nature by man
- vii. Correlation and inter-dependence of physics with various branches of science

Knowledge objective is considered to have been achieved if the student is able to recall and recognize terms, facts, symbols, concepts etc.

Understanding: This objective considered to have been achieved if the student is able to:

- i. Interpret charts, graphs, data, concept etc. correctly,
- ii. Illustrate various terms, concepts, facts, phenomenon etc.,
- iii. Explain facts, concepts, principles etc.,
- iv. Distinguish between different facts, concepts etc. that are closely related to each other
- v. identify relationships between various facts, concepts, phenomenon etc.,
- vi. Change tables, symbols, terms etc. from any given form to some other desired form
- vii. Find faults, if any, in statements, concepts etc.

Applications: This objective seems to be the most neglected one in our educational system.

The common observation that supports it is that a physics graduate fails to insert even a fuse wire in the electric circuit of his house. This objective is considered to have been achieved to a great extent if the pupil can:

- i. Analyze a given data
- ii. Explain giving reasons various physics phenomenon
- iii. Formulate hypothesis from his observations
- iv. Confirm or reject a hypothesis
- v. Correctly infer the observed facts
- vi. Give new illustrations
- vii. Predict new happenings
- viii. Find relationships that exist between various facts, concepts, phenomenon learnt by him

Skills: This objective can be considered to have been achieved if a pupil learns can

- i. handle pieces of apparatus
- ii. assemble pieces of apparatus for experiment
- iii. draw diagrams and illustrations
- iv. construct things, and
- v. carry out repairs of apparatus and appliances.

Thus here we aim to develop three types of skill in the pupil. These are;

- Drawing skill
- Manipulative skill
- Observational and recording skill.

The Drawing skill is considered to have been achieved if pupil is able to draw labelled sketches and diagrams quickly. The manipulative skill is considered to have been achieved if pupil is able to;

1. Keep and handle the apparatus properly
2. Improvise models and experiments

Observe various precautions while handling apparatus and doing experiments. The observational and recording skill is considered to have been achieved if the pupil can

- (i) read correctly the instrument or apparatus,
- (ii) Record observations faithfully,
- (iii) Make calculations correctly, and
- (iv) Draw inferences correctly.

Interests

To achieve this objective, the pupil is provided with physics hobbies and other leisure time activities. By providing such activities our aim is to inculcate, among pupils, a living and sustaining interest in environment in which he lives. This aim is considered to have been achieved if the pupil becomes curious and develops such an interest in physics that he is always eager and is on look out to:

- i. Take to some interesting physics hobby.
- ii. Visit places of interests for physicist.
- iii. Undertake some physics projects,
- iv. Meet and interact with some reputed person in the field of physics,

- v. Read literature of physics,
- vi. Collect specimen, photographs, biographies etc. concerned with physics,
- vii. Participate in fairs, science exhibitions, clubs etc. concerned with physics,
- viii. Actively participate in debates, declamation contests, quiz etc. held in connection with various topics connected with physics.

Attitudes

Development of proper scientific attitude is one of the major objectives of teaching physics. The development of scientific attitude makes pupil open minded, helps him to make critical observations, develops in him intellectual honesty, curiosity, unbiased and impartial thinking etc.

This objective is considered to have been achieved if pupil;

- i. becomes free of superstitions and prejudices,
- ii. depends for his judgment only on verified facts and not on opinion
- iii. is readily willing to reconsider his own judgment when some more facts are brought to his notice,
- iv. has an objective approach,
- v. is honest in recording and collecting scientific data.

Abilities

By the teaching of physics we expect to develop the following abilities in the pupil:

- i. Ability to use scientific method,
- ii. Ability to use problem solving method,
- iii. Ability to process information,
- iv. Ability to report things in a technical language,
- v. Ability to collect data from suitable source and to interpret it correctly,
- vi. Ability to organize fair, exhibition, etc.

Appreciation

To achieve this objective, the teaching of physics has to be done in an evolutionary way. For this the curriculum should include such topics where it is possible to reveal stirring biographical anecdotes, some stories having some incidents of adventure, charm and romance. It is possible to achieve this objective by teaching history of physics including life stories of some physicists. This objective can also be achieved by telling the impact of physics on modern life. This objective of teaching physics may be considered to have been achieved if the pupil:

- i. appreciates the contributions of various physicists to human progress
- ii. appreciates the history of development of physics
- iii. realizes the importance of physics in modern civilization

- iv. takes pleasure in understanding the progress made by physics.

Providing Vocational Career

In the modern world majority of career courses depend to a large extent on the basic knowledge of physics. Some vocational courses can be taken up only by students of physics, e.g., Engineering, Agriculture etc. Thus physics opens a vast field of opportunities for taking up any vocational course and choose a career. Not only this the knowledge of physics develops in a pupil the manipulation skills and he can easily improvise apparatus and experiments and can use his knowledge and skill to make some common things which provide the pupil with a profitable leisure time work.

SCIENTIFIC ATTITUDE

One of the major aims of teaching physics is the development of *scientific attitude* in the pupil. Following are some of the various aspects included in the scientific attitude;

- i. making pupils open minded
- ii. helping pupils make critical observations
- iii. developing intellectual honesty among pupils
- iv. developing curiosity among pupils
- v. developing unbiased and impartial thinking
- vi. developing reflective thinking.

1.3 LEARNING OBJECTIVES

Learning objectives are important in all aspects of the teaching and learning process. Learning or instructional objectives are concrete statements of the goals towards which instruction is directed. Objectives provide a genre for choosing subject matter content, sequencing topics and for allocating teaching time. Learning objectives also guide in the selection of materials and procedures to be employed in the actual teaching process. Further they provide standards as well as criteria for evaluating the quality and efficiency of teaching and learning activities.

Historically teachers have looked to Blooms taxonomy (1956) “Taxonomy of Educational Objectives” for the levels of learning, teaching and evaluating. The main value of taxonomy is twofold:

- It can stimulate teachers to help learners acquire skills at all of levels by laying the proper foundations for higher levels by assuring mastery of lower level objectives.
- It provides a basis for developing measurement strategies to assess student performance at all the levels of learning. (Bloom, 1956)

Definition of learning objectives

A learning objective is a statement of the description of the behaviour expected of a learner after instruction. Simply put they are instructional goals.

In this activity we will study the following aspects of learning objectives:

- Functions of learning objectives
- Components of learning objectives
- Classification of learning objectives
- Types of learning objectives
- Elements of learning objectives

- Determining the domains of learning objectives
- Writing learning objectives

Functions of learning objectives

An instructional goal is some outcome of instruction expressed in terms of student learning. As a result of instructing learners the teacher expects them to acquire knowledge, skills, abilities and attitudes.

For a learning objective to be useful for learning purposes, it must perform the following three functions:

- It must serve as a guide for planning instruction
- It must state an acceptable standard for assessing students' achievement
- It must provide a criterion for evaluating instruction itself

Classification of learning objectives

To insure diversity of goals and objectives when planning you must consider using a systematic classification of education objectives. One widely used classification scheme was proposed Sixty years ago by Benjamin Bloom (1956).

Bloom's Taxonomy of cognitive domain of learning is stated as follows;

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

These tasks should have helped you establish that according to Bloom, the lowest order objective is knowledge which involves recalling information of previously learned material while the highest order objective is evaluation which involves judging the value of the product.

In this unit on instruction, we will be exploring how this taxonomy of objectives influences how learning is organized. The major idea of the taxonomy is that what educators want students to know can be arranged in a hierarchy from less to more complex levels of learning. Bloom is also reminding teachers to set a variety of objectives. The purpose of writing objectives is to define what the instructor wants the student to learn; using detailed objectives will also help students to better understand the purpose of each activity by clarifying the student's activity during the lesson.

Blooms Taxonomy in the cognitive domain can be arranged in a hierarchy, from less to more complex as follows: Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. In selecting objectives teachers must also build the level of the content to be taught and activities to be learnt from simple to the complex.

1.4 BLOOM'S TAXONOMY OF OBJECTIVES

Taxonomy is Classification, especially of animals and plants according to their natural relationships. Taxonomy of educational objectives is intended to provide for classification of the goals of our educational system. It is expected to help in the discussion of curricular and

evaluation problems with greater precision. It is expected to facilitate the exchange of information about curricular developments and evaluation devices.

Bloom's taxonomy is a classification of instructional objectives in a hierarchy, it is found quite useful in communicating the objectives of a physics lesson as also as a criterion for evaluation of physics teaching. Under this scheme the specific objectives are classified as falling into the following three domains.

1. Cognitive domain objectives.
2. Affective domain objectives.
3. Psychomotor domain objectives.

Cognitive Domain

Probably the most common educational objective is acquisition of knowledge. Knowledge, as defined here, involves the recall of specifics and universals, the recall of methods and processes of the recall of a pattern, structure or setting. The cognitive domain can be summarized as under:

Knowledge

Knowledge of specifics	Recall and recognition of facts, information, principles, laws and theories of physics
Knowledge of terminology	The recall of specific and isolable bits of information.
Knowledge of specific facts	Knowledge of dates, events persons, places etc.
Knowledge of ways and means of dealing with specifics	Knowledge of the ways of organizing, studying, judging and criticizing.
Knowledge of conventions	Familiarity with the forms and conventions of scientific papers.
Knowledge of trends and sequences	Knowledge of the processes, directions and movements of phenomenon with respect to time.
knowledge of classification and categories	To recognize the area encompassed by various kinds of problems and arguments.
Knowledge of criteria	Knowledge of criteria by which facts, principles, opinions and conduct are tested or judged
Knowledge of methodology	Knowledge of scientific methods for evaluation
Knowledge of principles and generalizations	Knowledge of important principles

Comprehension

Translation	It represents the lowest level of understanding The ability to understand non – literal statements
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Interpretation	The ability to grasp the thought of the work as a whole at any desired level of generality
Extrapolation	The ability to deal with the conclusions of a work in terms of the immediate inference made from the explicit statements
Application	Application to the phenomena discussed in one paper of the scientific terms or concepts used in other papers
Analysis	The breakdown of a communication into its constituent elements or parts such that the relative hierarchy of ideas is made clear and/or the relations between the ideas expressed are made explicit
Analysis of Elements	The ability to recognize unstated assumptions skills in distinguishing facts from hypotheses
Analysis of relationships	Ability to check the consistency of hypotheses with given information and assumptions
Analysis of organizational principles	The organization, systematic arrangement, and structure which hold the communication together.
Synthesis	The putting together of elements and parts so as to form a whole.
Production of a unique communication	The ability to understand non-literal statements. Skill in writing, Using an excellent organization of ideas and statements. Ability to tell a personal experience effectively.
Production of a Plan	Ability to propose ways of testing hypotheses.
Derivation of a set of Abstract Relations	Ability to formulate appropriate hypothesis based upon an analysis of factors involved and to modify such hypothesis on the basis of new factors and considerations. Judgment about the value of material and methods for given purposes.

Evaluation

Judgment about the value of material and methods for given purposes

Judgment in terms of internal evidence The ability to indicate logical fallacies in arguments

Judgment in terms of external criteria Judging by external standards, the ability to compare a work with the highest known standard in its field.

Psychomotor Development of skills such as of handling pieces of apparatus, their assemblies, drawing diagrams and circuits, repair of apparatus and appliances.

Cognitive domain involves knowledge and development of intellectual skills. It includes recall of facts, patterns and concepts. It has six major categories which are listed in order from the simplest to the most complex the order in which they are mastered. A further description of cognitive domain as it relates to developing objectives for unit of instruction is given in the tabular form as follows;

NO	CATEGORY:MAIN CONCEPTS	KEY WORDS (FIVE)	STATE OBJECTIVES FROM YOUR TEACHING SUBJECT MATTER
1.	Knowledge Recall of data or information	Define, identify, Name, State, list, enumerate etc.	By the end of the lesson the learner should be able to: (i) Define the term motion (ii) Identify the types of motion.
2.	Comprehension	Distinguish, discuss, describe, explain etc.	
3.	Application	Constructs, draw, illustrate, apply etc.	
4.	Analysis	Compare, contrast, breakdown, study, investigate etc.	
5.	Synthesis	Combines, compose, mix, amalgamate, form a composite, relate,	
6.	Evaluation	Contrasts, examine, justify, test, judge etc.	

Affective Domain

This domain deals with the manner in which learners deal with emotions, such as feeling values, appreciation, motivation and attitudes. It has five major categories again listed from the simplest to the most complex.

NO.	CATEGORY MAIN CONCEPTS	KEY WORDS(FIVE)	STATE OBJECTIVES FROM YOUR TEACHING SUBJECT
1.	Receiving	asks	
2.	Responding	Helps	
3.	Valuing	demonstrates	
4.	Organization	Adhere	
5.	Internalizing	performs	

Psychomotor Domain

The domain includes physical movement, co-ordination and use of motor skills. The development of these skills requires practice, speed, precision, procedures and techniques to perform. It has seven categories listed from the simplest behaviour to the most complex.

NO	CATEGORY,MAIN CONCEPTS	KEY WORDS (FIVE)	STATE OBJECTIVES FROM YOUR TEACHING SUBJECT
1.	Perceptions	describes	
2.	Set	explains	
3.	Guided response	Traces	
4.	Mechanism	assembles	
5.	Complex overt response	rearranges	
6.	Adaptation	rearranges	
7.	Origination	combines	

To further understand the application of Bloom's Taxonomy in teaching and learning answer the following questions referring to the same article.

- Compare and contrast the cognitive and affective domains of learning in 200-250 words.
- What is the effectiveness of writing learning objectives using a Bloom's taxonomy? Use 200-250 words to explain.
- The table below shows a list of examples of learning objectives. Classify them according to their domain that is cognitive, psychomotor, and affective.

By completing the exercises, you will have written objectives that fall in one of the three domains. A domain as we noted on the key terminology is a specification that shows the elements and interrelationships of teaching and learning. These three domains you will note from the reading have different outcomes on teaching and learning as shown in the learning tip as the table.

Objective	Domain Cognitive / Psychomotor / Affective
<p>By the end of the lesson the learner should be able to:</p> <ol style="list-style-type: none"> 1. Solve at least 10 Simultaneous equations 2. Explain the process of soap making 3. Draw and label all the structure of a mammalian heart 4. Identify the various parts of the urinary system 5. Develop interest in the writing of poetry 6. State the names of the capital cities of Africa 7. Distinguish between the Anopheles and Culex mosquitoes 8. Kick the football using the instep 9. Construct a third class lever. 10. Set a practical to show that light is required for photosynthesis by plants 11. Describe how a pinhole camera can be used to model the actual camera 12. Type a letter using the computer 	

Learning Tips

1. **COGNITIVE DOMAIN** focuses on acquisition of knowledge. This is what a learner recalls, understands or the information he or she knows.
2. **AFFECTIVE DOMAIN** focuses on acquisition of particular attitudes, values or feelings. The learners show increased interest, are motivated or they demonstrate a change in attitude. This domain is usually under used by teachers.
3. **PSYCHOMOTOR DOMAIN** focuses on how a learner moves or controls the body. The learner learns how to manipulate an object, use a tool, produce a product or perform a routine.

1.5 Components of a learning objective

The different components of a learning objective\ are;

- Terminal behaviour
- Test conditions
- Performance standards

Terminal behaviour

This component of a learning objective describes the behaviour of a student after instruction, what is the outcome of instruction? Behaviour means any performance or activity that can be observed or recorded. Terminal behaviour is the description of a pattern of behaviour or performance we want the learner to be able to demonstrate. An objective should be a statement of performance and responsibility.

Examples

- 1) **Identify** all the components of an induction coil

2) **Draw** an electric bell and describe each component

The words identify, draw, describe are action words or verbs that can be observed and recorded. The terms that learning experience is expected to produce.

Practice

List down 10 other verbs or action words used in formulating objectives.

CAUTION AVOID using words that are open to many interpretations such as: To know, understand, grasp, believe, enjoy e.t.c at this level just to mention a few.

Test conditions

The tests conditions component of a learning activity describes the situation in which the students will be required to demonstrate the terminal behaviour. There are 3 general conditions that affect student's performance during a task or test. These include the availability of reference books, the time allocated, resource/tools available for the use and how the information will be presented during the testing period or teaching period.

For example to be able to identify different classes of lever from a chart of different tool or machines or from each of the tools provided for the learners during the lesson.

Identify the different classes of lever.

Draw each class of lever indicating load, effort and fulcrum/pivot.

Performance standards

The standard describes the minimal level of performance that will be accepted as evidence that a student has achieved an objective. Examples:

- Answer all the questions correctly.
- Complete at least 10 questions within one hour

Performance standards provide a criterion for judging the effectiveness of terminal behaviour.

An objective has three components: Terminal behaviour, test conditions and performance standards

Types of learning objectives

Have you identified the three types of objectives as?

1. Terminal performance objective or long term objective
2. Enabling objective or short term objective
3. Pre-requisite entry, objectives. A learner should have achieved before beginning a unit of learning

Activity

1. Continue using the information on the types of objectives to answer the following questions about you;

- a. What do you hope to achieve at the end of this course? (Long term)
- b. What are you going to do in order to achieve the objective above? (Short term)
- c. What did you know about teaching methods of education before you started this module? (Pre requisite entry)

2. Refer to the reading you did for this section and describe how teachers use long-term and short term objectives in their planning for teaching in 100-120 words.

You have read that teachers have long term and short term objectives for students to work towards. To achieve these objectives, they formulate objectives from specific to general ones for setting behavioural objectives or general to specific for choosing content topics. They must also find out what their learners know before they do that is, pre-requisite knowledge.

Elements of learning objectives

In writing an objective the first step is to write down a statement of the learning outcome. Keep in mind that well formulated objective contains four elements. These can be referred to as the A, B, C, D elements of learning objectives.

- **Audience:** This is the learner, the student or pupil
- **Behaviour:** An action verb and object to describe the observable action the learner/student will be doing as a result of a learning experience,
N.B. behaviour change indicated must be visibly observable
- **Conditions:** are limitations or restrictions placed on the student, or materials or aids given to the learner when she/he is evaluated
- **Degree:** The acceptable level of learning at which a student proves he/ she has mastered the objectives. The common stem or statement of beginning of an instructional objective is:

The example below shows you the four elements of a learning objective. At the end of the lesson the learner should be able to draw and identify all components of electric circuit.

Audience: Class I student

Behaviour: Draw and identify each component of an electric circuit

Conditions: At the end of the lesson

Degree: All the components of an electric circuit.

Writing learning objectives

Below is a summary of a quick checklist for writing learning objectives an exercise that you will do for every lesson that you plan to teach in the future.

Check List For Writing Objectives

You should ask yourself the following questions as you write objectives are they:

1. Written in terms of **students' performance**?
2. **Observable** by one or more of the five senses?
3. **Specific**?
4. **Valid** and **reliable** to the major objectives and goals of the course?
5. **Measurable** in terms of level of performance and conditions under which performance takes place?
6. **Sequential** in relation to prior and subsequent knowledge?
7. **Relevant** to the students' experiences
8. **Attainable** within the **time period** you have allotted for it?
9. **Challenging** to each student?
10. **Acceptable** to society?
11. **Realistic**?
12. Having a **stem**: At the end of a given period (lesson, course, module)

Learning Tips

Use the checklist to ensure the objectives you have written in the exercise above are **S. M. A. R. T** that is: **Specific, Measurable, Achievable, Reliable and Time-bound.**

L6 INSTRUCTION

The teacher has for many years been seen as a giver of information to the learners. This role has rapidly changed with the introduction of new options and aids for instruction. These new concepts include team-teaching, individualized instruction, programmed learning, television equipment, electronic learning laboratories; computer assisted learning, dial-access retrieval systems. These options have tremendously increased a teacher's choice of ways to accomplish defined learning outcomes. This creates new concerns for the individual learner new ways of presenting information in order to plan effective instruction, your role as a teacher is changing rapidly, as teachers tend to become directors or facilitators of learning experience and goals. This gives a teacher the freedom to design an instructional programme more suitable for the individual students to be taught. With this freedom, a teacher is now strictly required to own the basic knowledge contained in the educational curriculum made syllabuses, and must know what she/he wants to teach by selecting proper content, in order to be a successful coordinator of the learning process. The teacher must be able to describe specific objectives and skills that the students should be able to display under defined conditions and at a designated time.

Using the systems approach in education improves the decision-making process by enabling the teacher to understand the education process and all that is involved in education. The information necessary is found easily and within the teacher's reach, since everyone in the educational setting is involved in a systematic manner.

With the help of systems approach, we are able to provide feedback. Feedback means a reaction to the message sent from source to receiver or vice-versa. Knowledge gained from feedback helps the teacher applying the systems approach will apply feedback at almost every stage in the process of preparing source material. Therefore, teaching becomes a science, since educational practitioners and theorists will be using scientific methods of going about their work. By applying recognized principles that have evolved through research and have been field tested, you can become a better teacher.

Today's teacher must assume the directorship of learning and must develop a plan or system for reaching defined goals. Your teacher's role as a director is to find ways of dealing with the teaching of such comprehensive systems like those of human growth and development or components of a system of generator (induction coil, dynamo, DC or AC), where most elements are related to each other and contribute to a given common goal. A change in one element may cause a change in other elements or in the system itself.

Instructional System: The elements of an instructional system are

- a) Specification of objectives
- b) Selection of content
- c) Assessment of entering behavior
- d) Learning strategies
- e) Classroom Organization
- f) Allocation of time
- g) Allocation of learning spaces
- h) Selection of learning resources
- i) Evaluation of teachers' and learners' performance
- j) Feedback by the teacher and by the learner.

An instructional system requires a teacher to be:

- The designer and developer of the Instruction Programme.

- Knowledgeable in the subject matter content.
- Skilled in the writing of instructional objectives.
- Creative in the choice of teaching resources and aids.
- Innovative in the choice of teaching techniques.
- An assessor and evaluator of teaching and learning outcomes.

1.7 THE ROLE OF TEACHERS AND LEARNERS IN INSTRUCTION

Largely as a result of technological change, forces of globalism, multiculturalism and multi-modalism the roles of both the learners and the teachers have been transformed and ultimately enriched in the process. In the traditional classroom, teachers stand in front of the class and present information to the learners. This process is seen as effective because teachers can present immense amount of information in a short period of time. Constructivist research has however shown how ineffective this practice is. Instead their research has shown that when teaching focuses on students and challenges their perceptions learning becomes more meaningful and productive to the learners. In this activity we will study the roles of the learner and those of the teacher during instruction, have they changed?

The role of teachers

The role of teachers falls broadly into the six categories listed below.

The information provider: A traditional responsibility of the teacher is to pass on information, knowledge and understanding of the contents of the study. This information can be delivered using various teaching methods. The choice is the challenge in teaching.

The role model: A teacher should exemplify what should be learned. They should be models not only as they teach but as they perform their duties.

The facilitator: As we move to the learner- centered view of learning the role of the teacher is changing to that of a facilitator of learning. Teachers are no longer viewed as ‘walking tape recorders’ teachers must therefore hone their skill of facilitation and mentorship as they support the problem - based learning and the learner’s ability to source for information.

The assessor: The teacher assesses the student and the curriculum. The assessment of the students competence through examinations. The teachers assess the curriculum by monitoring and evaluating the effectiveness of the teaching of the courses.

The planner: Teachers plan the curriculum and the courses to be taught as well as their implementation.

The resource developer: Teachers develop the resources that are used during the delivery of the curriculum. They develop their teaching aids, incorporate new technologies in the teaching technique, prepare study guides and they also keep abreast of any changing knowledge. In a school setting some teachers have only one role. Most teachers have several roles. All roles must however be represented in an institution or school.

- Which teachers represented these roles in your former secondary school?
- Which roles would you like to play as a teacher?

Learning Tips

The teacher plays multiple roles and these roles are often interconnected and closely related. As a teacher you are an information provider, role model, facilitator, assessor, Planner and a resource developer. It would be unreasonable to expect an individual to be competent in all of them. Schools and institutions have a human resource planning section that matches teachers with the roles that they have the greatest aptitude.

Discussion

1. Suggest why it is difficult for teachers to move over and let students learning be the focus of the classroom by reading the above article on a learner centered set up? Give at least 4 reasons in 100-150 words.
2. Discuss the **role of the teacher** in a learner-centered classroom in 200-250 words. Enumerate at least six different roles.
3. Describe the **role of the learner** in a learner –centered classroom in 200- 250 words. Enumerate at least six roles.

Self-Assessment Question

1. Discuss the nature of Physics
2. From your knowledge of the nature of physics, how would you address students' misconceptions about physics
3. What are the possible misconceptions that students have about Physics?
4. What are the characteristics of good learning objectives?
5. From Bloom's Taxonomy discuss cognitive domain of learning
6. Write out objectives in each level of cognitive domain for any topic of your choice in Senior 4, using the format given in the unit.

References

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