

-A high level of skill proficiency is developed;-There is increase in understanding as this improves long-term retention;

Disadvantages: -It could be monotonous;

-It needs different levels of practice to acquire efficiency;

Suggestion/Techniques

-Avoid un necessary practice;

-A variety of relevant practice situation to reduce boredom;-Present both easy and difficult practice so as to challenge everyone; Avoid focusing on final answers.

(ix) Socratic Method: This is a method where the instructor uses a series of probing and leading questions that guide students to reason out solutions to problems step-by-step.

Advantages: -There is high class participation;

-Develops and encourages critical thinking;

-There is immediate and continuous evaluation and reinforcement of students' learning;

-Conclusions are more readily accepted by students because they are the results of their logical thinking

-Students are more relax to learn from their peers;

Disadvantages: Few students may do all the work while others do little;

-Group progress may be inhibited from major disagreements;

-Shy students may be stifled by more domineering ones;

Suggestions/Techniques

-Arrange each group in a circle around a table to facilitate communication;

-Small groups of four to five per table is good;

-Clear objectives should be given before start of work: state objectives; Outline the Tasks; Specify the expected form of end products. Move round the classroom from one group to another to check the students progress and understanding; Use provocative qns to assist the groups.

(F) THE NATURE OF INQUIRY TEACHING:

The learning environment is arranged so as to facilitate student-centered instruction and sufficient guidance is also arranged to ensure direction and success in discovering physics concepts and principles. Of course one way by which the instructor can help students a sense of direction and to use his mind is by questioning. Since a good conversationalist requires listening to insightful questions ,a good inquiry oriented teacher then is an excellent conversationalist. Such an instructor listens well and ask appropriate questions ,assisting individuals in organizing their thoughts and gaining insights.

Such an instructor then seldom(rarely)tells but often questions because by questioning the instructor assist the student in using his mind. Example you want students to discover that the frequency(f) of a simple pendulum is related to the length(L) (ie $f \propto L$).What tye of inquiry discussion can you carry with the students?. You start with a divergent questioning needing a number of responses thus: What have you found out about the pendulum?.

-When L is decreased does it take more or less time to make one complete oscillation;- What seems to affect the number of times it swings a second ?;-The answer by students could be I don't know. The teacher now has to ask a series of convergent questions so as to guide the student to come out with the right answer .The instructor through the discussion never stole the thrill of discovery from students but merely facilitated it(resource person)This is a

Sophisticated teaching art and to do so teacher must switch from the classical concepts of teaching to listening and questioning and should be opened to students thoughts.(inductive inquiry).

(fi) TYPES OF QUESTIONING

This may be planned before class or may arise spontaneously as the instructor interact with the students. A series of questions should be planned by the instructor before entering an inquiry-oriented class. Having thought about the questions gives the instructor direction and a sense of security ,furthering his ability to carry on a discussion. It is then very important for the instructor to be constantly flexible and be always ready to deviate from the series of questions already planned to formulate new ones as he/she interact with students .In devising questions the following are considered:-What talent are you trying to develop;-What critical thinking process will you try to nurture:-What subject matter, Objectives does the instructor want to develop,-What type of answer will the instructor accept :-What does the instructor wish to develop and what attitudes and values does he/she wish to emphasize.

However, there also exist the following learning styles as instruction is carried on by the instructor in the class:-The Learning Retention Core,-The Experiential Learning Model and others already treated which we should try and put into practice.

(fii) Convergent And Divergent Questions

They represent other ways of classifying questions where only a simple answer is needed or many answers.-Convergent Questions are those that allow for a limited number of responses(answers).-Divergent questions are those that allow for a number of answers as they provide for wider responses plus more plus more creative critically considered answers

In an inquiry discussion ,it is generally desired to start with divergent type of questions and move towards more convergent types. It will be of the instructors interest to keep away those requiring a Yes or No answer because students are given little or no opportunity for critical thinking since the fundamental purpose in using the inquiry approach is to stimulate critical thinking, creative behavior and multiple talents.

For inquiry investigation, it is important that the student has a chance to use his mind because learning to think rationally and creatively does much to increase a person's self concept. What do you think will be the effect of an instructor who is only forcing to get the right answer? What about a wrong conclusion by a student has followed the right procedure from the onset? Now consider a mathematic teacher who is only looking for the correct answer ,do you think his step in solving a problem would have given more than 75% of the total score ?.This is because a decimal point or a significant figure may be misplaced. Do you think the Instructor will be right to score the student a zero, and what will be the effect on him/her. It is also important for the instructor to formulate talented -oriented questions as this will help them know their students and which can be followed by some external intrinsic motivation even though some educationist do not accept the frequent use as this can be ends in themselves. What do you think will happen to students who manifest their best talents ?Questioning students about their likes helps to convey your interest in them as people and not as sponges to soak up information as Jean Piaget pointed out that proper questioning gives insight into students thought pattern.

(fiii) SOME LEARNING STYLES

There are many learning adapted by students at the same time instruction is going on. There are formal learning styles and informal also. Educational research has revealed so

many learning characteristics thus:-It is Goal Oriented;-It is linking new information to prior knowledge;-It is organizing information;-It is strategic;-It occurs in phase but non linear and is Influenced by Individual development. From the above characteristics what is learning then to you and can learning take place without teaching and vice versa?.

A learner can learn through some modes of representation thus: ENACTIVE;ICONIC &SYMBOLIC. For Enactive when a learner observe any physical phenomena he/she can acquire knowledge and skills through their own action and those of others. For Iconic ,learners, knowledge is acquired with the help of visual representations: pictures, charts, and diagrams. It is only very effective when learners already have relevant concrete (enactive) experience. The Symbolic learning enable learners to acquire knowledge through the use of words ,numbers and symbols to represent objects and ideas.

Another learning style is the LEARNING RETENTION CORE; This involved an Activity to be carried out by three volunteer(students)Think of any practical activity in physics and let the three students illustrate thus: one person in class does all the activities, etc. The next Learning style is what is called THE EXPERIENTIAL LEARNING MODEL: This can be learnt Informally and Formally.(a)Informally. –Bitten by a snake implies a Concrete Experience(CE).This snake as I realized was not mean but only defended itself as I hit it Reflective Observation (RO).I concluded that a Snake will bite if attacked but will leave me alone if I leave it alone to go Reflective Observation(R O).I concluded that I will never see a snake and attack it Active Experimentation(A E).Try to explain these other examples: Sitting in front of a car and hit my head on the windscreen as it suddenly stopped; -My battery ran down and the time I tried to start using a battery from another car my car almost burnt; I Was surrounded by flames the first time I tried to light a gas lamp. etc The next learning.

(G)THE GOALS OF SCIENCE(PHYSICS TEACHING

Goals are broad statements of purpose that give direction to a science(physics) curriculum or class room instruction.Their broadness gives the advantage of relating to many aspects of physics ,society and education ;and simultaneously give some direction to planning and instruction in science(physics).Their disadvantage here is that they are too broad for specific directions s'a grade levels,science subjects personal aims and preferences of science(physics teachers).Goals are then formulated into appropriate teaching objectives for a physics lesson.Though many Goals exist for the teaching of physics,they are summarized into a few categories using the below named criteria: - Goals should be comprehensive enough to include the general accepted aims and objectives of physics teaching;-Goals should be neutral;-Goals should be few in number ;-Goals should differ conceptually from each other;-Goals should be easily applicable to instructional and learning objectives.The following goals of Science Education can be identified with the above criteria:-Goals of Scientific method;-social issues;-personal needs and career awareness. Research on more please.

(gi)THE OBJECTIVES OF SCIENCE(PHYSICS) TEACHING

Of course ,the best instructional method is that of interaction with students where they will understand the instructor better when he humbles himself to level of his students .By so doing, this will enable them to know more about the lesson and even where they never understood well. So, it is left for the instructor to be well armed. Lets imagine that you are travelling to New York where you have never been, surely you will need different maps because they will serve different purposes. This is why we need objectives for every lesson to be taught.

(gii)SELECTING OBJECTIVES FOR THE TEACHING OF PHYSICS

This is defined scientifically as a change in experience or behavior or behavior resulting from purposeful observations, overt activity or thinking accompanied by motivational-emotional reactions which results in more adequate satisfaction of the motivating conditions.

TYPES OF OBJECTIVES FOR THE TEACHING OF PHYSICS: Objectives are always started in instructional or Learning results. First is on what the instructor does and secondly on what the student does (ie Student/Teacher Activities). There are two types: Teaching Objectives and Learning Objectives. **Teaching Objective:** The Teacher illustrate to the students how to use a micrometer screw gauge. The teaching here is deductive. This Is Teacher-centered.

Learning Objectives: Here the Instructor describes the different steps in the proper use of a micrometer screw gauge. This is an inductive method because there is going to be interaction between the instructor and the students. When Objectives are stated in instructional results , it is advantageous because it gives the instructor direction but disadvantageous in that it may not be clear to whether the students learnt anything. In forming Objectives it is better to concentrate on learning results b/c it helps to define instructional sequence setting the stage for Evaluation. Learning Objectives are Student-Centered. Are specific statements of learning students are expected to accomplish at the end of the course

(fiii) Six Criteria to Differentiate Objectives From Goals:

- They should be general enough to be identifiably related to goals but be specific enough to give clear direction for planning/evaluation.
- Should be clearly understood by parents, administrators and students ;
- Should be few in number but comprehensive for any lesson;
- Should be challenging;
- Should differ conceptually from each other;
- Should be appropriate

Objectives are classified as Behavioral and Non Behavioral.

Behavioral Objectives states how the students will behave as a result of Instruction .Such behaviors are Observable indicating that learning has been effected. They are usually written down in instructional terms thus: At the end or By the end of the Lesson students should be able to: Identify symbols used in the Lesson;-Define the terms Power, Energy and Work; Describe an elastic collision etc. Some Non Behavioral Objectives are: At or By the end of the Lesson Students should be able to-Understand the Concept of work;-Know how to use the scientific method.;-Know what momentum is. Specific behaviors have clearly stated in the first three examples. If students can Identify, Describe and define then he is has learned. It is little less clear in the second set as to how one will know whether or not the student has learned, does comprehend or does know.

(fiv)Advantages of The Behavioral Objectives –They help the physics teacher to be more precise in his teaching

- They clarify exactly what is expected;
- The teacher plans more carefully because he knows the type of performance the students should display after finishing a physics lesson, Unit or Course of Study.
- The teacher knows what materials are needed and what is able to give more specific help to students in direction to outside sources of information;-They provide performance criteria for students achievements and accountability for the Teacher.;

-They help the physics teacher in evaluation, in preparing paper/pencil tests questions etc.;

-Questions can be phrased in such a way that the teacher has precise knowledge of the students ability to perform certain tasks.

Disadvantages Of The Behavioral Objectives-They may tend towards emphasis on trivial behaviors and ignore the important objectives too difficult to define behaviorally.

-The teacher spontaneity and flexibility may be inhibited.

(G) DOMAINS OF OBJECTIVES FOR PHYSICS TEACHING

(gi)It is customary to think of objectives in three aspects: Cognitive, Affective and Psychomotor. These terms come from the work of Benjamin Bloom and others who developed Taxonomies of Educational Objectives. As far as a learner is concerned, Bloom used three(3)different categories of Objectives:-Cognitive domain objective ,Affective domain objective and the psychomotor domain objective.

-The Cognitive Domain Objective: This deals with intellectual results, knowledge, concepts and understanding. So it deals exclusively with the mind, mental abilities and skills to be developed at different levels.

-Affective Domain Objective :This includes the feelings ,interest and attitudes and appreciations that may result from science instruction.

-Psychomotor Domain Objective: Include Objectives that stress motor development muscular coordination and physical skills.

The Cognitive Domain has for the past years received far more attention than the Affective

And psychomotor domains. Our understanding of the three domains will be one of the most helpful aids in formulating objectives for the teaching of physics. The cognitive domain is again divided into six categories thus: Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. In order of importance are classified thus: Evaluation, Synthesis, Analysis, Application, Comprehension and Knowledge(ie from the highest to the lowest level).-Evaluation: This is the highest level of learning results in hierarchy and includes all the other levels plus the ability to make value judgement of information based on internal evidence ,consistency and clearly defined external criteria.

Synthesis.

-Synthesis: This is the bringing together of scientific ideas(concepts) to form a unique one. Place or pattern could be a learning formulation results at this level .It then requires the formulation of new understanding of scientific systems. I analysis stresses the path then synthesis stresses the whole.

-Analysis: It requires more than knowledge ,comprehension and Application with an understanding of the underlying structure of the material .This is the ability to break down scientific material into its fundamental elements for better understanding of the organization. It includes: identifying parts, clarifying relationship among parts and recognizing organizational principles of scientific systems.

-Application: It is the ability to show the pertinence (importance) of scientific principles to different situations. Students at this level may apply scientific concepts, methods, laws or theories to actual concrete problems.

-Comprehension: This is the first step beyond simple recall, first level of demonstrating an understanding of scientific information. It is the ability to apprehend (worry),grasp or understand the meaning of scientific material .this is shown in three ways:-Translation of scientific knowledge into other forms s'a drawing graphs from data;-Interpretation of

scientific knowledge by re ordering and showing and showing interrelationships and summarizing of materials (eg graphs and data);-Extrapolation of scientific knowledge ,students can here predicts between two or more items of data.

-Knowledge :This is the lowest level of the cognitive domain objectives.This is a simple recall of scientific material previously learnt.Simple recall then implies bringing to mind appropriate scientific information which should vary from simple to complex theories.

In the Teaching/learning of physics ,the psychomotor objective concerns learning results involving the physical manipulation of apparatus,skill development and proficiency in using scientific instruments and devices. Many of these desired behaviors are not ends in themselves but means for cognitive and affective learning.

SIMPLE VERBS FOR USE IN THE COGNITIVE DOMAIN WHEN WRITTEN A LESSON PLAN:

Since the most important domain objective for a lesson plan is the Cognitive Domain, some importance are usually used at different levels of it:

- (i)Knowledge:define,repeat,record,list,enumerate,name,state,reproduce,label,recall,underline etc;
- (ii)Comprehension: translate, restate describe, explain, express, identify, locate, report, summarize etc;
- (iii)Application: apply, employ, use, demonstrate, perform, practice etc;
- (iv)Analysis:differentiate,experiment,calculatecompare,test,contrastdiagram,deduce,criticiseetc;
- (v)Synthesis: integrate ,plan, propose ,compare, desing, formulate
- (vi)Evaluation:judge,rate,compare,score,select,choose,asses,estimate etc

DIFFERENT STEPS IN PREPARING OBJECTIVES:-Bear in mind your overall instructional objectives and your general lesson objectives;-Develop an understanding of concepts in physics;- Stimulate an interest in a new area of physics(intrinsic motivation);-These objectives should be combined;-What type of objectives;-Is there a congruence between the levels of objectives and your instructional aims;-Select the L T content desired to achieve the objectives of the Unit Lesson;-Do not allow the presence of a topical outline influence your objectives,-Always localize your teaching and content should be appropriate to your objectives and meaningful to students etc.