UNIT 1:
NATURE OF SCIENCE

Dear students you are welcome to Unit 1. This unit takes you through the Nature of Science it is going to be interesting. We know you will surely enjoy every bit of it. Please take your time to read the learning outcomes and indicators as stated below.

Indicators:

The student will be able to:

- Explain the science as a body of knowledge, method for acquiring knowledge, and as an institution.
- Explain the pedagogical implication to the teaching and learning process
- Explain why we teach science in basic schools
- Describe at least six characteristics of scientific knowledge
- Describe the processes and product of science
- Differentiate between science and technology

Well done for reading the above. Now do the activity below

- ***Activity 1*:**

Brainstorm the meaning of Science. Compare your answer with the information below

1.1 Meaning/Some Definitions of Science

Science comes from the Latin word ***Scientia*** which means knowledge

Science may be defined as:

- A method of exploring the environment by observing things and solving problems
- The gathering and recording of information to find answers to questions and challenges of human race
- A method of obtaining knowledge through observation and experimentation
- A process of generating knowledge
- A way of learning that involves first hand experiences, inquiry, problem solving, communication of findings
- That body of knowledge which can be communicated to others and which can be verified by anyone willing to make the efforts to do so.

From the various meaning of science we can now say that: science is a way of learning which involves first hand experiences, inquiry, problem solving, interpretation and communication of findings.

Science is a process of generating knowledge and a search for explanation.

Science is both a process and a product

Dear student you are to answer the question in Activity 2

- ***Activity 2***:

How will you explain science as a body of knowledge? The content below will help you to explain it better

1.1.1 Categories or Group of Science

Science is divided into two broad categories. These are **Pure Science** and **Applied Science**
Pure science: Pure Science deals with the attempt to understand nature
Applied Science: Applied Science deals with the use of the knowledge acquired in pure science

Branches of Pure Science

Pure Science can be grouped into three main branches. These are **Biology**, **Chemistry** and **Physics**

1. **Biology** is the study of living organism (plant and animal) and their interactions with each other and the environment
2. **Chemistry** is the study of the composition and existence of matter
3. **Physics** is concerned with the forces that exist between objects and their interrelationship between matter and energy.

Some Fields of Applied Science

Meteorology; Engineering; Medicine; Pharmacy; Geography; Agriculture; Forestry; Horticulture; Environmental Health; Sociology; Geology; Psychology; Astronomy.

Dear student please answer the question below

- ***Activity 3*:**
  Explain science as an institution. Read the content below to add up to your answer

1.1.2 Fields of Science

We have two fields of science. These are the **Natural Science** and **Social Science.**
Natural Science deals with problems of nature. Examples are Biology, Physics, Chemistry, Geology, Agriculture, Engineering, and Astronomy. **Social Science** deals with problems of Economics and Political Science.
Both Natural and Social Scientist have some characteristics in common. They both use scientific methods or processes to acquire knowledge and achieve their objectives. However, their products of findings differ. The findings of socialist are not reliable. It is also not reproducible because taste of people change with time. The products of Natural Scientists are universal, can be reproduced, predicted and reliable.

Dear student please attempt Activity 4 below

***Activity 4*:**

- Explain Science as a method for acquiring knowledge. Read the information below to assist you to explain it better.

1.1.3 What Are Scientific Methods

Scientist methods are the procedures used by scientist to solve problems. The steps to follow are:

1. Recognizing a problem
2. Collecting information about the problem
3. Making hypothesis
4. Devising an experiment
5. Observing and recording result
6. Analysing the result (making deductions)
7. Drawing conclusion and generalisations.

Importance of Scientific Method

1. It provides logical procedures for arriving at knowledge.
2. It provides knowledge that can be verified or tested
3. It provides information on the existence of species which were otherwise thought not to exist
4. It leads to discovery of new things.

Dear student please answer the questions in Activity 5

Activity 5

- State and explain any four pedagogical implications of teaching and learning process in science.
- Mention and explain three scientific attitudes that can be developed in JHS learners.
- Mention two (2) values in science and explain how they contribute to the development of Science.

1.2 Implications to the Teaching and Learning Process (Pedagogical Implications)

1. Learners should accurately apply appropriate science concept, principles, laws and theories in interacting with the universe.
2. Learners should use processes in science in solving problems, making decision and furthering their own understanding of the universe.
3. Learners should interact with the various aspects of the universe in way that is consistent with the values that underline science.
4. Learners should develop scientific attitudes such as scientific objectivity, open mindedness, curiosity, perseverance, flexibility, respect for evidence, reflection, honesty, critical mindedness, thoroughness.
5. Leaners should be familiar with some values in science and how they contribute to the development of science. Some values in science includes: longing to know and understand,

questioning of all things, request for logic, consideration of premises, respect diversity, equity commitment to achieve excellence, team work/collaboration, truth and integrity.

Activity 6:

Explain why we teach science in the Basic schools. The content below will assist you to answer it better.

1.3 Why Teach Science in Basic School

1. **Cognitive Domain (Thinking Process)**
    a. To help pupils to discriminate between relevant and irrelevant information.
    b. To acquire basic concepts in science concerning phenomena in their environment and themselves.
    c. Think logically and learn to interpret finding in a logical manner.
    d. Acquire basic science knowledge necessary to appreciate and solve simple problems in their environment.
    e. Learn to classify materials, objects and animals.

2. **Affective Domain (Attitude and Interests)**
    a. To develop in the child the ability to ask questions about phenomena in their environment
    b. Develop interest in and show an appreciation of the natural environment.
    c. Helps the pupils to realize that the environment can be controlled or improved.
    d. To appreciate the importance of science in everyday life a well as its limitation.
    e. To help the child develop interest in carrying out scientific research and investigations.
3. **Psychomotor Domain (Practical/Process Skills)**
    a. Conducting experiments and making measurements.
    b. Communicating ideas orally and in written form (recording).
    c. To develop hand-eye co-ordination.
    d. Manipulating objects in their environment.

Activity 7:

You are to describe briefly any six (6) activity of scientific knowledge. Compare your answer with the information provided below.

1.4 Characteristics of Scientific Knowledge

CHARACTERISTICS	**MEANING**

Tentative	It is subject to change and therefore it does not claim to be absolute truth in final stage.
Replicable	It is based on evidence which could be obtained by other investigators working at different places
Humanistic	It is the product of mankind resulting from an effort to impose order on nature and involve creating imagination
Empirical	Scientific knowledge is based on observation and experiment not theory. However, theory may serve as useful guide for further work.
Historical	Scientific knowledge of the past has provided the basis for today's knowledge; which will in turn provide bases for tomorrow's knowledge.
Unique	Scientific knowledge can be identified from other realms of knowledge by its nature and procedures for generating new knowledge
Public	It is based on evidence that is public as opposed to personal

Dear learner we hope you are enjoying your lesson. You are to answers in Activity 8

Activity 8:

- What are the processes of science?
- Describe any five processes of science

1.5 Process of Science

What are the processes of science?

The processes of sciences are the procedures used by scientist. It involves observation, prediction, measuring and calculation, manipulation, designing and making experiment, communication, inferring, hypothesis, drawing conclusion, raising questions.

The process skills are:

Predicting, raising questions, making hypothesis, manipulation, observation, recording, experimentation, planning, observation and drawing conclusion.

No	Generic / Process Skills	Explanation / Meaning

	Planning	Defining the problem and thinking of ways to solve it through experimentation, or some structured investigation.
	Observation	It involves the use of the sense to take in information.
	Classification	Placing a collection of objects or events in categories based on similar characteristics.
	Experimentation / Fair Testing	Interaction with materials to find out things for yourself or managing the factors that may influence a situation or event so that the effect of a given factor may be learned.
	Raising Questions	Asking a variety of questions through words or actions; asking questions which can be answered through scientific investigation / experimentation.
	Measuring	Using measuring instruments correctly and with appropriate precision as required by the investigation, and being able to compute result from measurements taken.
	Manipulation	Skillful handling of objects and tools in accomplishing a task.
	Prediction	Forecasting what future observation will be on the basis of previous information, which distinguishes it from guessing.
	Interpretation data	Giving meaning to information gathered.
	Hypothesis	Suggesting reasons for events or phenomena, which can be tested scientifically. It involves applying concepts and ideas from previous experience.
	Inferring	Explaining an observation in terms of one's previous experience.
	Generalizing	Extending the conclusion of an experiment to other similar situations; being able to predict possible solutions to similar problems based on the result of a previous experiment.
	Evaluation	Assessing the result of the experiment and finding conclusion or inferring conclusions from the experiment; determine whether results confirm one's prior predictions or not.
	Communication	Being able to present information so that it can be understood by others, being able to understand information from others presented in various forms

		using graphs, charts, prose, written instruction, diagrams, pictorial and oral representation.

Dear learner you are to answer the question in Activity 9

Activity 9:

- What are the products of science?
- States any two (2) differences between science as a process and science as a product.

1.6 The Product of Science

The processes you used to arrive at a conclusion is referred to as Process of Science. The scientist ends up an investigation or research by making discoveries of facts and concepts, formulating generalizations, theories and laws. These are known as 'Products of Science'. Examples are facts drawn from Experiments, theories such as Atomic Theory and Mendel's Theory, law such as law of gravity, law of conservation of water, law of floatation, and principles such as Archimedes' principles.

Principles such as Archimedes' Principles

The processes and products of science relate to one another. One depends on the other and they are both inseparable. Thus without processes, there is no scientific knowledge (product).

Activity 10:

- You are to differentiate between science and technology. The content provided below will guide you.

1.7 Science and Technology

1.7.1 Meaning of science

Science can be defined in various ways, such as:

- A knowledge-generating process
- A way of learning, which involves first-hand experiences, inquiry, problem solving, interpretation and communication of ideas.

1.7.2 Meaning of technology

Technology has also been defined in various ways:

- A process by which scientific knowledge and discoveries are applied and used.
- A discipline process using scientific materials and human resources to achieve human processes.

- The purposeful use of man's knowledge and materials, resources of energy and natural phenomena.
- The totality of the means employed by people to provide materials objects for human sustenance and comfort

1.7.3 Relationship Between Science and Technology

The definitions above portray technology as the application of scientific knowledge for human use. In other words, technology is a direct product of science.

1.7.4 Similarities Between Science and Technology

1. They are closely interwoven
2. They are both reproductive
3. They both create or solve human problems.

1.7.5 Differences Between Science and Technology

SCIENCE	TECHNOLOGY
1. The product (principles) are intangible (cannot be seen or touched)	1. The products (machines or other devices) are tangible
2. Can be demonstrated and understood	2. Can be brought and used without understanding
3. Changes occur only gradually	3. Can be changed and improved on in a relatively short time

1.7.6 Importance of Science

1. Science is important to the public because it helps address issues that are concern to the general population.
2. Scientific principles have been and continue to be applied to address issues, concerns and problems that people face in the day to day aspects of living.
3. Scientific research has value and importance to the layperson to the extent that it helps address problems of a practical nature.
4. How science is taught and learned can determine its relevance to the majority of students, not only to those planning career in scientific fields.

1.7.7 Limitation of Science

1. Practice of science is a human activity
2. Anything outside the sense is not science
    a. Anything beyond the boundary of senses
    b. No spiritual things in science

3. There is an authority in science and when that authority speaks then that is the end of it (observation)
    a. Truth being relative
    b. One truth being replaced by another truth
4. There is a building up on this observation
5. Method of science are based on observation but not limited to it.
6. From observation there are generalizations based on explanations and these are further tested by observation (building up process)

1.7.8 Importance of Technology

Technology is the use of scientific knowledge for our human comfort. Technology can also be explained as the use of scientific equipment for making work easier.

The relationship between science and technology is that science produces the knowledge and technology uses the knowledge for practical applications, for example, technologists use the knowledge of electricity and metals to produce refrigerator, electric iron and electric cookers. They also use the knowledge about sound to produce telephones for communication, use the knowledge of light to produce lenses, camera and microscopes. Without scientific knowledge there is no technology. Each depends on the other.

1.7.9 Effects of Technology on the society

a. Information technology has improved. Now we have computer for processing information very fast
b. Foo technology has brought new methods for processing and preserving of foods
c. Health technology has improved the life of people. We have three ways of medical treatment now. These are the orthodox medicine, traditional/herbs medicine and computer medicine. We also have gadget for treating heart, cancer and kidney diseases.
d. In agriculture we have new breeds of seeds, improved crop storage and new agricultural machinery.

Knowledge has brought understanding and awareness to the society. For example, people are aware of how flood and earthquakes occur and know what to do in these situations. They are also aware of HIV/AIDS and are taking steps to avoid it.

Dear student you are welcome to the last Activity of this unit to be precise Activity 11. Well done for completing the last ten (10) Activities above.

Activity 11:

- What is a traditional belief?
- Discuss any two effects of traditional belief on science teaching.
- State three reasons why beliefs are held.

1.8 Relationship Between Science and Local Beliefs In The Teaching Of Science

1.8.1 What is a traditional belief?

Traditional beliefs are beliefs and taboos handed over to us by our ancestors. These beliefs are not challenged but we accept them. They differ from one ethnic group to another. In America the number thirteen is considered as a bad omen. That is, they do not use it to number their houses, rooms and floors.

In Ghana, there many cultural beliefs and practices pupils learn at home. Pupils with these beliefs and prejudiced minds come into conflict with the science they learn at school. Scientific research has shown that some traditional beliefs have real scientific bases so our ancestors have reason for giving such beliefs and taboos.

The traditional beliefs and taboos which have good scientific bases are termed positive beliefs but those without good scientific bases are known as "negative beliefs"

1.8.2 Positive Beliefs and Their Scientific Explanations

1. **Beliefs**: One should not talk whilst eating else the offender will die
   Scientific explanation: In talking, sound is produced by expelling air from the lungs and inhaling large volumes of air. So when one talks whilst eating there is the possibility of food getting into the lungs. The presence of food in the lungs is harmful and this might cause death. The child is barred from talking in order not to die.

2. **Belief:** One should not sing when bathing else the offender's mother would die
   Scientific explanation: to produce sound, air must expelled from the lungs, and to obtain enough air for the activity, the singer must inhale large volume of air. That is, when one sings whilst bathing there is possibility of inhaling water and soap into the lungs. The presence of these items in the lings is harmful and may cause death. The child is therefore deterred from singing whilst bathing in order not to cause death of their mother whom they love so much.
   Secondly caustic soda which is used in preparing soap is very strong (highly corrosive) and this will cause serious burns when it gets to the lungs. Thus the child is barred from singing

3. **Belief:** At funerals we do not go round corpse weeping else the corpse will decompose immediately.
   Scientific explanation: At funerals, there is decomposition of the corps which gives bad odour due to heat in the crowded room. Inhaling such polluted air may give one an airborne disease because the corpse was not properly embalmed in the olden days. Only local herbs were used. To avoid this, people were deterred by the fact that the corpse will decompose immediately. If you do not want your loved one or relative's corpse to decompose, you stop crying immediately.

1.8.3 Negative Beliefs and Their Scientific Explanation

1. **Belief:** Whatever elders say is indisputable truth and should not be questioned.
   Scientific explanation: It has no scientific basis. It is used to deter people from asking questions about the taboo.
2. **Belief:** Pregnant women are not supposed to eat snails or eggs else the unborn baby will become a thief in future.
   Scientific explanation: This taboo deprives pregnant women of proteins which the unborn baby needs to build the body. It has no scientific basis and can lead to miscarriage
3. **Belief:** one should not shout when a ghost is seen else you may have sores around your mouth.
   Scientific explanation: Has no scientific basis.

1.8.4 What Are the Reasons for Using Traditional Beliefs in Teaching Science?

Most of the traditional beliefs and taboos in our locality are backed by long experiences of our ancestors. Many reasons have been given and some of them are:

1. Personal safety of the individual and society. For example one should not sing whilst bathing else the offender's mother would die.
2. The maintenance of personal hygiene and to check the spread of disease. For example we do not cry around a corpse else the corpse will decompose immediately
3. Preventing cruelty to others and to animals. For examples, we do not throw stones at pregnant animals else the offender's mother will get a miscarriage
4. Instilling good social habits. For example we do not have sex in the bush else the gods will curse you.

1.8.5 Effects of Traditional Beliefs on Science Teaching

1. Makes the teaching and learning of science very difficult because the pupils/students are reluctant to assimilate what they see as inconsistent with their local life.
2. The local beliefs could be a good source for the application of science knowledge.
3. Sensitise science teachers to relate scientific knowledge to home knowledge.
4. Make students appreciate the wisdom of local folks.

1.8.6 Effects of Unscientific Traditional Beliefs on the Teaching and Learning of Science

1. Makes the teaching and learning of science difficult because students do not see any relation between scientific knowledge and the local belief.
2. It promotes superstition which is inconsistent leads to research
3. Arouses curiosity in the student and this leads to research.

UNIT 1: SUMMARY

This Unit focused on the following sub-topics:

1.1 Meaning/Some Definitions of Science

1.2 Implications to the Teaching and Learning Process (Pedagogical Implications)

1.3 Why Teach Science in Basic School

1.4 Characteristics of Scientific Knowledge

1.5 Process of Science

1.6 The Product of Science

1.7 Science and Technology

1.8 Relationship Between Science and Local Beliefs In The Teaching Of Science

EBS 203 UNIT 2 PART 1

Methods of Teaching Science

Unit 2 -The Teacher

Lesson outcomes

- *Who is a Teacher?*
- *Some Qualities of a Good Teacher*
- *What is Teaching?*
- *Teaching: As An Art or a Science?*
- *Teaching Competencies*
- *Roles of the Teacher in the Teaching and Learning Process*
- ***Phases of Teaching***

- **Reflective Teaching (next meeting)**
- NTS (NTS 2a, 2b, 2c,2e. 2f, 3e)

WHO IS A TEACHER

- A teacher is a person who helps student to acquire knowledge, competence or virtue.
- One whose professional or occupational function is to help others learn and develop new ways
- A **teacher** (also called a **school teacher** or, in some contexts, an **educator**) is a person who helps students to acquire knowledge, competence or virtue

Class discussion

- Is teaching an ARTS or SCIENCE
- Give to students as an assignment as well.

Qualities of GOOD TEACHER

- Develops self-confidence in students.
- Encourages students, never criticizes.
- Inspires the students.
- Impartial to all students.
- Promotes all-round development of students.
- Imparts moral values and values of Life.
- Prepares himself/herself for each class-hour.
- Incorporates good communication skills and discipline.
- Takes the responsibilities as a teacher and guide.
- Develops good interpersonal relationships.
- Develops patriotism.

WHAT IS TEACHING

- Teaching is the process of attending to people's needs, experiences and feelings, and intervening so that they learn particular things, and go beyond the given.
- Paul Hirst (1975) concluded, 'being clear about what teaching is matters vitally because how teachers understand teaching very much affects what they actually do in the classroom'

Hirst (1975) makes two very important points. For him teaching should involve:

- Setting out with the intention of someone learning something.
- Considering people's feelings, experiences and needs. Teaching is only teaching if people can take on what is taught

- Jerome Bruner's insights around the nature of education, and the process of learning and problem solving

To instruct someone… is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as an historian does, to take part in the process of knowledge-getting. Knowing is a process not a product. (1966: 72)

Good teachers 'have deep knowledge of the subjects they teach, and when teachers' knowledge falls below a certain level it is a significant impediment to students' learning' (Coe *et. al.* 2014: 2).

The schoolmaster had no such close contact with his pupils. (Castle 1961: 63-4)

- Loosely as in a situation in which a mother teaches her daughter to prepare soup; or a village carpenter teaches an apprentice to make a chair, and
- Officially as in school situation where a professional teacher trains pupils to read and write. In this Unit institutionalized teaching will be dealt with.

FORMS OF INSTITUTIONALISED TEACHING

- ***formal teaching*** the teacher takes full control of the class and decides on what to teach and the methods to use. He may decide to use the class or lecture method, whole class discussion or brainstorming technique.
- ***Informal teaching*** is the approach in which the teacher is more of facilitator of learning rather than a director of it. The teacher organizes teaching in such a way that learners are brought in contact with the learning material and left to interact with the learning materials themselves in the way they please.

- https://raccoongang.com/blog/difference-between-formal-and-informal-learning/

TEACHING COMPETENCIES

- Knowledge of Students and Their Development. Understands and appreciates diversity. ...
- Creates an Effective Learning Environment. ...
- Understands Subject Matter. ...
- Plans and Designs Appropriate Learning Experiences. ...
- Uses On-going Assessment to Monitor Student Learning. ...
- Develops Professional Practice.

Competencies continue

- Instructional delivery
- Classroom management
- Formative assessment
- Personal competencies (soft skills)

Instructional delivery:

- *Teacher sets criteria for success.*
- *Teacher informs students of criteria ahead of the lesson.*
- *Teacher demonstrates to the students successful use of the knowledge/skills through modeling.*
- *Teacher evaluates student acquisition.*
- *Teacher provides remedial opportunities for acquiring the knowledge/skills, if necessary.*
- *Teacher provides closure at the end of the lesson.*

Classroom management:

- Rules and procedures

  School wide rules and procedures:

  Classroom rules and procedures:
- Proactive classroom management:
- Effective classroom instruction
- Behaviour reduction

Formative assessment

- Should be able to conduct assessment
- For
- Of and
- As

Personal competencies (soft skills):

- Establishing high but achievable expectations
- Encouraging a love for learning
- Listening to others
- Being flexible and capable of adjusting to novel situations
- Showing empathy
- Being culturally and gender sensitive
- Embedding and encouraging higher order thinking along with teaching foundation skills
- Having a positive regard for students

Roles of the Teacher in the Teaching and Learning Process

- ***The Controller***: The teacher is in complete charge of the class
- ***The Prompter***: The teacher encourages students to participate and makes suggestions about how students may proceed in an activity the class
- ***The Resource:*** The teacher is a kind of walking resource center ready to offer help if needed, or provide learners with whatever language they lack when performing communicative activities
- ***The Assessor***: The teacher assumes this role to see how well students are performing
- ***The Organizer***
- ***The Participant***:
- ***The Tutor:*** (coach); ***Leader, administrator and manager; Scholar, researcher and lifelong learner***
- ***Community, citizenship and pastoral role***

- Thank you for your time

CHARACTERISTICS OF A GOOD TEACHER

- Good Teachers Are Strong Communicators
- Good Teachers Listen Well
- Good Teachers Focus on Collaboration
- Good Teachers Are Adaptable
- Good Teachers Are Engaging
- Good Teachers Show Empathy
- Good Teachers Have Patience
- Good Teachers Value Real-World Learning
- Good Teachers Share Best Practices
- Good Teachers Are Lifelong Learners

UNIT 3: LEARNING

Dear student nice to meet you once again. We hope you are enjoying your lessons. We now welcome you to Unit 3. You are to read the learning outcome and indicators below

Indicators:

The student will be able to:

- Differentiate among the three categories of learning (cognitive learning, effective learning and psychomotor learning)
- Describe the pedagogical implications each of the three categories of learning.
- Differentiate among the three major theories of learning
- Describe the pedagogical implications each of the three major theories of learning.

- ***Activity 1: You are to answer the following questions:***

1. Who is a good learner?
2. Mention and explain any five qualities of a good learner

3.1 Who is a good Learner?

Is someone who understands that the reason for studying is not to fulfill an obligation or to pass a test. You study for yourself. For this reason, a good learner will always keep on learning because he will always want to know more. Not only that. But a good learner will want to use what he/she has learned.

Some Qualities of a good learner:
These include: Discipline, Building Relationships, Asking Relevant Questions, Sense of Respect, Taking Responsibility, Participating in Extra Curricular Activities, Searching Knowledge, Working Hard, Punctuality, Attentive to Lesson, Self Confidence, Positive Attitude, Setting up Aim, A Good Listener, Having Smartness, Good Manners, Having Seriousness, Excellent Organizer, Simplicity of Mind, Keeping Updating, Having Commitment, Ambitious, and Academic Competencies

- ***Activity 2:***

What is learning?

3.2 What is Learning?

- Learning is acquisition of knowledge or skills through study, experience, or being taught.
- Learning is a *process* that leads to *change*, which occurs as a result of *experience* and increases the potential for improved performance and future learning.
  The change in the learner may happen at the level of knowledge, attitude or behavior. As a result of learning, learners come to see concepts, ideas, and/or the world differently.
- Learning is a change in human disposition or capacity that persists over a period of time.
- Learning is a change in an individual that results from experience.

- ***Activity 3:***

Mention and discuss any **principles** of Learning Science

3.3 Principles of learning:

To teach effectively, the teacher must understand the basic principles of learning. Based on the different concepts of the learning process and the laws that govern them, the following general principles of learning are presented for guidance in teaching:

1. **Learning** is considered as the acquisition of knowledge, habits, skills, abilities, and attitudes through the interaction of the whole individual and his total environment. Responses are considered an integral part of the unified self in meeting life's demands.

2. **Learning** is meaningful if it is organized in such a way as to emphasize and call for understanding, insight, initiative, and cooperation. When the learner is capable of gaining insight or understanding into the learning situation, then and only then will learning take place. Understanding is an organiz¬ing, synthesizing process that integrates experiences into larger meaningful units.

3. **Learning** is facilitated by motives or drives. Needs, interests, and goals are fundamental to the learning process. If the individual has to learn, he must have some goal to be accomplished. Learning is best when the learner knows and

understands his motive in learning.
4. **Learning** is facilitated by the law of readiness or mind¬set. Learning does not occur unless the learner is ready to act or to learn. When a person is ready to learn, he learns more effectively and with greater satisfaction than when unprepared. When a person feels ready to act and is prevented from doing so, he feels annoyed. Mental set is conductive to effective learning.
5. **Learning** is facilitated by the law of exercise. Practice and exercise are so common that they are universally accepted as an active means of learning. Lack of practice or exercise causes memory of learned materials to weaken; and in general, the longer the period of disuse, the greater the loss. We learn and retain by exercise and forget through disuse.
6. **Learning** is facilitated by the law of effect. The law of effect pertains to the influence of satisfying or unsatisfying feeling tones that accompany a response and either strengthen or weaken that response. When the learner finds the correct answer to a question, he feels pleased about his achievement and the connection is consequently strengthened. A feeling of satisfaction fixes a response, whereas a feeling of annoyance tends to destroy it.
7. **Learning** is facilitated by the law of belongingness. When the learner perceives the relationship of facts presented, the speed of learning is greatly increased. In other that learning, in the classroom will be more meaningful to the learner, it must be related in some way to his previous knowledge. It must belong to the context of learning the learner has already achieved.
8. **Learning** is facilitated when the teacher provides the learner with the proper stimuli and guides, and uses the principle of conditioning or associating those learning functions that need to be made automatic for most effective learning. Automatic responses are of prime importance in the formation of new habits or skills for they increase power and lessen fatigue. They serve as time-and-energy-saving habits.
9. **Learning** is conditioned by the attitude of the learner, the environmental conditions conducive to learning, and the attitudes and skills of the teacher in setting the stage for learning, which includes teaching skill itself. Learning is most effective in an atmosphere of security and belonging.
10. **Learning** difficulty is due to many factors within the learner. The most common factors which affect the learning process are the intellectual, physical, emotional and social factors. All of these factors may be found in the learner.
11. **Learning** is effective when more senses are utilized by the learner. The combination of seeing and hearing with touch, taste, and smell will facilitate the learning and under¬standing of the ‘learning situation. The use of different senses will also add electiveness in causing learning to be meaningful and

functional.

12. **Learning** is effective when it is made functional and aided by understanding derived from experience. The experi¬ences of the pupil when utilized by the teacher will add to the understanding of the learning situation. Experiences and other material devices are often used in teaching to give meaning and understanding to the learner. The maturity and intelli¬gence of the learner will determine the need for supplemental experience and other instructional devices.

- ***Activity 4:***

    1. Explain the following

        i. Deductive learning

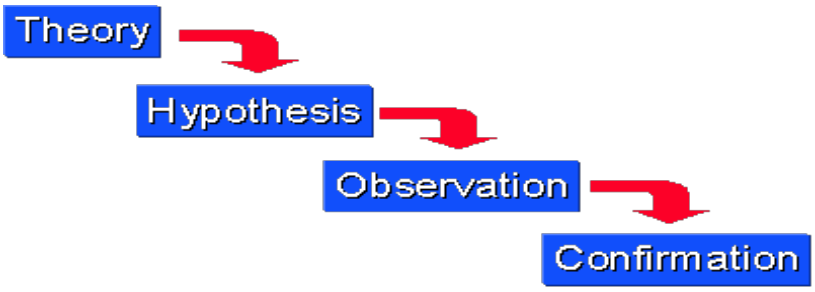
        ii. Inductive learning.

    2. State a difference between deductive learning and inductive learning.

Read the content below to get better understand

A deductive approach to instruction is a more teacher-centered approach. This means that the teacher gives the students a new concept, explains it, and then has the students practice using the concept.

Deductive reasoning works from the more general to the more specific. Sometimes this is informally called a "top-down" approach. We might begin with thinking up a *theory* about our topic of interest. We then narrow that down into more specific *hypotheses* that we can test. We narrow down even further when we collect *observations* to address the hypotheses. This ultimately leads us to be able to test the hypotheses with specific data – a *confirmation* (or not) of our original theories.

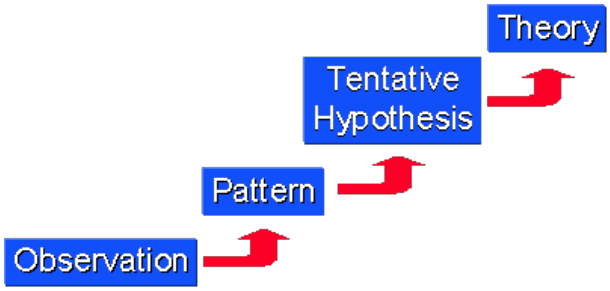


3.4.2 What is inductive Learning?

In contrast with the deductive method, inductive instruction makes use of student "noticing". Instead of explaining a given concept and following this explanation with

examples, the teacher presents students with many examples showing how the concept is used. The intent is for students to “notice”, by way of the examples, how the concept works.

Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories. Informally, we sometimes call this a “bottom up” approach (please note that it’s “bottom up” and *not* “bottom**s** up” which is the kind of thing the bartender says to customers when he’s trying to close for the night!). In inductive reasoning, we begin with specific observations and measures, begin to detect patterns and regularities, formulate some tentative hypotheses that we can explore, and finally end up developing some general conclusions or theories.



3.4.3 How can a teacher decide which method is the best choice for a given topic?

Both deductive and inductive sequences are valuable for teaching concepts, generalizations, processes, and skills. The teacher must decide which to select given the learning outcomes desired and the composition of the class. When choosing, the teacher should consider a number of factors:

- How personalized should the learning be? Students will usually be more involved in the learning experience and tend to participate more actively when an inductive approach is used. If a deductive approach is chosen, it is important to structure the learning experience in order to draw on students' prior experiences and learning, and to provide for their active involvement.
- Should learning experiences be predictable? The deductive approach is more predictable because the teacher selects the information and the sequence of presentation.
- What depth of understanding and rate of retention is desired? Students tend to understand and remember more when learning occurs inductively.
- How much time is available to teach the material? The deductive approach is faster and can be an efficient way to teach large numbers of facts and concrete concepts.

Instructional methods tend to be either deductive or inductive, although some methods use both. Many lessons can include both approaches.

3.4.4 Difference between Inductive and Deductive Approach:

DEDUCTIVE	INDUCTIVE
Deductive reasoning depends on facts and evidence	**Inductive** reasoning looks at patterns.
Deductive reasoning provides solid, repeatable conclusions	**Inductive** reasoning makes general, most probable conclusions about evidence that has been observed.
Deductive reasoning will always have strong conclusions as to whether the premise is valid or invalid.	**Inductive** reasoning may not always have strong conclusions on the validity of its hypothesis
Deduction moves from idea to observation,	**Induction** moves from observation to idea.
Deduction moves from more general to more specific	**Induction** moves from more specific to more general
Deductive arguments have unassailable conclusions assuming all the premises are true	**Inductive** arguments simply have some measure of probability that the argument is true—based on the strength of the argument and the evidence to support it.
Deductive is a **discovery**	Inductive is a **Innovation**
Deductive is **finding** from the theory	Inductive is **making** a theory
Deductive is **whole** to part	Inductive is **making** a part to the whole.

Deductive is **empirical**	Inductive is **experimental** by nature

Advantages of a deductive approach:

• It gets straight to the point, and can therefore be time-saving. Many rules — especially rules of form — can be more simply and quickly explained than elicited from examples. This will allow more time for practice and application.

• It respects the intelligence and maturity of many - especially adult -students, and acknowledges the role of cognitive processes in language acquisition.

• It confirms many students' expectations about classroom learning, particularly for those learners who have an analytical learning style.

• It allows the teacher to deal with language points as they come up, rather than having to anticipate them and prepare for them in advance.

Disadvantages of a deductive approach:

• Starting the lesson with a grammar presentation may be off-putting for some students, especially younger ones. They may not have sufficient metalanguage (i.e. language used to talk about language such as grammar terminology). Or they may not be able to understand the concepts involved.

• Grammar explanation encourages a teacherfronted, transmission-style classroom; teacher explanation is often at the expense of student involvement and interaction.

• Explanation is seldom as memorable as other forms of presentation, such as demonstration. Such an approach encourages the belief that learning a language is simply a case of knowing the rules.

Advantages of inductive approach:

• Rules learners discover for themselves are more likely to fit their existing mental structures than rules they have been presented with. This in turn will make the rules more meaningful, memorable, and serviceable.

• The mental effort involved ensures a greater degree of cognitive depth which, again, ensures greater memorability.

• Students are more actively involved in the learning process, rather than being simply passive

recipients: they are therefore likely to be more attentive and more motivated.

• It is an approach which favours patternrecognition and problem-solving abilities which suggests that it is particularly suitable for learners who like this kind of challenge.

• If the problem-solving is done collaboratively, and in the target language, learners get the opportunity for extra language practice.

• Working things out for themselves prepares students for greater self-reliance and is therefore conducive to learner autonomy.

Disadvantages of an inductive approach include:

• The time and energy spent in working out rules may mislead students into believing that rules are the objective of language learning, rather than a means.

• The time taken to work out a rule may be at the expense of time spent in putting the rule to some sort of productive practice.

• Students may hypothesise the wrong rule, or their version of the rule may be either too broad or too narrow in its application: this is especially a danger where there is no overt testing of their hypotheses, either through practice examples, or by eliciting an explicit statement of the rule.

• It can place heavy demands on teachers in planning a lesson. They need to select and organise the data carefully so as to guide learners to an accurate formulation of the rule, while also ensuring the data is intelligible. However carefully organised the data is, many language areas such as aspect and modality resist easy rule formulation.

• An inductive approach frustrates students who, by dint of their personal learning style or their past learning experience (or both), would prefer simply to be told the rule.

- ***Activity 5:***

1. Difference among the three categories of learning that is cognitive learning, affective learning and psychomotor learning.
2. State and explain one pedagogical implication each of the three

3.5 Categories of learning

The Three Levels of the Mind and the domains of learning

Learning is everywhere. We can learn mental skills, develop our attitudes and acquire new physical skills as we perform the activities of our daily living. These domains of learning can be categorized as cognitive domain (knowledge), psychomotor domain (skills) and affective domain (attitudes). This categorization is best explained by the Taxonomy of Learning Domains formulated by a group of researchers led by Benjamin Bloom in 1956.

3.5.1 Cognitive Domain

The cognitive domain involves the development of our mental skills and the acquisition of knowledge. The six categories under this domain are:

1. **Knowledge**: the ability to recall data and/or information.
   Example: A child recites the English alphabet.
2. **Comprehension**: the ability to understand the meaning of what is known.
   Example: A teacher explains a theory in his own words.
3. **Application**: the ability to utilize an abstraction or to use knowledge in a new situation.
   Example: A nurse intern applies what she learned in her Psychology class when she talks to patients.
4. **Analysis**: the ability to differentiate facts and opinions.
   Example: A lawyer was able to win over a case after recognizing logical fallacies in the reasoning of the offender.
5. **Synthesis**: the ability to integrate different elements or concepts in order to form a sound pattern or structure so a new meaning can be established.
   Examples: A therapist combines yoga, biofeedback and support group therapy in creating a care plan for his patient.
6. **Evaluation**: the ability to come up with judgments about the importance of concepts.
   Examples: A businessman selects the most efficient way of selling products.

3.5.2 Affective Domain

The affective domain involves our feelings, emotions and attitudes. This domain is categorized into 5 subdomains, which include:

1. **Receiving Phenomena**: the awareness of feelings and emotions as well as the ability to utilize selected attention.
   Example: Listening attentively to a friend.
2. **Responding to Phenomena**: active participation of the learner.
   Example: Participating in a group discussion.
3. **Valuing**: the ability to see the worth of something and express it.
   Example: An activist shares his ideas on the increase in salary of labourers.
4. **Organization**: ability to prioritize a value over another and create a unique value system.

Example: A teenager spends more time in her studies than with her boyfriend.

5. **Characterization**: the ability to internalize values and let them control the person`s behaviour.
   Example: A man marries a woman not for her looks but for what she is.

3.5.3 Psychomotor Domain

The psychomotor domain is comprised of utilizing motor skills and coordinating them. The seven categories under this include:

1. **Perception:** the ability to apply sensory information to motor activity.
   Example: A cook adjusts the heat of stove to achieve the right temperature of the dish.
2. **Set**: the readiness to act.
   Example: An obese person displays motivation in performing planned exercise.
3. **Guided Response**: the ability to imitate a displayed behavior or to utilize trial and error.
   Example: A person follows the manual in operating a machine.
4. **Mechanism:** the ability to convert learned responses into habitual actions with proficiency and confidence.
   Example: A mother was able to cook a delicious meal after practicing how to cook it.
5. **Complex Overt Response**: the ability to skillfully perform complex patterns of actions.
   Example: Typing a report on a computer without looking at the keyboard.
6. **Adaptation**: the ability to modify learned skills to meet special events.
   Example: A designer uses plastic bottles to create a dress.
7. **Origination**: creating new movement patterns for a specific situation.
   Example: A choreographer creates a new dance routine.

3.5.4 Implication to teaching and learning

Developing and delivering lessons by teachers are integral in the teaching process. It is hence important for teachers to ensure that the three (3) domains of learning which include cognitive (thinking), affective (emotions or feeling) and psychomotor (physical or kinesthetic) to be achieved. It is imperative to understand that there are different categories of learners who have varying needs and as such different methods must be adopted in the planning and delivery of lessons to ensure that such needs are addressed. The world of education has gradually adopted the strategy of '*Every child matters*' structure that requires that all learners with different needs are counted.

3.5.5 Pedagogical implications of the three domains of learning

1. **Cognitive Domain (Thinking Process)**
   a. To help pupils to discriminate between relevant and irrelevant information.
   b. Think logically and learn to interpret finding in a logical manner.
2. **Affective Domain (Attitude and Interests)**
   a. Develop interest in and show an appreciation of the natural environment.
   b. To help the child develop interest in carrying out scientific research and

investigations.

3. **Psychomotor Domain (Practical/Process Skills)**
    a. To develop hand-eye co-ordination.
    b. Manipulating objects in their environment.

- ***Activity 6:***

1. Differentiate among the three major theories of learning.
2. Describe the pedagogical implications each of the three major theories of

3.6 CONSTRUCTIVIST, BEHAVIOURAL AND COGNITIVE THEORIES OF LEARNING

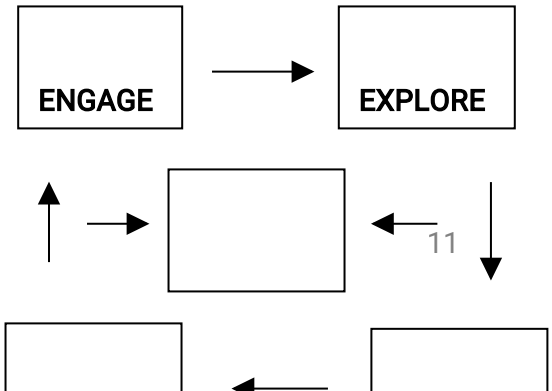
3.6.1 CONSTRUCTIVISM (John Dewey, Jean Piaget, Jerome Bruner, Lev Vygotsky)

Constructivism is an educational learning theory that places emphasis on students' role in learning through a guided means by the teacher to enable them construct their own understanding of materials or concepts through mental models and exposure to hands-on experiences.

Fundamentally, constructivism says that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences.

The Learning Cycle or "5 E's"characterizes the constructivist theory of learning

Engage……Explore……Explain……Extend…….Evaluate



The Five Es Instructional Model (Constructivism)

Please note that there are two groups of constructivism (the social and the cognitive)

1. Engage: This stage provides the opportunity for the teachers to discover what students know or what they think they know.
2. Explore: This stage provides a common set of experiences as well as a broad range of experiences. This stage allows students to compare what they think about with what they are actually observing.
3. Explain: This stage provides opportunities for students to connect their previous experiences and to begin to make conceptual sense of the main ideas within the unit of study.
4. Extend /Elaborate: In this stage students apply or extend the concepts in new situations and relate their previous experiences to new ones.
5. Evaluate: Evaluation of students' conceptual understanding and ability to use skills begins at the engage stage and continues throughout the model.

3.6.2 Pedagogical Implications of Constructivism Theory

The chart that follows outlines teacher and student behaviors within the 5 E model.

5Es	Suggested Activity	What the Teacher Does	What the Student Does
Engage	• Demonstration • Reading • Free Write • Analyze a Graphic Organizer	• Creates interest. • Generates curiosity. • Raises questions. • Elicits responses that uncover what the	• Asks questions such as, Why did this happen? What do I already know about this? What can I found out about this?

	• KWL • Brainstorming	students know or think about the concept/topic.	• Shows interest in the topic.
Explore	• Perform an Investigation • Read Authentic Resources to Collect Information • Solve a Problem • Construct a Model	• Encourages the students to work together without direct instruction from the teacher. • Observes and listens to the students as they interact. • Asks probing questions to redirect the students' investigations when necessary. • Provides time for students to puzzle through problems.	• Thinks freely but within the limits of the activity. • Tests predictions and hypotheses. • Forms new predictions and hypotheses. • Tries alternatives and discusses them with others. • Records observations and ideas. • Suspends judgement.
Explain	• Student Analysis & Explanation • Supporting Ideas with Evidence • Structured Questioning • Reading and Discussion • Teacher Explanation • Thinking Skill Activities: compare, classify, error analysis	• Encourages the students to explain concepts and definitions in their own words. • Asks for justification (evidence) and clarification from students. • Formally provides definitions, explanations, and new labels. • Uses students' previous experiences as basis for explaining concepts.	• Explains possible solutions or answers to others. • Listens officially to others' explanations. • Questions others' explanations. • Listens to and tries to comprehend explanations the teacher offers. • Refers to previous activities. • Uses recorded observations in explanations.
Extend	• Problem Solving • Decision Making • Experimental Inquiry	• Expects the students to use formal labels, definitions, and	• Applies new labels, definitions, explanations, and skills in new, but

	• Think Skill Activities: compare, classify, apply	explanations provided previously. • Encourages the students to apply or extend the concepts and skills in new situations. • Reminds the students of alternative explanations. • Refers the students to existing data and evidence and asks, What do you already know? Why do you think…? • Strategies from Explore apply here also.	similar situations. • Uses previous information to ask questions, propose solutions, make decisions, and design experiments. • Draws reasonable conclusions from evidence. • Records observations and explanations. • Checks for understandings among peers.
Evaluate	• Any of the Above • Develop a Scoring Tool or Rubric • Test • Performance Assessment • Produce a Product • Journal Entry • Portfolio	• Observes the students as they apply new concepts and skills. • Assesses students' knowledge and/or skills. • Looks for evidence that the students have changed their thinking or behaviors. • Allows students to assess their own learning and group-process skills. • Asks open-ended questions, such as: Why do you think…? What evidence do you have? What do you know about x? How would you explain x?	• Answers open-ended questions by using observations, evidence, and previously accepted explanations. • Demonstrates an understanding or knowledge of the concept or skill. • Evaluates his or her own progress and knowledge. • Asks related questions that would encourage future investigations.

1. Schemata ----------prior knowledge

2. Schema ---------- knowledge or concept
3. KWL is a strategy enabling students to know what they ***know***, what they ***want to learn***, and what they ***did learn***. (**(Dixon-Krauss, 1996)**
4. PQ4R (***Preview, Question, Read, and Reflect, Recite*** and ***Review***)
5. IDEAL is an acronym for ***Identify***, ***Define***, ***Explore***, ***Act*** and ***Look***

3.6.3 Cognitive Constructivism Approach to Teaching (Piaget, Brunner)

Firstly, you must present examples and non-examples of the concepts you are teaching

Examples:
Give examples that include people, kangaroos, whales, cats, dolphins, and camels as examples, and chickens, fish, alligators, frogs, and penguins as non-examples

Secondly, help students see connections among concepts.

Examples:
1. Ask questions such as these:
What else could you call this apple?" (Fruit)
"What do we do with fruit?" (Eat)
What do we call things we eat? (Food)
2. .Use diagrams, outlines, and summaries to point out connections.

Thirdly, pose a question and let students try to find the answer.

Examples:
1. How could the human hand be improved?
2. What is the relation between the area of one tile and the area of the whole floor?

Fourthly, encourage students to make intuitive guesses.

Examples:
1. Instead of giving a word's definition, say, "Let's guess what it might mean by looking at the words around it."
2. Give students a map of ancient Greece and ask where they think the major cities were.
3. Don't comment after the first few guesses. Wait for several ideas before giving the answer.
4. Use guiding questions to focus students when their discovery has let them too far astray

Social constructivism characteristics (Vygotsky)

- An important classroom goal is construction of collaborative meaning
- Teachers closely monitor student's perspective, thinking and feeling.
- The teacher and students are learning and teaching.
- Social interaction permeates the classroom.
- The curriculum and the physical contents of the classroom reflect student's interest and are infused with their culture.

There are 4 tools for making this happen, the tools are: ***scaffolding, cognitive apprenticeship, tutoring*** and ***cooperative learning***

Summary

1. Constructivism is "an approach to learning in which learners are provided the opportunity to construct their own sense of what is being learned by building internal connection or relationship among the ideas and facts being taught."
2. Constructivism begins as an impact of "cognitive revolution" in the 1950's.
3. Constructivism can be divided into cognitive constructivism and social constructivism.
4. Some of constructivist teaching techniques are scaffolding, peer tutoring, cognitive apprenticeship, cooperative learning and discovery learning.
5. Met cognitive is "thinking about one's thinking".
6. Expert learners think purposefully, reflective and open-minded whereas novice learners are rigid and narrow-minded.
7. Some of the metacognitive strategies are self-questioning, PQ4R, KWL, IDEAL, reflective thinking and critical thinking.

The Theory

According to constructivist theory,

- Learning needs to focus on overall concepts not isolated facts.
- Students rely on experiences to develop meaningful connections between topics, thus developing higher level thinking skills.
- Teachers act as facilitators, guiding student understanding by providing learning experiences in the classroom.
- Learning is an active process
- Knowledge is constructed from (and shaped by) experience
- Learning is a personal interpretation of the world

Benefits

- Constructivism gives students ownership of their learning experiences.
- Students are able to make real world connections.
- The information that students get from constructionist techniques is not learned by rote memorization, but through meaningful (relational experiences).
- Constructionist techniques are transferable from one subject matter to another.
- Gives students preferred learning style
- Caters for students rate of learning
- Caters for students personal interactions with other learners

Criticisms

- Critics of constructivism say that this technique leads to "group thinking" where the majority of the ideas win overall in the classroom, clouding all other original thoughts.
- Individuals may conform their own thinking to match those of the group.
- Students may not perform well on standardized testing as individual concepts are lost to the constructivist "big picture" ideal.

Learning Techniques

- Students play a much larger role in the constructivist classroom (learner centered)
- Problem-based learning gives students hands-on experience in solving problems, providing for meaningful learning experiences.
- Teachers may also employ experiments, projects and research assignments as part of the constructivist repertoire.

Assessment techniques

- Constructivist teachers use alternative forms of assessment. Many teachers will use a portfolio assessment where learning progress can be seen over time.
- Teachers will also use project guides to help assess student understanding.
- Teachers require students to consistently reflect on their learning in the constructivist classroom.

Characteristics /roles of the constructivist teacher

- Encourages and accepts students autonomy and initiatives
- Uses raw data and primary source along with manipulative, interactive and physical materials
- When framing tasks uses cognitive terminologies such as analyze, evaluate, predict, classify and create
- Allows students' responses to drive lessons, shift instructional strategies and

alter content

- Enquires about students' understanding of concepts before sharing their own understanding of those concepts.
- Encourages students to engage in dialogue both with the teacher and among one another
- Encourages students' enquiry by asking thoughtful and open ended questions and encourages students to ask questions of each other.
- Seek elaborations of students' initial responses.
- Engages students in experiences that might engender contradictions to their initial hypothesis and then encourages discussion.
- Allows wait time after posing questions
- Provides time for students to create relationships and metaphors
- Nurtures students natural curiosity through frequent use of learning cycle models
- The Teacher in a Constructivist Classroom is a Researcher
- Constructivist Teaching Involves Negotiation
- Constructivism Uses a Process Approach
- Teacher is a facilitator/consultant

Role of the student/learner in the constructivist classroom

- Help develop own goals and assessments
- Create new understandings (via coaching, moderating, suggesting)
- Control learning (reflecting)
- Member of community of learners
- Collaborate among fellow students
- Learn in a social experience –appreciate different perspectives
- Take ownership and voice in learning process

Characteristics of a constructivist classroom

- Organization and Management of a Constructivist Classroom are Democratic
- Power and Control in the Constructivist Classroom are Shared
- Classroom rules and regulation are flexible yet performance oriented
- Learning materials are in adequate supply because teachers are resourceful.

- There is no rush to finish a topic or concept since pace of learning is determined by learners.
- Knowledge construction and not reproduction is emphasized.
- This construction takes place in individual contexts and through social negotiation, collaboration and experience.
- The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.
- Multiple perspectives and representations of concepts and content are presented and encouraged.
- Goals and objectives are derived by the student or in negotiation with the teacher or system.

Possible learning activities in the constructivist classroom

- Modeling
- Collaborative Learning
- Coaching
- Scaffolding
- Problem-Based Learning
- Authentic Learning
- Anchored Instruction
- Cognitive Flexibility Hypertexts
- Object-based Learning

3.6.4 Pedagogical Implications of Constructivist Theory to the teaching and learning of science

Constructivist classrooms should be structured so that learners are immersed in experiences within which they may engage in meaning-making inquiry, action, imagination, invention, interaction, hypothesizing and personal reflection.

Teachers need to recognize how people use their own experiences, prior knowledge and perceptions, as well as their physical and interpersonal environments to construct knowledge and meaning.

The goal is to produce a democratic classroom environment that provides meaningful learning experiences for autonomous learners.

It is worth suggesting that there may be many ways of interpreting or understanding the world. Thus, the teacher is no longer seen as an expert, who knows the answers to the questions she or he has constructed, while the students are asked to identify their

teacher's constructions rather than to construct their own meanings.

In a constructivist classroom, students are encouraged to use prior experiences to help them form and reform interpretations.

Applying constructivism in the classroom

- Pose problems that are or will be relevant to students
- Structure learning around essential concepts
- Be aware that students' points of view are windows into their reasoning
- Adapt teaching to address students' suppositions and development
- Assess student learning in context of teaching

Differences between the constructivist's classroom and the traditional classroom

S/N.	Constructivist classroom	Traditional classroom
1	Begins with the whole – expanding to parts	Begins with parts of the whole Emphasizes basic skills
2	Pursuit of student questions / interests	Strict adherence to fixed curriculum
3	Primary sources / manipulative Materials	Textbooks and workbooks
4	Learning is interaction-building on what students already know	Instructor gives/ students receive
5	Instructor interacts / negotiates with students	Instructor assumes directive, authoritative role
6	Assessment via student works, observations, points of view, tests. Process is as important as product	Assessment via testing / correct answers
7	Knowledge is dynamic / changes with experiences	Knowledge is inert
8	Students work in groups	Students work individually

Drawbacks of the use of the constructivist approach to the teaching of science

- Loaded curriculum hence lack of adequate time
- Lack of technical know how
- Inadequate teaching and learning materials

- Lack of conducive learning environment
- Fear of teachers losing their pride due to contestation of ideas etc.

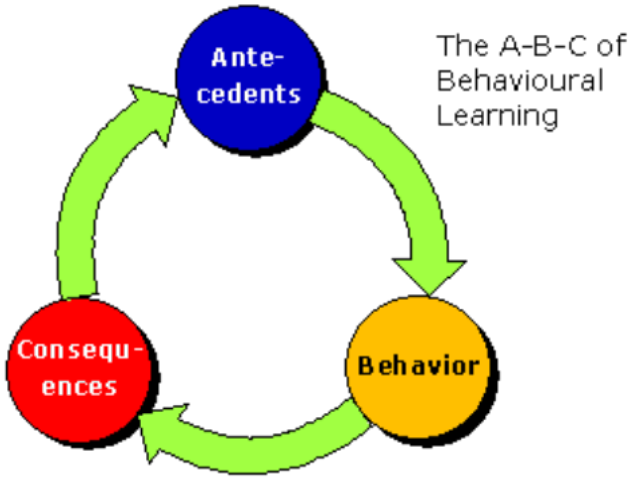
3.6.5 THE BEHAVIOURISTS LEARNING THEORY (BEHAVIOURISM)

Behaviourism (B. F. Skinner, E. Thorndike, Ivan Pavlov, Clark Hull & B. Watson) - *built upon Ivan Pavlov's theories of classical conditioning and operant conditioning*

Behaviourism is a theory of learning based upon the idea that all behaviours are acquired through conditioning. Conditioning occurs through interaction with the environment. Behaviourists believe that our responses to environmental stimuli shape our behaviours (acquisition of new behaviours)

A behaviorist theory is based on the fundamental idea that behaviors that are reinforced will tend to continue, while behaviors that are punished will eventually end.

This school of thought suggests that only observable behaviors should be studied, since internal states such as cognitions, emotions and moods are too subjective.



Learning is really about the increased probability of a behaviour based on reinforcement which has taken place in the past, so that the antecedents of the new behaviour include the consequences of previous behaviour

There are two major types of conditioning:

1. **Classical conditioning** is a technique used in behavioral training in which a naturally occurring stimulus is paired with a response. Next, a previously neutral stimulus is

paired with the naturally occurring stimulus. Eventually, the previously neutral stimulus comes to evoke the response without the presence of the naturally occurring stimulus. The two elements are then known as the *conditioned stimulus* and the *conditioned response.*

2. **Operant conditioning** (sometimes referred to as instrumental conditioning) is a method of learning that occurs through rewards and punishments for behavior. Through operant conditioning, an association is made between a behavior and a consequence for that behavior.

Operant conditioning can be described as a process that attempts to modify behaviour through the use of positive and negative reinforcement. Through operant conditioning, an individual makes an association between a particular behavior and a consequence.

- Example 1: Parents rewarding a child's excellent grades with candy or some other prize.
- Example 2: A schoolteacher awards points to those students who are the most calm and well-behaved. Students eventually realize that when they voluntarily become quieter and better behaved, that they earn more points.
- Example 3: A form of reinforcement (such as food) is given to an animal every time the animal (for example, a hungry lion) presses a lever.

The term "operant conditioning" originated by the behaviorist B. F. Skinner, who believed that one should focus on the external, observable causes of behaviour (rather than try to unpack the internal thoughts and motivations)

Reinforcement comes in two forms: positive and negative.

Positive and Negative Reinforcers

- ***Positive Reinforcers*** are favorable events or outcomes that are given to the individual after the desired behavior. This may come in the form of praise, rewards, etc.
  Example 1: A dog trainer giving a dog a biscuit when she performs a trick;
  Example 2: A father providing his child with a piece of candy for picking up his toys;

- ***Negative Reinforcers*** typically are characterized by the removal of an undesired or unpleasant outcome after the desired behavior. A response is strengthened as something considered negative is removed.
  Example 1: Removing obstacles to autonomy (e.g., rigid timelines or prescribed ways of carrying out tasks) when an employee successfully completes an

important project.

Example 1: Abolishing the practice of clocking in and out when employees have proven they can be trusted to accurately report their time worked.

The goal in both of these cases of reinforcement is for the behavior to increase.

Positive and Negative Punishment

Punishment, in contrast, is when the increase of something undesirable attempts to cause a decrease in the behavior that follows.

- ***Positive punishment*** is when unfavorable events or outcomes are given in order to weaken the response that follows.
  Example 1: Yelling at a child for bad behaviour.
  Example 2: Assigning students who forget to turn in their assignment extra work
- ***Negative punishment*** is characterized by when a favourable event or outcome is removed after an undesired behaviour occurs.
  Example 1*:* A child kicks a peer (behaviour), and is removed from his/her favourite activity (reinforcing stimulus removed)
  Example 2: A child fights with her brother (behaviour) and has her favourite toy taken away (reinforcing stimulus removed).

The goal in both of these cases of punishment is for a behavior to decrease.
What is the difference between operant conditioning and classical conditioning? In operant conditioning, a voluntary response is then followed by a reinforcing stimulus. In this way, the voluntary response (e.g. studying for an exam) is more likely to be done by the individual. In contrast, classical conditioning is when a stimulus automatically triggers an involuntary response.

Operant conditioning is similar to classical conditioning in that both are concerned with how we can teach others how to behave

Principles of behaviourism by B. F. Skinner

- The following are valuable:
  - Repetition
  - Small, concrete, progressively sequenced tasks
  - Positive and negative reinforcement
  - Consistency in the use of reinforcers during the teaching-learning process
- Habits and other undesirable responses can be broken by removing the positive reinforcers connected with them.
- Immediate, consistent, and positive reinforcement increases the speed of

learning.

- Pleasant experiences (such as rewards or praise) are positive reinforcers. They cause learners to make desired connections between stimuli and responses.
- Unpleasant experiences (such as punishment) are negative reinforcers. They cause learners to avoid undesirable responses to stimuli.
- Continuous reinforcement increases the rate of learning.
- Intermittent reinforcement contributes to longer retention of what is learned.
- Both positive and negative reinforcement can shape behaviour.
- A lack of any reinforcement can also shape behaviour. If people receive no acknowledgement of their behaviour, they will likely change that behaviour until they receive some kind of reinforcement.
- Present the information to be learned in small behaviorally defined steps.
- Give rapid feedback to pupils regarding the accuracy of their learning (learning being indicated by overt pupil responses)
- Allow pupils to learn at their own pace.

Criticisms of Behaviourism

- Many critics argue that behaviorism is a one-dimensional approach to understanding human behavior and that behavioral theories do not account for free will and internal influences such as moods, thoughts and feelings.
- Behaviorism does not account for other types of learning, especially learning that occurs without the use of ***reinforcement*** and ***punishment***.
- People and animals are able to adapt their behavior when new information is introduced, even if a previous behavior pattern has been established through reinforcement.

Strengths of Behaviourism

- Behaviorism is based upon observable behaviors, so it is easier to quantify and collect data and information when conducting research.
- Effective therapeutic techniques such as intensive behavioral intervention***, behaviour analysis***, token economies and discrete trial training are all rooted in behaviorism. These approaches are often very useful in changing maladaptive or harmful behaviours in both children and adults.

3.6.6 Pedagogical Implications of Behaviorism Theory to the Teaching and Learning of Science

Role/characteristics of the science teacher in the behaviorist classroom

- Designs the learning environment.

- Shapes child's behaviour by positive/ negative reinforcement
- Presents the information and then students demonstrate that they understand the material.
- Assesses students primarily through tests.

Role/characteristics of the student in the behaviorist classroom

- Learners are basically passive recipients of knowledge
- Respond to stimuli
- Answer questions posed by teacher
- Ask little or no question
- Empty barrels

How does learning take place in the behaviorist classroom?

B.F. Skinner (Known for operant conditioning)

- A stimulus is provided
- A response is generated.
- Consequence to the response is present.
- Type of consequence is present.
- Reinforcement is provided which could be positive or negative.

***Pavlov* (**Known for classical conditioning).

- A spontaneous reaction that occurs automatically to a particular stimulus to alter the "natural" relationship between a stimulus and a reaction was viewed as a major breakthrough in the study of behaviour.

Thorndike

- Thorndike concluded that animals learn, solely, by trial and error, or reward and punishment.
- All learning involves the formation of connections, and connections are strengthened according to the law of effect.
- Intelligence is the ability to form connections and humans are the most evolved animal because they form more connections then any other being.

*The **"law of effect"** states that when a connection between a stimulus and response is positively rewarded it will be strengthened and when it is negatively rewarded it will be weakened.*

Thorndike later revised this "law" when he found that negative reward, (punishment) did not necessarily weaken bonds, and that some seemingly pleasurable consequences do not necessarily motivate performance.

*The **"law of exercise"** held that the more an S-R (stimulus response) bond is practiced the stronger it will become. As with the law of effect, the law of exercise also had to be updated when Thorndike found that practice without feedback does not necessarily enhance performance.*

Also Thorndike maintained that a skill should be introduced when a learner is conscious of their need for it as a means of satisfying some useful purpose. Regarding material, Skinner specified that to teach well, a teacher must decide exactly what it is they want to teach - only then can they present the right material, know what responses to look for and hence when to give reinforcement that usefully shapes behaviour.

Watson

Watson believed that humans are born with a few reflexes and the emotional reactions of love and rage. All other behavior is established through stimulus-response associations through conditioning.

Relevance of behaviorism to the teaching of science

- Identify possible reinforcers by observing behaviours of learners
- Select Stimulus
- Identify and describe the terminal objective - observable behaviour
- By a process of shaping and smaller steps achieve goals
- Mastery learning is an example of behavioral approach
- Behaviorism still continues to play a large role in motivation, classroom management, and special education needs

Possible learning activities in the behaviorist classroom

There should be:

- Instructional cues to elicit correct response
- Practice paired with target stimuli
- Reinforcement for correct responses
- Building fluency (get responses closer and closer to correct response)
- Multiple opportunities/trials (Drill and practice)
- Discrimination (recalling facts)
- Generalization (defining and illustrating concepts)
- Associations (applying explanations)
- Chaining (automatically performing a specified procedure)

Implications of behaviorism in the Science Classroom

When designing lessons from a behaviorist stance, the designer (teacher) should:

- ✓ Analyze the situation and sets a goal. Individual tasks should be broken down into smaller tasks and learning objectives developed from them.
- ✓ Evaluation should consist of determining whether the criterion for the objectives has been met. In this approach the designer should decide what is important for the learner to know and attempt to transfer that knowledge to the learner.
- ✓ The learning package should be somewhat of a closed system, though it can allow for some branching and remediation, the learner should be confined to the designer's "world".

Strengths of behaviourism

The strength of instructional design grounded in behaviorism is that:

- When there are specific goals to be met, the learner is focused clearly upon achieving those goals whenever there are cues to prompt the learner's behaviour.
- Clearly stated objectives allow the learner to focus on one goal.
- Cueing responses to behaviour allows the learner to react in a predictable way under certain conditions. In a stressful situation like combat or flying a plane, cued responses can be a very valuable tool.

Weaknesses of behaviourism

- Since behaviorism is stimulus – response based, instructional design is dependent on the workplace or classroom having and maintaining the appropriate stimuli to continue the intended behaviour. Thus, if a certain incentive is not present or does not occur, then the expected and desired performance may not take place.
- Additionally, learning is a reactionary process to an environmental condition and knowledge is considered finite.
- Skinner realized there is a burden on the instructor to maintain reinforcement. "Behaviour that is not reinforced is likely to become less frequent and may even disappear" (Merriam and Caffarella, (1999).
- The learner might find himself in a situation where s/he needs to respond, but the mental "cues" s/he has learned to respond to might not exist.
- Behaviorism does not explain some learning such as the recognition of new language patterns by young children for which there is no reinforcement

mechanism.

Classical conditioning can occur unintentionally. Too frequent exposure to humiliation, failure, or other negative feedback may lower in individual's self-confidence and lead to withdrawal. For example, if a child is constantly corrected during a reading exercise, the child's feelings of humiliation may ultimately be replaced by a fear of reading aloud. Eventually whenever the teacher announces read-aloud-time, the child may withdraw or begin exhibiting undesirable behaviour. For this reason, it is important for teachers to be careful or prepare their students very well when engaging in such potentially "risky" activities in the classroom; it is important to minimize embarrassment or disappointment in the case of failure.

Operant conditioning is similar to classical conditioning in that both are concerned with how we can teach others how to behave. Operant conditioning adds the concept of a reinforcer or a reward. The basic idea of operant conditioning is that behaviours which are followed by something pleasurable will be reinforced; the reinforcement will result in the behaviour being repeated (Ormrod & Rice, 2003, p. 68). Operant conditioning can occur effectively at all levels of development including early adulthood providing that a suitable reinforcer can be identified for the individuals. To better understand the implications of this behaviour theory, it is also important to understand the following terms: baseline behaviour, terminal behaviour, shaping, and extinction.

3.6.7 THE COGNITIVIST LEARNING THEORY (COGNITIVISM)

Cognitivism *(Jean Piaget, Robert Gagne, Lev Vygotsky)*

Cognitivism is "the psychology of learning which emphasizes human cognition or intelligence as a special endowment enabling man to form hypotheses and develop intellectually" (Cognitivism) and is also known as cognitive development. The underlying concepts of cognitivism involve how we think and gain knowledge

Theory of the cognitivist

The cognitivist paradigm essentially argues that the "black box" of the mind should be opened and understood. The learner is viewed as an information processor (like a computer).

Cognitivism focuses on the "brain". How humans process and store information is very important in the process of learning.

- Schema - An internal knowledge structure. New information is compared to existing cognitive structures called "schema". Schema may be combined,

extended or altered to accommodate new information.

- Three-Stage Information Processing Model:
  - Input first enters a ***sensory register***,
  - Then is processed in ***short-term memory***, and
  - Then is transferred to ***long-term memory*** for storage and retrieval.

Sensory Register - receives input from senses which lasts from less than a second to four seconds and then disappears through decay or replacement. Much of the information never reaches short term memory but all information is monitored at some level and acted upon if necessary.

Short-Term Memory (STM) - sensory input that is important or interesting is transferred from the sensory register to the STM. Memory can be retained here for up to 20 seconds or more if rehearsed repeatedly. Short-term memory can hold up to 7 plus or minus 2 items. STM capacity can be increased if material is chunked into meaningful parts.

Long-Term Memory and Storage (LTM) - stores information from STM for long term use. Long-term memory has unlimited capacity. Some materials are "forced" into LTM by rote memorization and over learning.
Deeper levels of processing such as generating linkages between old and new information are much better for successful retention of material.

Factors that influence learning

- ✓ ***Meaningful Effects*** - Meaningful information is easier to learn and remember. If a learner links relatively meaningless information with prior schema it will be easier to retain.

- ✓ ***Serial Position Effects*** - It is easier to remember items from the beginning or end of a list rather than those in the middle of the list, unless that item is distinctly different.

- ✓ ***Practice Effects*** - Practicing or rehearsing improves retention especially when it is distributed practice. By distributing practices the learner associates the material with many different contexts rather than the one context afforded by mass practice.

- ✓ ***Transfer Effects*** - The effects of prior learning on learning new tasks or material.

- ✓ ***Interference Effects*** - Occurs when prior learning interferes with the learning of new material.

- ✓ ***Organization Effects*** - When a learner categorizes input such as a grocery list, it is easier to remember.

- ✓ ***Levels of Processing Effects*** - Words may be processed at a low-level sensory analysis of their physical characteristics to high-level semantic analysis of their meaning. The more deeply a word is process the easier it will be to remember.

- ✓ ***State Dependent Effects*** - If learning takes place within a certain context it will be easier to remember within that context rather than in a new context.

Retrieval

When information is needed a search is initiated as follows:

- Search
  - A search is conducted in long-term memory.
- Retrieval
  - When the information is found, it is retrieved.
- Response organization
  - The information is sent to a response generator, another mechanism which organizes a suitable response.
- Performance
  - The response generator sends the signal to effectors, body parts such as the hands or eyes, which carry out the action.
- Feedback and reinforcement

  The mind observes the effect of its performance and prepares itself to repeat the process as appropriate in answer to the response perceived.

How does learning take place in the cognitivist classroom

Piaget

❖ Human intelligence and biological organisms function in similar ways. They are both organized systems that constantly interact with the environment.

- ❖ Knowledge is the interaction between the individual and the environment.
- ❖ Cognitive development is the growth of logical thinking from infancy to adulthood.

Vygotsky

- ✓ Vygotsky's components of Cognitive Development:
- ✓ Mastering symbols of the culture and developing the cultural forms of reasoning.
- ✓ Complex functions begin as social interactions between individuals; gradually acquire meaning and are internalized by the learner.
- ✓ Speech and other symbols are first mastered as a form of communication and eventually structure and manage a child's thinking.
- ✓ Zone of Proximal Development focuses on interactive problem solving.

3.6.8 Pedagogical Implications of Cognitivism Theory to the Teaching and Learning of Science

Relevance of Cognitivism to the teaching of science

Cognitivists believe learners develop learning through receiving, storing and retrieving information.

With this idea, it is important for instructional designers (teachers):

- ✓ To thoroughly analyze and consider the appropriate tasks needed in order for learners to effectively and efficiently process the information received.
- ✓ Consider the relevant learner characteristics that will promote or impede the cognitive processing of information.
- ✓ To do task analysis and learner analysis
- ✓ To create tests
- ✓ To create learning materials according to any one of the Instructional Design Models

Learning activities in the cognitivist classroom

- ✓ Explanations
- ✓ Demonstrations
- ✓ Illustrative examples
- ✓ Gestalt Theory (the whole theory)
- ✓ Matched non-examples

- ✓ Corrective feedback
- ✓ Outlining
- ✓ Mnemonics
- ✓ Dual-Coding Theory (*The Dual Coding Theory assumes there are two cognitive subsystems, one specialized for the representation and processing of nonverbal objects and the other specialized for dealing with language*)

- ✓ Chunking Information (***Chunking*** **refers to the strategy of breaking down *information* into bite-sized pieces so the brain can more easily digest new *information*.)**
- ✓ Repetition
- ✓ Concept Mapping (***concept mapping is a technique to visualize relationships between different concepts)***
- ✓ Advanced Organizers ***(they are simply devices used in the introduction of a topic which enable learners to orient themselves to the topic, so that they can locate where any particular bit of input fits in and how it links with what they already know)***
- ✓ Analogies
- ✓ Summaries
- ✓ Keller's ARCS Model of Motivation ***(According to John Keller's ARCS Model of Motivational Design, there are four steps for promoting and sustaining motivation in the learning process: Attention, Relevance, Confidence, Satisfaction (ARCS).***
- ✓ Interactivity
- ✓ Synthesis
- ✓ Schema Theory
- ✓ Metaphor
- ✓ Generative Learning
- ✓ Organizational strategies
- ✓ Elaboration Theory ***(According to elaboration theory, instruction should be organized in increasing order of complexity for optimal learning.)***

Characteristics of the cognitivist classroom

1. Task analysis
2. Prerequisite skills
3. ***Cognitive objectives-according to Bloom*** [Bloom, B. (1956). *Taxonomy of Educational Objectives. Book 1, Cognitive Domain.* NY" Longman] this domain includes six intellectual skills proceeding from simple to complex and includes:

   A) Knowledge-ability to remember learned information
   Example: The student states the definitions of Cognitivism and Constructionism

upon completing this presentation.

B) Comprehension-ability to understand the information learned
Example: The student describes the differences between Cognitivism and Constructivism.

C) Application-ability to apply the new information in concrete situations
Example: The student learns how to use Blooms taxonomy to construct objectives for a class they will teach.

D) Analysis-ability to separate important from non-important information
Example: The student describes the advantages of using objectives to measure learning.

E) Synthesis-ability to reconstruct pieces of information to form new information
Example: The student utilizes characteristics of Constructivism and Cognitivism to teach material.

F. Evaluation-ability to judge the new information
Example: The student describes if and how the teaching strategy utilizing Cognitivism and Constructivism was effective

3. Learning taxonomies-according to Gagne [Gagne, R. (1974). *Essentials of Learning of Instruction.* Hinsdale, IL: Dryden Press.] The intellectual skills include:

I. Signal
II. Stimulus-response
III. Chaining-this includes more than one stimulus-response links
IV. Verbal association
V. Multiple discrimination-which allows for different responses to stimuli
VI. Concept formation-identifying and responding to a class of objects
VII. Principle formation-applying at least one chain of two or more concepts
VIII. Problem solving-processing 2 or more principles

Role of learners in the cognitivist classroom

- Learners process, store, and retrieve information for later use, creating associations and creating a knowledge set useful for living.
- Learner use information processing approach to transfer and assimilate new information.

- Learners answer questions and ask questions

Role of the teacher in the cognitivist classroom

- Manages problem solving and structured search activities, especially with group learning strategies.
- Provides opportunities for students to connect new information to schema.
- Coordinator and facilitator

Implications of Cognitivism in the Science Classroom

In a classroom environment, there are many variables that influence and contribute to learning. When creating and implementing a learning environment, it is imperative that the teachers not only create a setting that promotes learning, but also take the time to understand each child. Classrooms are widely diverse and complex.

Students learn differently and are at various developmental levels. Teachers who properly manage their classrooms and establish expectations will be able to incorporate diverse teaching philosophies and create an excellent learning environment for each student.

It is important that teachers create a learning environment that encourages students to do their best and makes learning interesting. This creates a motivational climate within the classroom.

When designing lessons from a behaviorist stance, the designer (teacher) should:

- ✓ Analyze the situation and sets a goal. Individual tasks should be broken down into smaller tasks and learning objectives developed from them.
- ✓ Evaluation should consist of determining whether the criterion for the objectives has been met. In this approach the designer should decide what is important for the learner to know and attempt to transfer that knowledge to the learner.
- ✓ The learning package should be somewhat of a closed system, though it can allow for some branching and remediation, the learner should be confined to the designer's "world".
- ✓ Carefully assess the current stage of a child's cognitive development and only assign tasks for which the child is prepared. The child can then be given tasks that are tailored to their developmental level and are motivating.
- ✓ Provide children with learning opportunities that enable them to advance through each developmental stage. This is achieved by creating disequilibrium. Teachers should maintain a proper balance between actively guiding the child and allowing opportunities for them to explore things on their own to learn through discovery.
- ✓ Be concerned with the process of learning rather than the end product. For

example, the teacher should observe the way a child manipulates play dough instead of concentrating on a finished shape.

- ✓ Children should be encouraged to learn from each other. Hearing others' views can help breakdown egocentrism. It is important for teachers to provide multiple opportunities for small group activities.
- ✓ Piaget believed that teachers should act as guides to children's learning processes and that the curriculum should be adapted to individual needs and developmental levels.
- ✓

Strengths of Cognitivism

- Unlike Behaviorism, which is environment-focused, Cognitivism directs instructional designers to consider the learner as the focus of the design process.
- The goal is to train learners to do a task the same way to enable consistency. Because learners are trained to perform a function the same way based on specific cues, their behavior will be consistent with others who are trained in the same manner.
- The context of a learner - their thoughts, beliefs and values are influential in the learning process.

Weaknesses of Cognitivism

A major weakness of Cognitivism lies in its strength.

- ➢ Whereas schemas help to make learning more meaningful, a learner is largely at a disadvantage whenever relevant schemas or prerequisite knowledge do not exist. (*To account for this, an instructional designer will need to ensure that the instruction is appropriate for all skill levels and experiences. Designing such instruction could be costly and time-consuming).*

- ➢ One additional weakness of Cognitivism is similar to behaviorism. There are only finite, predetermined goals. Having predetermined goals may be in fact desirable for an organization since it offers clear direction and purpose but such a fixed set of expectations can limit the potential of the learning. Learners and instructors may become satisfied with obtaining minimum competencies or carry the attitude that "if it's not broke, then don't fix it!" when the learning experience could actually be designed better (McLeod, n.d.)

- ➢ As with behaviorism, the learner knows a certain way to do things based upon specific cues, but that way may not always be the best, most efficient, or safest way to do something in the advent of different environmental stresses or

scenarios.

UNIT 3: SUMMARY

The unit covered the following sub-topics:
3.1 Who is a good Learner?
3.2 What is learning?
3.3 Principles of learning:
3.4 Two Main Ways of Learning
3.5 Categories of learning
3.6 Constructivist, Behavioural and Cognitive Theories of Learning

UNIT 4

INSTRUCTIONAL OBJECTIVES

Dear student you are welcome to a new Unit. You will learn about instructional objectives. Just take it easy and read through.

Indicators:

The student will be able to:

- Formulate SMART learning objectives (performance-based objectives) in the three domains of learning.
- Evaluate learning objectives.

Activity 1: You are to answer the following questions

Explain the following terms:

i. A goal and an objective

4.1 Goals and Objectives

A **goal** sets out the overall aim of a course. An **objective** describes the skill, knowledge, or attitude a learner will have at the end of the learning activity or course. In other words, the goal describes the purpose behind the topic whilst the objective describes what the learner will learn, the conditions of learning, and the degree of mastery.
For example, let us consider the topic "Blood Pressure"
The goal and objective could be stated as follows:

Goal

The learner will demonstrate competency with monitoring blood pressure.

Objective

The learner can accurately measure and interpret changes in blood pressure in the clinical setting.

It is important to clarify the meaning of the term's *educational objectives, instructional objectives,* and *behavioral* or *learning objectives.* Although often used synonymously, these terms can be distinguished from one another. ***Educational objectives*** are used to identify the intended outcomes of the education process, whether in reference to an aspect of a program or a total program of study, that guide the design of curriculum units. ***Instructional objectives*** describe the teaching activities and resources used to facilitate effective learning (Morrison, Ross, & Kemp, 2004). ***Behavioral objectives***, also

referred to as ***learning objectives***, make use of the modifier *behavioral* or *learning* to denote that this type of objective is action oriented rather than content oriented, learner centered rather than teacher centered, and short-term outcome focused rather than process focused. Behavioral objectives describe precisely what the learner will be able to do following a learning situation.

Definitions

Goals and objectives imply the target that one's efforts is desired to accomplish. Goals are generically for an achievement or accomplishment for which certain efforts are put. Objectives are specific targets within the general goal. Objectives are time-related to achieve a certain task.

A **goal** is defined as

1. The purpose toward which an endeavor is directed.
2. The result or achievement toward which effort is directed or aimed.

   An **objective** has a similar definition but is supposed to be a clear and measurable target.

The words **goal** and **objective** are often confused with each other. They both describe things that a person may want to achieve or attain but in relative terms may mean different things. Both are desired outcomes of work done by a person but what sets them apart is the time frame, attributes they are set for and the effect they inflict.

A goal is a desired result you want to achieve, and is typically broad and long-term. You might use company goals to inform yearly strategies and guide the direction of all your marketing efforts. An objective, on the other hand, defines the specific, measurable actions each employee must take to achieve the overall goal. Objectives are essentially the measurable actions you can take to achieve your overall goals. For instance, if your overall goal is to increase brand awareness, one objective might be to increase blog traffic by 10%.

Activity 2:

- State and explain any four differences between goals and objectives

4.1.2 Comparison chart

	Goals	**Objectives**
Definition	Something which you try to achieve	A specific result that a person or system aims to achieve within a time frame and with available resources.

	Goals	Objectives
Time Frame	Usually long-term.	A series of smaller steps, often along the way to achieving a long-term goal.
Magnitude	Typically involves life changing outcomes, like retiring, buying a home or making a major career change.	Usually a near-term target of a larger expected outcome, such as passing a course as part of completing a degree program.
Outcome of immediate action	Actions tend to advance progress in a very general sense; there is often awareness that there are several ways to reach a goal, so specific outcomes aren't necessary.	Very specific and measurable, a target is established and victory is declared only when the target is hit.
Purpose of action	A goal if often characterized as a change of direction that will ultimately lead to a desired outcome.	Objectives tend to be actions aimed at accomplishing a certain task.
Measure	Goals may not be strictly measurable or tangible.	Must be measurable and tangible.
Example 1	"I want to retire by age 50"	"In order to reach my goal of retiring at age 50, I need to save $20,000 by the end of this year"
Example 2	I want to achieve success in the field of genetic research and do what no one has ever done.	I want to complete this thesis on genetic research by the end of this month.
Hierarchy	Goals tend to control objectives; a change in a goal could eliminate one	An objective can modify a goal, but will seldom change it in a fundamental way, even if the

	Goals	Objectives
	or more objectives, or add new ones.	objective isn't reached.

Both are a Way of Moving Forward

The major similarity between goals and objectives is that they both involve *forward motion*, but accomplish it in very different ways. We can think of goals as being the Big Picture — where we hope that our efforts will ultimately bring us. Objectives are about a specific plan of attack — usually a series of them — each being relatively short-term in nature.

Activity 3:

- Discuss any two attributes of a goal and an objective.

  Read the content below

4.1.3 Attributes of goals verses objectives

Differences in scope

Goals are broader than objectives in the sense that goals are general intentions and are not specific enough to be measured. Objectives are narrow and are set for certain tasks in particular.

Specificity

Goals are general while objectives are specific. Goals are just general intentions towards the attainment of something while objectives are precise actions for accomplishment of a specific task.

Tangibility

Goals may be intangible while objectives ought to be tangible. Goals may be directed at achieving non-measurable things while objectives may be targeted at getting measurable things or tasks.

Differences in time frame

Both have a certain time frame. Goals usually have a longer time-frame than objectives. Objectives are usually precise targets set for a short term. Goals may be set for a longer term but many objectives may be set within that goal.

Measuring goals and objectives

Goals may or may not be measured, but in most cases objectives are measurable.

Examples

"I want to achieve success in the field of genetic research and do what no one has ever done." This is a goal.

"I want to complete the thesis on genetic research within this month." This is an objective.

4.2 Bloom's Taxonomy of Learning

Bloom's taxonomy divides educational objectives into three domains. The three domains of learning include:

- **Cognitive**: this is for mental skills (knowledge).
- **Affective**: this is for growth in feeling or emotional areas (attitude or self)
- **Psychomotor**: this is for manual or physical skills (skills)

Activity 4:

1. What is Bloom's Cognitive Domain of Learning?

4.2.1.1 Bloom's Taxonomy of Cognitive Domain of Learning

The cognitive domain involves knowledge and the development of intellectual skills (Bloom, 1956). This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories of cognitive domain, starting from the simplest to the most complex:

Levels of Cognitive Domain

Skills in the **cognitive domain** revolve around knowledge, comprehension, and critical thinking on a particular topic. Traditional education tends to emphasize the skills in this domain, particularly the lower-order objectives. The levels of cognitive processes are listed below:

1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation

The categories can be thought of as degrees of difficulties. That is, the first ones must normally be mastered before the next one can take place.

Knowledge

Knowledge: recall data or information.

Key words that can be used when constructing objectives are: arrange; define; describe; identify; knows; label; list; match; name; outline; recall; recognize; reproduce; select; state, etc.

Comprehension

Comprehension: Understand the meaning, translation, interpolation and interpretation of instructions and problems in one's own words

Key words that can be used in constructing objectives are: comprehend; convert distinguish; estimate; explain; generalize; infer; interpret; paraphrase; predict; rewrite; summarize; translate, etc.

Application

Application: Use of concept in a new situation or unprompted use of an abstraction. Apply what was learnt in the classroom into novel situations in the work place or everyday life

Key words: apply; change; compute; construct; demonstrate; manipulate; modify; produce; prepare; show; solve; use

Analysis

Analysis: Separates material or concepts into component parts so that its organizational structure may be understood. Distinguish between facts and inference.

Key words: analyse; breakdown; compare; contrast; differentiate; distinguish; identify; illustrate; infer; relate; select; separate

Synthesis

Synthesis: Build a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure

Key words: categories; combine, compile compose; create; devise; design; explain; generate; reorganize; rewrite; summarize

Evaluation

Evaluation: - make judgments about the value of ideas or materials.

Key words: - appraise; compare; conclude; contrast; criticize; defend; describe; discriminate; evaluate; explain; interpret; justify; relate; support

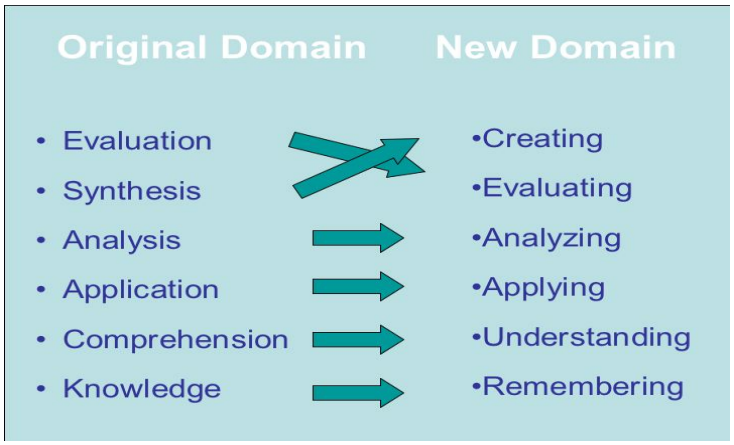
4.2.1.2 Revision of Bloom's Taxonomy of Cognitive Learning

Lorin Anderson, a former student of Bloom, and David Krathwohl revisited the cognitive domain in the mid-nineties and made some changes, with perhaps the three most prominent ones being the following:

- changing the names in the six categories from noun to verb forms
- rearranging them as shown in the chart below
- creating processes and levels of knowledge matrix

This new taxonomy reflects a more active form of thinking and is perhaps more accurate. In the revised version of Bloom's Taxonomy, the names of the major cognitive process categories were changed to indicate action because thinking implies active engagements.

The difference between Bloom's Taxonomy of Cognitive Learning and the revised version is that the newer taxonomy moves the evaluation stage down a level and the highest cognitive process becomes "creating" as shown in Chart 1 below.



The new taxonomy has cognitive process dimension and knowledge dimension. The cognitive process dimension has been presented in the Table of the Revised Cognitive Domain. The knowledge dimension in this new taxonomy is divided into different types of knowledge: factual, conceptual, procedural, and metacognitive as shown in Table 4.1

Table 4.1: Levels of Knowledge

MAJOR TYPE	SUBTYPE
Factual Knowledge	Knowledge of terminology; Knowledge of specific details and elements
Conceptual Knowledge	Knowledge of classifications and categories; Knowledge of principles and generalizations; Knowledge of theories, models, and structures
Procedural Knowledge	Knowledge of subject specific skills and algorithms; Knowledge of subject-specific techniques and methods; Knowledge of criteria for determining when to use appropriate procedures
Meta-cognitive Knowledge	Strategic knowledge; Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge; Self-knowledge

Anderson and Krathwohl (2001) also created the Cognitive Processes and Levels of Knowledge Matrix

Cognitive Processes and Levels of Knowledge Matrix

The Knowledge Dimension	The Cognitive Process Dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge						

Procedural Knowledge						
Meta-cognitive Knowledge						

Activity 5:

1. What is Bloom's Affective Domain of Learning?
2. State and discuss the five Levels of Bloom's Affective Domain of Learning

4.2.2 The Affective Domain of Learning

The affective domain includes the manner in which we deal with things emotionally such as feelings; values; appreciation; enthusiasm; motivations; and attitudes. The five major categories are listed from the simplest behavior to the most complex:

Levels of Affective Domain

There are **five levels** in the affective domain moving through the lowest order processes to the highest:

1. **Receiving**

The lowest level; the student passively pays attention. Without this level no learning can occur. Receiving is about the student's memory and recognition as well.

Key Words: acknowledge, asks, attentive, courteous, dutiful, follows, gives, listens, understands

2. **Responding**

The student actively participates in the learning process, not only attends to a stimulus; the student also reacts in some way.

Key Words: answers, assists, aids, complies, conforms, discusses, greets, helps, labels, performs, presents, tells

3. **Valuing**

The student attaches value to an object, phenomenon, or piece of information. The student associates value or some values to the knowledge acquired.

Key Words: appreciates, cherish, treasure, demonstrates, initiates, invites, joins, justifies, proposes, respect, shares

4. **Organizing**

The student can put together different values, information, and ideas and accommodate

them within his/her own schema; comparing, relating and elaborating on what has been learned.

Key Words: compares, relates, synthesizes

5. **Characterizing**

The student holds a particular value or belief that now exerts influence on his/her behavior so that it becomes a characteristic.

Key Words: acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, serves, solves, verifies

Activity 6:

1. What is Bloom's Psychomotor Domain of Learning?
2. Discuss the levels of Psychomotor Domain of Learning

4.2.3 Psychomotor Domain of Learning

Bloom published the taxonomy of educational objectives on the cognitive domain of learning in 1956 and the taxonomy of educational objectives on the affective domain of learning in 1965. However, another taxonomy, for the psychomotor domain was planned but never got published.

Since then, there have been several published taxonomies of the psychomotor domain such as Simpson's (1972) taxonomy; Dave's (1975) taxonomy; and Harrow's (1972) taxonomy.

4.2.3.1 Simpson's (1972) Taxonomy

Simpson taxonomy of the psychomotor domain (includes physical movement, coordination, and of the motor skills area. Development of skills requires practice and is measured in terms of speed, precision, distance, procedures or techniques in execution. Thus, psychomotor skills range from manual tasks such as digging a ditch or washing a car, to more complex tasks such as operating a complex piece of machinery. The seven major categories are listed from the simplest behaviour to the most complex.

1. **Perception**

The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation. Examples: Detects non-verbal communication cues. Estimate where a ball will land after it is thrown and then moving to the correct location to catch the ball. Adjusts heat of stove to correct temperature by smell and taste of food. Adjusts the height of the forks on a forklift by comparing where the forks are in relation to the pallet. Key Words: chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.

2. **Set**

Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets). Examples: Knows and acts upon a sequence of steps in a manufacturing process. Recognize one's abilities and limitations. Shows desire to learn a new process (motivation). NOTE: This subdivision of Psychomotor is closely related with the “Responding to phenomena” subdivision of the Affective domain. Key Words: begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.

3. **Guided response**

The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing. Examples: Performs a mathematical equation as demonstrated. Follows instructions to build a model. Responds to hand-signals of instructor while learning to operate a forklift. Key Words: copies, traces, follows, react, reproduce, responds.

4. **Mechanism**

This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency. Examples: Use a personal computer. Repair a leaking tap. Drive a car. Key Words: assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.

5. **Complex overt response**

The skillful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation, and automatic performance. For example, players will often utter sounds of satisfaction or expletives as soon as they hit a tennis ball or throw a football, because they can tell by the feel of the act what the result will produce. Examples: Maneuvers a car into a tight parallel parking spot. Operates a computer quickly and accurately. Displays competence while playing the piano. Key Words: assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches. NOTE: The Key Words are the same as Mechanism, but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.

6. **Adaptation**

Skills are well developed and the individual can modify movement patterns to fit special requirements. Examples: Responds effectively to unexpected experiences. Modifies instruction to meet the needs of the learners. Perform a task with a machine that it was not originally intended to do (machine is not damaged and there is no danger in performing the new task). Key Words: adapts, alters, changes, rearranges, reorganizes, revises, varies.

7. **Origination**

Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills. Examples: Constructs a new theory. Develops a new and comprehensive training programming. Creates a new gymnastic routine. Key Words: arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.

4.2.3.1 Dave's (1975) Taxonomy

Dave's taxonomy of the psychomotor domain has five major categories listed from the simplest behaviour to the most complex as shown below.

1. **Imitation**

Observing and patterning behaviour after someone else. Performance may be of low quality. **Examples**: Copying a work of art, performing a skill while observing a demonstrator. **Key Words**: copy, follow, mimic, repeat, replicate, reproduce, trace.

2. **Manipulation**

Being able to perform certain actions by memory or following instructions. **Examples**: Being able to perform a skill on one's own after taking lessons or reading about it; follows instructions to build a model. **Key Words**: act, build, execute, perform

3. **Precision**

Refining, becoming more exact. Performing a skill within a high degree of precision. **Examples**: Working and reworking something, so it will be "just right;" perform a skill or task without assistance; demonstrate a task to a beginner. **Key Words**: calibrate, demonstrate, master, perfectionism.

4. **Articulation**

Coordinating and adapting a series of actions to achieve harmony and internal consistency. **Examples**: Combining a series of skills to produce a video that involves music, drama, colour, sound, etc.; combining a series of skills or activities to meet a novel requirement. **Key Words**: adapt, constructs, combine, creates, customize, modifies, formulate.

5. **Naturalization**

Mastering a high-level performance until it become second-nature or natural, without needing to think much about it. **Examples**: Manoeuvres a car into a tight parallel parking spot; operates a computer quickly and accurately; displays competence while playing the piano; Michael Jordan playing basketball or Nancy Lopez hitting a golf ball.

Key Words: create, design, develop, invent, manage, naturally

4.2.3.1 Harrow's (1972) Taxonomy

Harrow's taxonomy has a focus toward physical ability. This taxonomy is better suited

to assessing ability to perform a task or activity or to sports and recreation activities. Harrow's taxonomy of the psychomotor domain has six major categories listed from the simplest behaviour to the most complex:

1. **Reflex Movements**

Reactions that are not learned, such as an involuntary reaction. **Examples**: Instinctive response. **Key Words**: react, respond

2. **Fundamental Movements**

Basic movements such as walking, or grasping. **Examples**: Perform a simple task. **Key Words**: grasp an object, throw a ball, walk.

3. **Perceptual Abilities**

Response to stimuli such as visual, auditory, kinaesthetic, or tactile discrimination. **Examples**: Track a moving object, recognize a pattern. **Key Words**: catch a ball, draw or write

4. **Physical Abilities (fitness)**

Stamina that must be developed for further development such as strength and agility. **Examples**: Gain strength, run a marathon. **Key Words**: agility, endurance, strength.

5. **Skilled movements**

Advanced learned movements as one would find in sports or acting. **Examples**: Using an advanced series of integrated movements, perform a role in a stage play or play in a set of series in a sports game. **Key Words**: adapt, constructs, creates, modifies.

6. **Nondiscursive communication**

Use effective body language, such as gestures and facial expressions. **Examples**: Express one's self by using movements and gestures **Key Words**: arrange, compose, interpretation.

Activity 7:

1. Formulate three SMART learning objectives. One on each of the three Domains of Learning
2. Mention any four (4) characteristics of instructional objectives
3. Discuss two importance of instructional objectives

4.3 Formulation of Learning Objectives

Learning objectives should be formulated explicitly in such a way that they are given in the form of concrete, observable actions of students. They indicate precisely which concepts and skills are to be addressed; which activity students must be able to carry out; under what conditions this behaviour must be produced; and what the acceptance

level of behaviour is

It is important to realize that all kinds of unexplained hidden aims play a role. Examples of these are:

- Learning to plan
- Learning to reason abstractly
- Getting a sense of the order of magnitude of a quantity.

Bloom (1956) and Anderson and Krathwohl (2001) have categorized learning objectives into three different domains; each domain is subdivided into different categories according to their complexity as discussed earlier. The domains are:

A. Cognitive Domain

The aims in this domain have to do with thinking and reasoning. For example, with learning to reproduce facts, solve problems, acquire insight, explain concepts, analyse and interpret data, write an essay, and so on.

B. Psychomotor Domain

This domain addresses so-called skills which relate to motion. In the sciences, most motor skills are learned in practical work that is by using apparatus; working with instruments, and setting up experiments. Motor skills are always related to thinking and therefore to the cognitive domain.

C. Affective domain

This has to do with attitudes or feelings, such as enthusiasm, motivation, working safely and accurately; it also includes feelings about careful treatment of nature and the environment. Also, the scientific attitudes fit into this domain. Scientific attitudes concern the tendency to follow scientific conventions; to report data honestly; and to be open to criticism and alternative interpretations. A fourth domain is often added.

4.3.1 Learning objectives can be formed by using the following guidelines.

1. Differentiate between goals and objective. Objectives and goals are terms that are sometimes used interchangeably, but there is a distinct difference between educational objectives and educational goals. One should be sure of this difference before attempting to write an objective.

2. Use the Bloom's Taxonomy to classify different types of learning, as well as a hierarchy illustrating different levels of learning. Bloom's taxonomy is usually used when writing educational objectives.

3. Learn the characteristics that communicate your intention. When writing an educational objective, there are three characteristics that one needs to focus on.

    - Performance; - This is the first characteristic. An objective should always state what your students are expected to be able to-do by the end of a unit or lesson.

    - Condition; this is the second characteristic. A good educational objective will outline the conditions under which a student is supposed to perform a said task.

    - Criterion; is the third characteristic. It outlines how well a student must perform. That is, the specific expectations that need to be met. For example; 'By the end of the lesson, the learner will be able to dissect a small mammal, in a typical laboratory setting, without killing it'. This outline the performance - dissecting a small mammal; the conditions - typical laboratory settings; and the criterion - without killing it.

4. Write stem statements: A stem statement should outline the performance expected of a learner. You should use measurable verbs to form your stem statement.

    - Your stem statement should begin by referencing the lesson. For example; By the end of the lesson…….

    - Your stem statement outlines the duration of time your learners need to have mastered a certain skill. For example, it should be; 'By the end of the lesson----'and not, "By the end of the course……." specify the lesson in the objective rather than the whole course content.

5. Select the proper verb: The verb you use are contingent on which level of learning in cognitive, affective and psychomotor taxonomies you are conveying. For example, you should write a variety of educational objectives that all speak to differing levels of Bloom's taxonomy of cognitive learning.

    - For knowledge, you should go for words like, list, recite, define, name etc.

    - For comprehension; words like describe, explain, paraphrase, restate etc.

    - For application; include verbs like calculate, predict, illustrate, apply etc.

    - For analyses; words like; categorize, analyze, draw, illustrate etc.

    - For synthesis use words like; design, formulate, build, invent, create, etc.

- For evaluation; try terms like; choose; relate; contrast; argue; support etc.

6. Make sure your objectives are SMART.

   - S stands for **specific**. Do your learning objectives outline skills that you are able to measure?

   - M stands for **measurable**. Your objectives should be able to be measured in classroom setting, through testing or observed performances.

   - A stands for **action** – oriented or achievable. Can the objective be achieved?

   - R stands for **relevant**, realistic or reasonable. Make sure your learning objectives reflect realistic expectations of your learners given the timeframe of your lesson.

   - T stands for **time-bound**. All educational objectives should outline a specific timeframe they need to be met.

4.3.2 Verb to avoid when writing learning objectives;

Understand	Enjoy
Perceive	Know
Realize	Be aware of.

Instead use **SMART** verbs:

- Demonstrate Incorporate
- Create Play
- Organize Apply
- Implement Evaluate
- Produce Construct
- Analyse Identify

- Develop Explain
- Express List
- Compile etc

4.3.3 Characteristics of Instructional Objectives

It must be (BOMSTRA OR SMART)

- Behavioural
- Observable
- Measurable
- Specific
- Time bound
- Relevance
- Achievable

4.3.4 How instructional Objectives Enhance teaching and Learning

- The objectives should be based on the topic, nature of the subject matter and intellectual level of the pupils.
- Objectives should be selected from the syllabus
- Must be stated in behavioural terms. It must be achievable, specific, measurable, observable and time bound
- Should be stated to cover the three integral learning domains:
  i. Knowledge, Understanding and Application
  ii. Process Skills
  iii. Attitudes and Values.
- Appropriate percentage weighting should be placed on each of the classes of learning domains.
- Should state the performance standards.

4.3.5 Importance of Specific Objectives in Lesson Plan Preparation and Delivery

- It helps in the choice of the method of teaching
- It helps in the selection of content
- It helps in the collection of teaching and learning materials
- It helps in the evaluation or assessment of pupils
- It serves as a guide to the teacher not to digress from the lesson

Activity 8:

i. What is Evaluation?

ii. Explain formative and summative evaluation

4.4 Evaluation of Instructional, Behavioural and Learning Objectives

4.4.1 Evaluation is the process of obtaining information and using it to form judgement that, in turn are used in decision making.

Evaluation is a fact of life. Students require feedback on their progress. We must evaluate the progress of our student as well as the effectiveness of our teaching.
The evaluation process consists of 4 stages.

1. Preparing for evaluation: Determine the kind of information needed and decide how and when to obtain it.
2. Obtaining needed information: Obtain a variety of information as possible.
3. Forming Judgements: Judgements are made by comparing the information to selected criteria.
4. Using judgements in making decision and preparing evaluation reports: Record significant finding and determine appropriate courses of action.

In the process of evaluation, we may select essays, checklists, performance evaluation, surveys and many other methods to assess performance. We hold these assessments to standards that have been set. Then we evaluate or judge. The process of evaluating or judging is ongoing.

Formative and Summative Evaluation

Effective teaching involves both formative and summative evaluation. If the mode of evaluation is such that whatever judgements that are made count in the final analysis then the mode of evaluation is summative.

Formative evaluation includes identifying the areas in which the student needs improvement. Every time you give comments to student you are making a formative evaluation. The main purpose of formative evaluation is acquisition and strengthening of the student's knowledge and competencies.

Formative evaluation enables student to know how they are progressing towards meeting the objective of a give course. Some words synonymous with formative evaluation are: improvement, ongoing, feedback, betterment, enhancement, advancement, progression, assistance.

Summative Evaluation The focus of summative evaluation is judgement of the level of achievement. It refers to the final outcome, verdict or judgement. Summative evaluation is used in determining a final guide for the student. The decision is indicated as grades on a transcript, certificate, awarded diploma, accreditation, written evaluation and/or

performance appraisal.

4.4.2 Lesson Evaluation

Lesson evaluation is meant to find out whether the teacher has achieved the stated specific objectives or not after the lesson delivery.

To be able to evaluate the method of teaching you may ask yourself the following questions

a. Did I review the previous knowledge of the pupils?
b. Did I link the previous knowledge to the new topic?
c. Did I involve all the pupils in the lesson?
d. Did I present my teaching and learning activities sequentially?
e. Did I help the pupils understand the subject matter/core points I presented?
f. Did I present the subject matter sequentially?

The answers you will give to these questions will help you to evaluate your method of teaching. The evaluation of pupils' performance or achievement deals with how your pupils have understood the lesson and can apply the new concepts you have taught them to new unfamiliar situations. Evaluation of pupils' performance can effectively be done by using class test, oral questions, quizzes and assignment (homework). You should set adequate number of questions when you give pupils an exercise or a task on what you have taught. Exercise must be marked promptly

A complete evaluation of a lesson, involves the assessment of these competency areas:

- Lesson Plan Preparation
- Lesson Presentation or delivery and
- Class organisation

4.4.3 Evaluation of Instructional Objectives

Rating Scale:

Excellent -1: Very Good -2: Good -3: Fairy Good -4: Poor -5:

Competency Area	Teacher Requirement	Rating Scale				
		1	2	3	4	5
Objectives	a) All the main objectives stated (to cover knowledge and understanding, application of knowledge, and attitudes and process skills. b) Adequate number of objectives for the duration. c) Clarity of terms (behavioural terms using active words)					

Activity 10:

1. What is profile dimension?
2. How will you integrate profile dimension in your teaching and learning?

4.5 Profile dimensions of teaching and learning at the basic school level

4.5.1 Explanation of terms or words

a. Profile means a description of a state of something.
b. The word dimension means measurement in a specific direction.
c. Behaviour is the way in which an individual responds to his or her thought.

4.5.2 What are 'dimensions' of teaching and learning?

In teaching and learning, our dimensions are the behavioural changes in the learners. Normally, we say that learning has taken place in learners when there is a change in their behaviours. The changes in behaviour may be in the form of the knowledge acquired, their understanding, how they are able to apply the concept they have learnt, the process skills they have acquired and the desirable attitudes they have developed.

Some examples of the dimensions of teaching and learning at the basic school level are Knowledge, Understanding, Application, Process skills, Attitudes, Values etc.

4.5.3 What are Profile dimensions?

Profile dimensions describe the underlying behaviours for teaching, learning and assessment. In simple term, profile dimensions are a combination of any two or more of the dimensions of teaching and learning.

4.5.4 Learning Domains (Expected Learning Behaviours) Primary 1 -6

A central aspect of this curriculum is the concept of three integral learning domains that should be the basis for instruction and assessment. These are

1) Knowledge, Understanding and Application
2) Process Skills
3) Attitudes and Values.

4.5.5 Learning Domains (Expected Learning Behaviours) JHS 1-3

A central aspect of this curriculum is the concept of three integral learning domains that should be the basis for instruction and assessment. These are

1) Knowledge, Understanding and Application
2) Process Skills
3) Attitudes and Values.
4) Performance

4.5.8 Knowledge, Understanding and Application

Under this domain, learners acquire knowledge through some learning experiences. They may also show understanding of concepts by comparing, summarizing, re-writing etc. in their own words and constructing meaning from instruction. The learner may also apply the knowledge acquired in some new contexts. At a higher level of learning behaviour, the learner may be required to analyse an issue or a problem. At a much higher level, the learner may be required to synthesize knowledge by integrating a number of ideas to formulate a plan, solve a problem, compose a story, or a piece of music. Further, the learners may be required to evaluate, estimate and interpret a concept. At the last level, which is the highest, learners may be required to create, invent, compose, design and construct. These learning behaviours “knowing”, “understanding”, “applying”, “analyzing”, “synthesizing”, “evaluating” and “creating” fall under the domain “Knowledge, Understanding and Application”.

In this curriculum, learning indicators are stated with action verbs to show what the learner should know and be able to do. For example, the learner will be able to describe something. Being able to “describe” something after teaching and learning has been

completed means that the learner has acquired “knowledge”. Being able to explain, summarize, and give examples etc. means that the learner has understood the concept taught.

Similarly, being able to develop, defend, etc. means that the learner can “apply” the knowledge acquired in some new context. You will note that each of the indicators in the curriculum contains an “action verb” that describes the behaviour the learner will be able to demonstrate after teaching and learning has taken place. “Knowledge, Understanding and Application” is a domain that should be the prime focus of teaching and learning in schools. Teaching in most cases tends to stress **on** knowledge acquisition to the detriment of other higher level behaviours such as applying knowledge.

Each action verb in any indicator outlines the underlying expected outcome. Each indicator must be read carefully to know the learning domain towards which you have to teach. The focus is to move teaching and learning from the didactic acquisition of “knowledge” where there is fact memorization, heavy reliance on formulae, remembering facts without critiquing them or relating them to real world – ***surface learning*** – to a new position called – ***deep learning***. Learners are expected to deepen their learning by knowledge application to develop critical thinking skills and to generate creative ideas to solve real life problems in their school lives and later in their adult lives. This is the position where learning becomes beneficial to the learner.

The explanation and the key words involved in the “Knowledge, Understanding and Application” domain are as follows:

Knowing:

The ability to remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is the ability to remember or recall concepts already learnt and this constitutes the lowest level of learning.

Understanding:

The ability to explain, summarize, translate, rewrite, paraphrase, give examples, generalize, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some concepts that may be verbal, pictorial, or symbolic.

Applying:

This dimension is also referred to as “Use of Knowledge”. Ability to use knowledge or apply knowledge, apply rules, methods, principles, theories, etc. to situations that are new and unfamiliar. It also involves the ability to produce, solve, plan, demonstrate,

discover etc.

Analyzing:
The ability to break down concept/information into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc., ability to recognize unstated assumptions and logical fallacies; ability to recognize inferences from facts etc.

Synthesizing:
The ability to put parts or ideas together to form a new whole. It involves the ability to combine, compile, compose, devise, plan, revise, organize, create, generate new ideas and solutions.

Evaluating:
The ability to appraise, compare features of different things and make comments or judgment, contrast, criticize, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some concepts based on some criteria.

Creating: The ability to use information or materials to plan, compose, produce, manufacture or construct other products. From the foregoing, creating is the highest form of thinking and learning and is therefore a very important behaviour. This unfortunately, is the area where most
learners perform poorly. In order to get learners to develop critical thinking skills beginning right from the lower primary level, it is advised that you do your best to help your learners to develop analytic skills as we have said already.

4.5. 9 Skills and Processes

These are specific activities or tasks that indicate performance or proficiency in the learning of science. They are useful benchmarks for planning lessons, developing exemplars and are the core of inquiry-based learning.

Equipment and apparatus handling
This is the skill of knowing the functions and limitations of various apparatus, and developing the ability to select and handle them appropriately for various tasks.

Observing
This is the skill of using the senses to gather information about objects or events. This also includes the use of instruments to extend the range of our senses.

Classifying
This is the skill of grouping objects or events based on common characteristics.

Comparing

This is the skill of identifying the similarities and differences between two or more objects, concepts or processes.

Communicating/Reporting

This is the skill of transmitting, receiving and presenting information in concise, clear and accurate forms - verbal, written, pictorial, tabular or graphical.

Predicting

This is the skill of assessing the likelihood of an outcome based on prior knowledge of how things usually turn out.

Analyzing

This is the skill of identifying the parts of objects, information or processes, and the patterns and relationships between these parts.

Generating possibilities

This is the skill of exploring all the options, possibilities and alternatives beyond the obvious or
preferred one.

Evaluating

This is the skill of assessing the reasonableness, accuracy and quality of information, processes or ideas. This is also the skill of assessing the quality and feasibility of objects.

Designing

This is the skill of visualizing and drawing new objects or gargets from imagination.

Measuring

This is the skill of using measuring instruments and equipment for measuring, reading and making observations.

Interpreting

This is the skill of evaluating data in terms of its worth: good, bad, reliable, unreliable; making inferences and predictions from written or graphical data; extrapolating andderiving conclusions. Interpretation is also referred to as “Information Handling”.

Recording

This is the skill of drawing or making graphical representation boldly and clearly, well labelled and pertinent to the issue at hand.

Generalizing

This is the skill of being able to use the conclusions arrived at in an experiment to what could happen in similar situations.

Designing of Experiments

This is the skill of developing hypotheses; planning and designing of experiments; persistence in the execution of experimental activities; modification of experimental activities where necessary in order to reach conclusions.

4.5.10 Attitudes and Values

To be effective, competent and reflective citizens, who will be willing and capable of

solving personal and societal problems, learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. Learners, therefore need to acquire positive attitudes, values and psychosocial skills that will enable them participate in debates and take a stand on issues affecting them and others.

4.5.10.1 Attitudes

i. Curiosity:

The inclination or feeling toward seeking information about how things work in a variety of fields.

ii. Perseverance:

The ability to pursue a problem until a satisfying solution is found.

iii. Flexibility in ideas:

Willingness to change opinion in the face of more plausible evidence.

iv. Respect for Evidence:

Willingness to collect and use data in one's investigation, and also have respect for data collected by others.

v. Reflection:

The habit of critically reviewing ways in which an investigation has been carried out to see possible faults and other ways by which the investigation could be improved upon. The teacher should endeavours to ensure that learners cultivate the above scientific attitudes and process skills as a prelude to effective work in science.

4.5.10.2 Values

At the heart of this curriculum is the belief in nurturing honest, creative and responsible citizens. As such, every part of this curriculum, including the related pedagogy, should be consistent with the following set of values.

Respect: This includes respect for the nation of Ghana, its institutions and laws and the culture and respect among its citizens and friends of Ghana.

Diversity: Ghana is a multicultural society in which every citizen enjoys fundamental rights and responsibilities. Learners must be taught to respect the views of all persons and to see national diversity as a powerful force for nation development. The curriculum promotes social cohesion.

Equity: The socio-economic development across the country is uneven. Consequently, it is necessary to ensure an equitable distribution of resources based on the unique needs of learners and schools. Ghana's learners are from diverse backgrounds which require the provision of equal opportunities to all, and that, all strive to care for each other.

Commitment to achieving excellence: Learners must be taught to appreciate the opportunities provided through the curriculum and persist in doing their best in whatever field of endeavour as global citizens. The curriculum encourages innovativeness through creative and critical thinking and the use of contemporary technology.

Teamwork/Collaboration: Learners are encouraged to be become committed to team-oriented working and learning environments. This also means that learners should have an attitude of tolerance to be able to live peacefully with all persons.

Truth and Integrity: The curriculum aims to develop learners into individuals who will consistently tell the truth irrespective of the consequences. In addition, be morally upright with the attitude of doing the right thing even when no one is watching. Also, be true to themselves and be willing to live the values of honesty and compassion. Equally important, is the practice of positive values as part of the ethos or culture of the work place, which includes integrity and perseverance. These underpin the learning processes to allow learners to apply skills and competences in the world of work. The action verbs provided in the learning domains in each content standard should help you to structure your teaching to achieve the desired learning outcomes. Select from the action verbs provided for your teaching, for evaluation exercises and for test construction. Check the learning indicators to ensure that you have given the required emphasis to each of the learning domains in your teaching and assessment.

UNIT 4: SUMMARY

The unit covered the following sub-topics:
4.1 Goals and Objectives
4.2 Bloom's Taxonomy of Learning
4.2.1 Bloom's Taxonomy of Cognitive Domain of Learning
4.2.2 The Affective Domain of Learning
4.2.3 Psychomotor Domain of Learning
4.3 Formulation of Learning Objectives
4.4 Evaluation of Instructional, Behavioural and Learning Objectives
4.5 Profile dimensions of teaching and learning at the basic school level

UNIT 5

TEACHING DEVICES

Dear student welcome to Unit 5. This unit is about Teaching Devices.

Indicators:

- State the different types of teaching support materials
- Describe the importance of resources for teaching Science
- Explain the principles for the selection of teaching aids
- Explain the guidelines for effective use of teaching aids.
- Describe how to improvise three materials for teaching Science

Activity 1:

1. What are teaching aids?
2. (i) Explain any two**(2)** main types of teaching aids

   (ii) Give two**(2)** examples of each of the types mentioned

5.1Teaching Aids and Types

Teaching aids are objects or devices used by a teacher to enhance classroom instruction and promote active participation of learners during teaching and learning activities to achieve learning outcomes.

Objects such as textbooks, pictures, maps and other display materials are teaching aids. Also devices like computers, smart phone DVD, films are used in the classroom as teaching aids.

Four main Types of Teaching Aids

(i) **Visual Aids**: Helps the learner to acquire knowledge through his or her visual senses. They are aids that are looked at (appeal to eye sight). Examples include charts, silent motion pictures, projected displays, filmstrips, models, graphs, diagrams, chalk boards, marker boards, magnetic boards, flannel boards, etc.

(ii) **Audio Aids**: They help the learner to acquire knowledge through his auditory

senses. They are aids that are listened to (appeal to the ear and hearing). Examples include tape recorded lesson, radio, teaching machine, broadcast talks, etc.

(iii) **Audio-Visual Aids**: These are aids that are both looked at and listened to in order to see and hear at the same time. They are sensory aids that help to make teaching effective, interesting and concrete. Audio visual aids provide the learner an opportunity to utilize both his or her auditory and visual senses to gain the desired knowledge and learning experience. Examples include videos, sound motion films, television, living objects like a bird, etc.

(iv) **Activity Aids**: They are a combination of all the teaching aids that are necessary to enable the learner to engage in a specified useful activity. Examples include:

a. Field trips/excursions and visits
b. Exhibitions and fairs
c. Experimentation in the laboratory/workshop.

Activity 2:

1. Describe any five **(5)** importance of Science Teaching Aids.

5.2 Importance of Teaching Aids.

1. They create a visual and interactive experience for learners during classroom instruction.
2. They engage the students thereby promoting their understanding of the topic being taught.
3. They help in illustrating or reinforcing a skill or concept.
4. They motivate and relieve learners of anxiety and boredom by providing information in a new and exciting way.
5. They promote faster learning in students
6. They discourage leaners from the habit of cramming.

7. They make the classroom active. The element of fascination whilst learning with teaching aids encourages greater student participation.
8. They enable a large number of students to be taught at the same time even if the teacher is standing far away from one of the students.
9. They enable the teacher to win the interest and attention of the learners
10. They make the subject matter clear.
11. When used properly, teaching aides develop in the learner, the desired attitudes of a scientist and also trains them in the use of the scientific method.
12. They enable student to learn through first-hand experience as they look at demonstrations involving concrete objects.
13. Teaching aids make use of the five senses.

Activity 3:

1. Explain any five (5) principles for the selection of Science Teaching Aids

5.3 Principles for the selection of Teaching Aids

1. The aid should be relevant to the topic being taught.
2. It should be suitable to the topic and make it interesting.
3. It should motivate and have some specific educational values.
4. The aid to be used should be simple and easy to manipulate.
5. It should suit the physical, social and cultural environment of the learners.
6. It should be suitable for collaborative learning.
7. It should be appropriate in ensuring the achievement of standards and the learning goals given in the curriculum framework
8. The aid should be the best possible substitute in terms of reality, accuracy and truthful representation of the object or the first hand experience.
9. It should be accessible, visible and introduce learners to knowledge and skills that prepare them for the real world.

Activity 4:

1. Discuss any four**(4)** guidelines for effective use of Teaching Aids

5.4 Guidelines for the Effective Use of Teaching Aids

1. The teaching aid should be linked to the classroom teaching and used purposely to supplement oral and written work in class.
2. Ensure that the teaching aid is in conformity with the intellectual level of the class and fits the learners' previous experience.
3. Use the aid so that it stimulates greater thinking, creativity and activity in the learners.
4. Preferably use actual specimen exactly, accurately and practically in real terms if available.
5. Make sure that you are skillful in the handling and manipulation of the teaching aid.
6. The teaching aid used should be related closely to the learners experiences.
7. Plan well so that the teaching aid is used exactly at the point in the teaching and learning process where the conceptual purpose for its use is best manifested.
8. You should evaluate the use, function and the effect of the teaching aid used in the learning process from time to time.

Activity 5:

1. What is computer simulation?

5.5 Computer Simulation

Computer simulation is the process of mathematical modelling, performed on a computer, which is designed to predict the behavior of or the outcome of a real – world of physical systems. In this case the physical system in being simulated.

Simulation of a system is the running of the system model. Consequently, one should build a model first before running that model as simulation. Computer simulation is

useful because it enables one to explore and gain insight into new technology and to estimate the performance of systems.

Computer simulation serves as a "Substitute Laboratory". For example, in the various branches of science, they can be used to provide teaching and training experiences that would not be practicable using conventional methods on grounds of cost, time, safety etc.

Examples include the use of computer simulation to provide learners insight into systems such as nuclear reactors and experiments in genetics.

Activity 6:

1. (i) What is improvisation?

   (ii) State and explain the main types of improvisation

5.6 Improvisation

It is the use of low cost/no cost readily available materials in the locality to make equipment/objects/apparatus and **use these for teaching and learning** in the absence of the original equipment/objects/apparatus.

Improvised materials are a replica of the original equipment and apparatus made with low cost or no cost readily available materials in the local environments.

5.6.1 Improvised material are of three types

1. Improvisation by substitution:

   This means using improvised materials in place of real or original materials.

   For example, using a lighted candle as a bunsen burner; using lime juice as acid.

2. Improvisation by modification:

   That is when some changes are done to the locally available material before it can be used to represent the original one.

   For example, cutting a plastic bottle into two and using the bottom half as a beaker and top half as a funnel.

3. Improvisation by construction:

   That is when the locally available materials are used to make a model of the

original object in teaching.

Activity 7:

1. Describe how to improvise two materials for teaching Science

5.6.2 Teaching Aids that can be improvised

a . Charts and Wall Charts

Charts refer to displays on a large piece of manila card or cloth that are designed to be shown to a class or a group in the course of a lesson.
Wall charts are similar to charts except that they are pinned to a wall of the classroom or on a bulletin board and are meant for casual study of the context of a formal lesson.

Even though charts and wall charts are available commercially, it is still often necessary to make one's own in a specific way.

b. **Mobiles**: These are three-dimensional wall charts in which the individual components can move about. Instead of displaying a related system of pictures, words, sketches etc. on the surface of a wall chart, they are drawn on card, cut out and hung independently from a beam or a ceiling using fine threads. In this way the cut-out materials are seen without a paper background.

c. **Models**: these are three-dimension representation of real things or abstract system. Models are useful in three specific roles being: i) as visual support materials in mass instruction ii) as objects for study or manipulation in individualized learning iii) as project work to be constructed by individuals, small groups or even an entire class.

Models can be applied in several ways in the teaching and learning process.

- They can be used to reduce the sizes of very large objects (a planet) and enlarge very small objects (an atom) to a size that can conveniently be observed and handled.
- They can be used to demonstrate movement.
- They can be used to represent a highly complex situation or process in a simplified way that can easily be understood by students.

Activity 8:

1. State and explain any four **(4)** importance of improvisation in Teaching and learning of Science.

5.6.3 Improvisation is important in the teaching and learning process because;

1. It demystifies science
2. It makes the learning of science interesting.
3. It enables students to learn through first-hand experience.
4. It introduces students to the world of work.
5. It fosters cooperation and collaboration among learners.

Activity 9:

1. Discuss any four**(4)** factors you will consider when making improvised materials for teaching and learning Science.

5.6.4 Factors to consider when making improvised materials include

1. The age and intellectual ability of the learners that will use it.
2. Safety in using the improvised materials.
3. Availability of the basic materials in the locality.
4. The assistance of local craftsman such as carpenters, welders, electricians.

UNIT 5: SUMMARY

This Unit consists of the following sub-topics:

5.1 Teaching Aids and Types

5.2 Importance of Teaching Aids.

5.3 Principles for the selection of Teaching Aids

5.4 Guidelines for the Effective Use of Teaching Aids

5.5 Computer Simulation

5.6 Improvisation

UNIT 6
CLASSROOM MANAGEMENT

Welcome to Unit 6. This Unit is about Classroom Management

Indicators:

- Tell why Classroom Management matters
- Demonstrate knowledge on how to prevent management problems in the classroom situation.
- Demonstrate effective way of responding to student misbehaviour

Activity 1

1. What is Classroom Management?

6.1 Meaning of Classroom management

Simply put, classroom management refers to the wide variety of skills and techniques that teachers use to ensure that their classroom runs smoothly, without disruptive behavior from students. This boils down to having a structured learning environment with clear rules that promote learning as well as consequences that diminish or eliminate behaviors that get in the way of learning.

Classroom management is also a term teacher use to describe the process of ensuring that classroom lessons run smoothly without disruptive behavior from students compromising the delivery of instruction. The term also implies the prevention of disruptive behavior preemptively, as well as effectively responding to it after it happens.

To another, Classroom management refers to the wide variety of skills and techniques that teachers use to keep students organized, orderly, focused, attentive, on task, and academically productive during a class. When classroom-management strategies are executed effectively, teachers minimize the behaviors that impede learning for both individual students and groups of students, while maximizing the behaviors that facilitate or enhance learning. Generally speaking, effective teachers tend to display strong classroom-management skills, while the hallmark of the inexperienced or less effective teacher is a disorderly classroom filled with students who are not working or paying attention.

We sometimes make the mistake of interchanging the terms “behavior management”

and “classroom management.” The two terms are related, one might even say intertwined, but they are different. Classroom management means creating systems that support the kind of positive behavior across a classroom. Behavior management is made up of strategies and systems that will manage and eliminate difficult behaviours that prevent students from succeeding in an academic environment.

Again, Classroom management refers to all procedures and strategies used by a teacher to maintain discipline in the classroom to ensure a conducive environment that can facilitate student learning. A well-managed classroom improves student learning. The classroom is a congregation of different students with different personalities; thus, teacher needs to know how to effectively manage the class.

Classroom management is crucial in classrooms because it supports the proper execution of curriculum development, developing best teaching practices, and putting them into action. Classroom management can be explained as the actions and directions that teachers use to create a successful learning environment; indeed, having a positive impact on students achieving given learning requirements and goals (Webster, 2020). In an effort to ensure all students receive the best education it would seem beneficial for educator programs to spend more time and effort in ensuring educators and instructors are well versed in classroom management.

Activity 2

1. Discuss any five **(5)** purposes of Classroom Management

6.2 Purposes of classroom management

1. **To ensure that classroom teaching run smoothly despite the disruptive behaviour of some students.** Running a classroom smoothly and efficiently makes a powerful impact on the students learning achievement. A recent study indicated that effective classroom leadership is second only to teaching in regards to student success (Webster, 2020).

2. **To alert students of what is expected of them.** The goal and result of a well-managed classroom is structure. Teachers provide structure through creating and staying on a schedule, planning curriculum and extension activities and exhibiting preparedness. Students model behavior and work after the teacher, so modeling responsibility, pride, appropriate language and high expectations helps students do the same. Classroom structure is maintained through rule-based

procedures such as morning routines that focus kids on an academic task when first entering the classroom, center routines that promote moving from one center to the next when cued, getting books out at the beginning of each class and packing bags before dismissal.

3. **To maximize the time for academic learning**. Time is a precious commodity for teachers. Most teachers would argue that they never have enough time to reach every student, particularly the ones that are below grade level. Therefore, every second a teacher has with their students should be a meaningful and productive second. Successful teachers establish procedures and expectations that minimize wasteful downtime and maximize engaging learning opportunities. Wasted time does add up. A teacher who loses as little as five minutes of instructional minutes per day due to inefficiencies wastes fifteen hours of opportunity over the course of a 180-day school year. That extra time would likely make a significant difference for every student, but particularly those who are struggling learners.

4. **To minimize the effect of disruptive behaviour shown by students.** A goal of classroom management is a sound and rule-based environment that represents a setting where learning occurs. A system of rules and consequences that define and promote tolerance of classmates and teachers through respect and high standards for individual and group behavior results in a safe learning environment that students feel comfortable entering and participating within.

5. **To provide a conducive learning environment for students**. A good classroom management plan will help you create a favorable learning environment. Student academic achievement is an objective of classroom management. Teachers create student achievement through upholding high expectations by alerting students to the quality of behavior and work that is accepted within the classroom and school. This occurs through ongoing encouragement, positive peer pressure, adherence to rules and modeling.

6. **Effective classroom management is an absolute must.** It impacts your ability to be an effective educator and enjoy your job, and it impacts your students' success as learners. If your classroom is out of control, it won't matter how passionate you are about your subject or how much you are truly dedicated to children, learning will be negatively impacted.

7. **Classroom management achieves the goal of teachers by providing different**

types of modalities for kids to gain and apply knowledge. Classrooms that engage students in learning and following procedures offer more opportunities for teachers to implement effective instruction through experiential learning activities and differentiated instruction to students on a one-on-one basis or in small groups. An educator can entrust a well-managed class to follow procedure and directions while she attends to varying student needs and ability levels.

Activity 3

1. State and describe any three **(3)** principles of Classroom Management

6.3 Principles of classroom management

Brophy (1983) identified three principles for good classroom management.

i. Willingness of the teacher to accept responsibility for classroom management.
ii. Long-term, solution-oriented approaches to problems rather than short term responses.
iii. Check to see if symptomatic behaviour is caused by underlying personal problems.

Activity 4

1. State and explain any five **(5)** strategies you will use to manage student behaviour in a Science class.

6.4 Management of student behaviour strategies

1. **Proactive planning.**
   In-depth preparation of interesting and challenging activities to keep Students engaged.
2. **Systematic arrangement of the classroom.**
   A congested classroom is difficult to manage. Teacher should be able to move freely and reach any student. Sitting plan can be done so that teacher can keep an eye on students.
3. **Use preventive strategies.**
   Identify precursors to student disruptive behaviours.
4. **Fair treatment.**

Treat all students fairly. This increases respect for the teacher.

5. **Consistencies in dealing with students**. Class and school rules should be reinforced consistently. Maintain authority all year long. You meant it when you started the year, but it's easy to relax a bit as the year moves along. When you tell kids to stop talking and get back to work but you don't follow through, you tell them it doesn't matter that much. This can lead to teachers raising their voices and saying things they regret. You don't have to be mean; you just have to mean it. So, make a list of rules that are effective and really matter to you and then share them with your students. Post them visibly and refer to them often.

6. **Use humour**
   Have a good sense of humour. Use jokes to calm situations and ease tension.

7. **Avoid confrontation.**
   Don't confront students aggressively. Discipline is best administered in private.

8. **Have simple and understandable classroom rules**.
   Classroom rules should be simple and understandable. Classroom rules should be important for classroom management. Rules should communicate what is acceptable and unacceptable behaviour in the classroom. Make sure that students know what your rules mean. Just because you've stated them, shared them, and posted them, doesn't mean students know what they mean. Your version of no talking might be different from theirs. Human beings talk for lots of reasons, so keep your expectations appropriate. It might even be okay to joke around a bit as long as a student is staying focused on the task at hand. Some teachers find great success with acting out ways of talking that are effective.

9. **Use sarcasm cautiously**. Students may not identify it as sarcasm. Students may be offended and may respond accordingly.

10. **Know the names of students and build relationships**. This is hands down the most effective classroom management technique. When a student trusts their teacher, they make more of an effort to follow the rules. When teachers make an effort to get to know each student on a more personal basis, they get more out of their teaching experience as well. Each class should feel more like a family. If you don't know how to pronounce each child's name correctly, use sarcasm regularly, and make students feel dumb for asking questions, you need to change those behaviors first.

11. **Celebrate hard work**. Show students that you value the work they put into learning. Identify milestones in the work everyone is accomplishing each day. Once a week, choose one particularly hardworking team or student to share their story. Let the class ask them how they accomplished the work. What a valuable lesson kids learn when they hear peers talking about what hard work means to them. Kids who know their work will be celebrated instead of just their grades will pay more attention and stay focused.

Activity 5

1. Discuss any five **(5)** common classroom problems in a Science Lesson at the Basic School.

6.5 Common classroom problems in the classroom

1. Sleeping in class
2. Not paying attention.
3. Laughing unnecessarily
4. Coming to class late
5. Gossiping during lessons
6. Hold distracting conversations
7. Disapproving groans and comments
8. Using cell phones during class
9. Verbal and physical disrespect to the teacher

Activity 6

1. Mention and discuss any four **(4)** ways on how you will manage your learners learning environment.

6.6 Management of the learning Environment Wait time

Increases wait time after asking a question. This will help a lot of students to think about the

question. It also allows introvert students to muster courage to speak. Rowe (1987) found out that more students were willing to answer a question when the wait time was increased from 1.5s to 3-5s.

1. **Let students write down their ideas.**

Ask students to write down their responses to the question. Students can be called to read out their response. The responses can be collected in necessary.

2. **Think-pair-share**

Give students time to think about the question. Ask students to talk to their neighbouring student and compare ideas, points of agreement and disagreement. Ask students to bring out the pair's idea on the question. Students can bring out their disagreements.

3. **Multiple hands, multiple voices**

Make sure that multiple hands are raised whenever you ask a question. Call different students to answer questions. You may tell the students that you want more than one hand up when you ask a question. Students may be asked to rehearse with their colleagues what they will say if they are called.

4. **Random calling of students**

Establish the culture in the classroom that any student can be called on at any time to answer a question. Learn students' names.

5. **Whip around**

Let every student know that you would like to hear their opinions. Teacher listen to every student's opinion after asking a question. If a student says his ideas have been shared, let him share his in his own words. In a large class, you can ask only students on a row to share their ideas to a question. Rotate the rows during the course of the lesson. Do not judge wrong responses. If you want more students to participate in the lesson, then indicate to students that you would like to hear from a number of them and then sort out which responses are accurate. In such situations, acknowledge responses in neutral tone. "Thanks for sharing your idea" can be used to acknowledge students' responses.

6. **Use praise with caution**

Be careful of the words you use to acknowledge students' responses. Words like "fabulous", "exactly", "perfect" connote finality and this will prevent other students from speaking up.

7. **Establish classroom rules**

Indicate the standard acceptable behaviours in the classroom. No intimidation from colleagues. Indicate that all ideas are welcomed.

UNIT 6: SUMMARY

This unit covered the following sub-topics:
6.1 Meaning of Classroom management
6.2 Purposes of classroom management
6.3 Principles of classroom management
6.4 Management of student behaviour strategies
6.5 Common classroom problems in the classroom
6.6 Management of the learning Environment Wait time

UNIT 7

ASSESSMENT STRATEGIES

Dear student you are welcome to new Unit 7. This Unit is on Assessment Strategies

Indicators:

- Explain why we use varied tools for assessment in Science
- Describe six methods for collecting evidence of Science learning

Activity 1:

- How would you define Assessment in Science?

7.1 Definition/Meaning of Assessment

Assessment has been an integral part of any educational system and has been defined in several ways. Salvia and Ysseldyke (1998) define **assessment** as the collection of information in order to identify problems and make educational decisions. Airasian (1996) sees assessment as the process of collecting, synthesising and interpreting information to aid decision making

Assessment in education generally refers to a process for obtaining and interpreting information that is used for making decision about learners, curricula, programmes and educational policy. A number of decisions made about learner's competence are informed by information derived from assessment data. Therefore, assessing learner's competence, entails collecting information from the learner regarding their progress towards attaining the necessary knowledge, skills, attitudes, or behaviours, which is useful in deciding the degree to which the learner has achieved the performance standards

Assessment within the National Pre-Tertiary Education Curriculum is a coordinated plan for monitoring the academic achievements of learners from Kindergarten through to Senior High Schools in Ghana

Assessment is the **measurement** and **evaluation** of the individual's educational traits, potential and actual performance. The measurement aspect of assessment is the collection of quantitative and qualitative information on an individual through the use of instruments such as tests, assignments and checklist. The evaluation aspects involves making value judgements regarding the status regarding the status of the individual relative to some standards, expectations, other individuals or groups of the individuals and instructional programmes themselves.

On the other hand **measurement** can be said to be processed of collecting data on student performance. **Evaluation** can also be said to be processed whereby the data collected are analysed and compared for value judgement.

No matter what definition is given to assessment, the central issues are that it deals with information gathering, analysing and decision making (Yekple 2005)

Activity 2:

1. What is Testing?
2. State a difference between Assessment and Testing

7.2 Measuring Instrument

There are different measuring instruments for assessment. These include:

Essay and objective tests

In the objective test we have multiple choice, completion test and matching test. Exercises, quizzes, class tests, homework, project work and checklist are examples of instruments used in collecting data.

Types of tests

a. Essay Test
b. Objective Tests
    i. Multiple choice tests
    ii. Short answer tests
    iii. Matching test
    iv. True-False tests

7.2.1 Assessment vs Testing: what's the difference?

Assessment and testing are often used interchangeably. What's the difference between assessment and testing in education? When developing instruction, it's important to know what the difference is between assessment and testing. This article will give the answer, so keep on reading!

7.2.2 What is testing?

What is testing in education? Almost everybody has experienced testing during his or her life. Grammar tests, driving license test etc. A test is used to examine someone's knowledge of something to determine what that person knows or has learned. It measures the level of skill or knowledge that has been reached. An evaluative device or procedure in which a sample of an examinee's behaviour in a specified domain is obtained and subsequently evaluated and scored using a standardized process (The Standards for Educational and

Psychological Testing, 1999)

So, what's the difference?

Test and assessment are used interchangeably, but they do mean something different. A test is a "product" that measures a particular behaviour or set of objectives. Meanwhile assessment is seen as a procedure instead of a product. Assessment is used during and after the instruction has taken place. After you've received the results of your assessment, you can interpret the results and in case needed alter the instruction. Tests are done after the instruction has taken place, it's a way to complete the instruction and get the results. The results of the tests don't have to be interpreted, unlike assessment.

Activity 3:

1. What is evaluation?
2. Identify any two **(2)** differences between Assessment and Evaluation.

7.3 Relationship between Assessment and Evaluation

Besides the differences, there are also some similarities between assessment and evaluation. The both require criteria, use measures and are evidence-driven.

Difference between assessment and evaluation?

Assessment	Evaluation
Is on-going	Provides closure
Improves learning quality	Judges learning level
Individualized	Applied against standards
Ungraded	Graded
Provides feedback	Shows shortfalls
Process-oriented	Product-oriented

Activity 4:

- Discuss any five **(5)** Principles of Assessment in Science

7.4 Principles of Assessment

The following principles should guide assessment approaches:

1. **Test developer must be clear about the performance indicators to be assessed:** This involves clearly specifying the intended learning goals and selecting the appropriate assessment techniques, which should be clear, explicit and accessible to all stakeholders, including learners.
2. **The assessment technique selected must match performance indicators:** The main criterion is whether the procedure is the most effective in measuring learning within the performance indicators. Assessment tasks should primarily reflect the nature of the discipline or subject and should also ensure that learners have the opportunity to develop a range of generic skills and capabilities.
3. **Assessment techniques must serve the needs of the learners:** They should provide meaningful feedback to the learners about how closely they are meeting the demands of the performance indicators. Timely feedback promotes learning and facilities improvement and should be an integral part of the assessment process.
4. **Assessment is a goal-oriented process:** The assessment task should match the purpose of the subject being assessed. It works best when the programme being assessed has a clear, explicitly stated purpose.
5. **Good assessments use multiple methods:** Multiple indicators of performance provide a better assessment of the extent to which a learner has attained a given learning target. Assessment needs to be comprehensive. Formative and summative assessment should be incorporated into the programmes to ensure that the purposes of assessment are adequately addressed.
6. **Assessment is inherently a process of professional judgment:** Proper use of assessment procedures requires that the user is aware of the limitations of each technique. In interpreting the results of the assessment, these limitations must be considered. Therefore, all those involved in the assessment of learners must be competent to undertake their roles and responsibilities.
7. **Assessment is a means to an end:** It is not an end in itself but a vehicle for educational improvement. Assessment influences learners' motivation for learning. The nature of assessment influences what is learned and the degree of meaningful engagement by learners in the learning process, learners are, therefore, entitled to feedback on submitted formative assessment tasks and on summative tasks, where appropriate.
8. **Assessment should be valid and reliable:** Evidence needs to be provided that the interpretation and use of learners' assessment result are appropriate and reliable. For assessment to be reliable, it requires clear and consistent processes for setting, marking, grading and moderating assignments/tests.
9. **Good assessment appropriately incorporates technology:** As technology advances and teachers become more proficient in the use of technology, there will be

increased opportunities for teachers and district and regional education directorates to use computer based techniques (e.g. item banks, electronic grading, computer-adapted testing and computer based simulations)

10. **Good assessment is fair and ethical:** Usually, four view of fairness are presented by the Assessment Standards as:
    i. Absence of bias (e.g. offensiveness and unfair penalization)
    ii. Equitable treatment
    iii. Equality in outcomes
    iv. Opportunity to learn

Activity 5:

- State and explain any four **(4)** importance of classroom assessment.

7.5 Purposes and Uses of Classroom Assessment

1. To motivate learners to improve their work.
2. To advise learners on how to direct their learning efforts.
3. To advise individuals on their vocational choices.
4. To screen or select individuals for admission, promotion, certification and other honours.
5. To determine the effectiveness of instructional methods and materials
6. To discover individual problems and weaknesses
7. To determine how to group students for instruction in view of individual differences.
8. To determine the progress of each individual.
9. To determine the extent to which instructional goals are being achieved.

7.6 Types of Assessment

Assessment types are varied. They are diagnostic assessment, formative assessment and summative assessment.

Activity 6:

- What is Diagnostic Assessment?

7.6.1 Diagnostic Assessment

Diagnostic assessment is useful in identifying learners' current knowledge and skills and abilities and helps to clarify misconception prior to introducing learners to a new learning area. The information gathered from a diagnostic is essential or better planning of what is to be taught and how to teach it. Diagnostic assessment may take the form of pre-test of learners' knowledge and ability in a given content standards and performance indicator. It can also take the form of self-assessment against core competencies for the purpose of identifying areas of strength and weakness. Use of short interview of 10 minutes or less is another way to undertake a diagnostic assessment.

Activity 7:

- What is Formative Assessment?

7.6.2 Formative Assessment

Formative assessment provides feedback and information during a teaching and learning process. Formative assessment measures learners' progress and in a way assesses the teachers' own progress of delivering the content in a manner that ensures learning is taking place. Primarily, formative assessment focuses on identifying areas of learning that may need improvement. In order for it to serve this purpose, formative assessments are not normally graded and instead feedback is provided to enable the learner know their learning progression and to determine the effectiveness of lesson delivery by the teacher – whether the method and activities being used are appropriate.

Formative assessment in Ghana's classroom should include:

- Observations during in-class activities.
- Homework exercises as a review of class discussion and signal for further teaching and learning activities.
- Reflections journals that are reviewed periodically during the term.
- Question and answer sessions, both formal (planned) and informal (spontaneous).
- Progress review meetings between the teachers and students at various points in the term.
- In-class activities where learners informally present their results.

Activity 8:

- Identify a difference between **Assessment for Learning** and **Assessment as**

Assessment for Learning

The use of formative Ghanaian classrooms should be understood as Assessment for Learning (AfL), an assessment practice that describes approaches within the formative purposes of assessment. (AfL) is the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learner is in their learning, where they need to be (the desired goal), and how best to get there. AfL is one of the powerful methods for improving learning and raising standards (Black and William 1998)

Assessment for Learning also refers to all those activities undertaken by teachers and/or by their learners, which provides information to be used as feedback to modify the teaching and learning activities in which they are engaged' (Black and William, 1998). AfL can be achieved through processes such as sharing criteria with learners, effective questioning, and feedback.

Assessment as Learning

Assessment as learning relates to engaging learners to reflect on the expectations of their learning. Information that learners provided the teacher forms the basis for refining teaching -learning strategies. Learners are assisted to play their roles and to take responsibility of their own learning to improve performance. Learners are assisted to set their own goals and monitor their progress

Activity 9:

- What is Summative Assessment?

7.6.3 Summative Assessment

Summative assessment is an assessment usually conducted but not always, at the end of the school year based on the accumulation of the progress and achievements of the learner throughout the year in a given subject, together with any end-of-year test or examinations. Summative assessment demonstrates the extent of a learner's success in meeting the assessment criteria used to gauge the intended learning outcomes, and which contributes to the final mark given for the learning area within the content standards. The result of summative assessment is a single end-of-year promotion grade. Summative assessment captures a record of learning at the end of a period of study. However, formative and summative assessments are not in opposition; they are interrelated and complementary. The information from formative assessment, supplemented by class tests or tasks, helps to ensure dependable summative assessment.

Activity 10:

- How would you explain Assessment of Learning?

Assessment of Learning

Assessment of Learning (AoL) is carried out purposely for grading and reporting. AoL involves decision about the merits of learner performance in relation to standards of performance. It is designed to measure student achievement and gauge what they have learned. AoL take place at a point in time for summarising the status of student achievement. It occurs at the end of the learning unit. AoL has well established guidelines that include:

- A number or letter grade (summative)
- Comparing a learner's achievement with the standards.
- Communicating results to learners and parents, where necessary.

Activity 11:

- Explain how to use Assessment "for", "as" and "of" learning to teach a Science

7.7 Illustration of how to use Assessment "for", "as" and "of" learning to teach a lesson

Indicator	Assessment for learning	Assessment as learning	Assessment of learning
B 2. 1. 2. 3. 1 Describe a solid-solid mixture and explain how to separate the component	In the course of the lesson: identify the solid-solid mixtures among the following: gari, and water, sand and salt, charcoal and sand, iron nails in water	Before the lesson: find-out from the home, how sand is separated from roasted groundnut. Let learners share ideas in group discussion	End of term: Explain how you would separate a mixture of sand and stone
B 3. 3. 3. 1. 1 Identify organisms in a habitat and describe why they live in a particular place	During the lesson: Match the following animals with their home/habitat Habitat | Animal	During the lesson introduction: Discuss among yourselves: in your community , where do you normally see birds building their homes	End of Unit Exercise: what enables fish to live in water?

	• River • Tree Top • Hole in the ground	• Bird • Rat • tilapia		

Activity 12:

- What is Self-Assessment?

7.8 Self-Assessment

The goal of implementing self-assessment in a course is to enable students to develop their own judgement. In self-assessment students are expected to assess both process and product of their learning. While the assessment of the product is often the task of the instructor, implementing student assessment in the classroom encourages students to evaluate their own work as well as the process that led them to the final outcome. Moreover, self-assessment facilitates a sense of ownership of one's learning and can lead to greater investment by the student. It enables students to develop transferable skills in other areas of learning that involve group projects and teamwork, critical thinking and problem-solving, as well as leadership roles in the teaching and learning process.

Things to Keep in Mind about Self-Assessment

1. Self-assessment is different from self-grading. According to Brown and Knight, "Self-assessment involves the use of evaluative processes in which judgement is involved, where self-grading is the marking of one's own work against a set of criteria and potential outcomes provided by a third person, usually the [instructor]." (Pg. 52)
2. Students may initially resist attempts to involve them in the assessment process. This is usually due to insecurities or lack of confidence in their ability to objectively evaluate their own work. Brown and Knight note, however, that when students are asked to evaluate their work, frequently student-determined outcomes are very similar to those of instructors, particularly when the criteria and expectations have been made explicit in advance.
3. Methods of self-assessment vary widely and can be as eclectic as the instructor. Common forms of self-assessment include the portfolio, reflection logs, instructor-student interviews, learner diaries and dialog journals, and the like.

Activity 13:

- What is Peer Assessment?

7.9 Peer Assessment

Peer assessment is a type of collaborative learning technique where students evaluate the work of their peers and have their own evaluated by peers. This dimension of assessment is significantly grounded in theoretical approaches to active learning and adult learning. Like self-assessment, peer assessment gives learners ownership of learning and focuses on the process of learning as students are able to "share with one another the experiences that they have undertaken." (Brown and Knight, 1994, pg. 52)

Things to Keep in Mind about Peer Assessment

1. Students can use peer assessment as a tactic of antagonism or conflict with other students by giving unmerited low evaluations. Conversely, students can also provide overly favourable evaluations of their friends.
2. Students can occasionally apply unsophisticated judgements to their peers. For example, students who are boisterous and loquacious may receive higher grades than those who are quieter, reserved, and shy.
3. Instructors should implement systems of evaluation in order to ensure valid peer assessment is based on *evidence* and *identifiable criteria*.

UNIT 7: SUMMARY

This unit discusses the following sub-topics:
7.1 Definition/Meaning of Assessment
7.2 Measuring Instrument
7.3 Relationship between Assessment and Evaluation
7.4 Principles of Assessment
7.5 Purposes and Uses of Classroom Assessment
7.6 Types of Assessment
7.7 Illustration of how to use Assessment "for", "as" and "of" learning to teach a lesson
7.8 Self-Assessment
7.9 Peer Assessment

UNIT 8

LESSON PLAN

Dear student you are welcome to new Unit 8. This Unit is on Lesson Plan

Indicators:

- Prepare lesson note for teaching Science

Activity 1:

- What is a Lesson Plan?

8.1 MEANING OF LESON PLAN / LESSON NOTES OR EXPANDED SCHEME OF WORK

A lesson plan is simply an outline prepared in advance of teaching so that the time and the materials will be used effectively.

A lesson plan can be described as a programme of activities that guide the teaching techniques that would be followed.

Lesson planning is an individual exercise. Lesson plan may differ according to types of subjects, lesson, teachers, learners, administrators and supervisors.

Activity 2:

- State and discuss two general considerations in preparing lesson notes

8.2 GENERAL CONSIDERATIONS IN PREPARING LESSON NOTES/PLANS

In writing notes, the following should be considered:

1. **What does the teachers wants the pupils to learn?** To answer this question, refer to the basic resources: the syllabus, teacher's handbook, the pupil textbook. These basic materials will help the teacher to prepare a clear lesson objective that will guide the content and flow of the lesson.
2. **Where should the teacher start?** To answer this question, the teacher will need to find out what the pupils have learned so far in the subject, to make sure the pupils have sufficient background to be able to follow the lesson. This involves conducting relevant previous knowledge that should be part of the introduction of every lesson.
3. **How will the teacher get there?** To address this question, use a step by step approach to plan the teacher and learner activities that will occur during the lesson. The more detailed and well thought out these steps are, the greater the chance for a

successful lesson.

4. **How will the teacher know if the children have achieved the objective of the lesson?** To answer this question the teacher needs to set questions or exercised toward the ends of the class session that allow pupils to demonstrate whether or not they have learned. Both the teacher and the pupils need to know if the intended learning has been achieved. If pupils have not learned the materials, the lesson or parts of it must be re-taught, possibly using different methods and activities.

Activity 3:

- Mention and explain five specific steps in preparing good lesson

8.3 SPECIFIC STEPS IN PREPARING GOOD LESSON NOTES

1. Examine the topic in the syllabus for the subject.
2. Develop an overall scheme of work for the term which divides the syllabus into smaller units to be covered in the weekly forecast for the subject.
3. Select the topic to be taught in the lesson notes, based on the scheme of work, with reference to the syllabus, pupils' textbook and teachers' handbook.
4. Write specific instructional objectives for that lesson;
5. Find out what the pupils already know about the subject matter;
6. Select appropriate instructional method and procedures
7. Decide what teaching and learning materials to use for good delivery of the lesson.
8. Decide how to assess the puplils to find out if the objectives have been achieved.

Activity 4:

- What is scheme of learning?

8.4 THE SCHEME OF LEARNING

A scheme of learning is a plan, which ensures that the content of the syllabus provided by a certain period of time for instance a term is taught within that period. This entails breaking the topics in the syllabus into smaller units and assigning a duration of time within which each unit will be covered.

The units are arranged in such a way that those that provide pre-requisite learning are planned before subsequent ones.

Usually, the duration within which each unit should be completed is a week.

Activity 5:

- State and explain any five (5) factors influencing the preparation of scheme of

8.5 FACTORS INFLUENCING THE PREPARATION OF A SCHEME OF WORK

The teacher must consider the following factors when he is planning a scheme of work:

1. The syllabus
2. The age of the students
3. The social, physical, intellectual, emotional and moral development of the students. i.e. the students' abilities.
4. The needs of the students. These include both felt and unfelt needs.
5. The number of students in the class
6. The time available for teaching
7. The previous and/or background experience of the students, in learning science
8. To determine the effectiveness of instructional methods and materials
9. To discover individual problems and weaknesses
10. To determine how to group students for instruction in view of individual differences.
11. To determine the progress of each individual.
12. To determine the extent to which instructional goals are being achieved.

Activity 6:

- State and explain any importance of scheme of learning.

8.6 IMPORTANCE OF SCHEME OF WORK

1. It helps the teacher to know in advance the amount of work he has to do in each term, week and day.
2. It enables a substitute teacher to know where to continue in the absence of the class teacher.
3. It serves as a record of work for the periods.
4. It puts the syllabus into its natural, logical sequence.

5. It ensures that the teacher base his/her teaching on the approved curriculum or teaching syllabus but not on any other syllabus.
6. It helps the teacher to allocate appropriate time for teaching topics in a syllabus. This helps him to cover all or greater part of the syllabus.
7. It helps teacher to select teaching aids, materials, tools and equipment which will enable him to teach the selected topics effectively.

Activity 7:

- Draw the suggested scheme of learning for an academic term in a basic

8.7 SCHEME OF LEARNING FOR AN ACADEMIC TERM

The suggested format for writing the Scheme of Learning (SOL) for a given term (see excerpt in Table 2) requires listing the strands, sub strands, the content standard reference number and the associated indicators.

The template has also made provisions for indicating the resources requires to teach each week's lessons

Table 2: Template for Writing Scheme of Learning for a Given Term

Week	Strands	Sub-strands	Content indicator	Indicators	Resources
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

10.					

Activity 8: Draw the following:

i. Daily lesson plan template
ii. Weekly lesson plan template

8.8 TEMPLATE FOR PLANNING DAILY LESSON AND WEEKLY LESSON

8.8.1 Template for Planning Daily Lesson

Date: Period: Time: Class: Class Size:			Subject Strands Sub-Strands
Content Standard		Indicator:	Lesson 1 of 2
Performance indicator			Core Competencies
Keywords:			
Phase/Duration	Learner Activities		Resources
Phases 1: Starter (preparing the brain for learning. 10 minutes			
Phases 2: Main (new learning including assessment)			

40 minutes		
Phases 3: Plenary/ Reflections (learners and teacher) 10 minutes		

8.8.1 Template for Planning Weekly Lesson Plan

Learning Indicator (s) (Ref. No.)	
Performance indicators	
Week Ending	
Reference	
Teaching/Learning Materials	

DAY	Phases 1: Starter (preparing the brain for learning. 10 minutes	Phases 2: Main (new learning including assessment) 40 minutes	Phases 3: Plenary/ Reflections (learners and teacher) 10 minutes
Monday			
Tuesday			
Wednesday			

Thursday			
Friday			

Activity 9:

1. Discuss the features of daily and weekly lesson plans

8.9 FEATURES OF DAILY AND WEEKLY LESSON PLANS

8.9.1 The Three Phases of The Lesson Plan

Weekly lesson plan (referred to as lesson plan) based on this scheme of work must be prepared for the associated indicators to the content standard to be achieved. The lesson plan does not have to be lengthy. What is important is to make sure they contain the main elements of the lesson. They are meant to guide instructional activities so teachers can maximise classroom time.

Teachers must understand how to arrange the different learning activities in the indicators into a logical progression of learning for young children. To do this effectively is recommended that lessons in primary schools should comprise the following three phases of learning activities:

- **Phase 1: Starter (preparing the brain for learning)**
- **Phase 2: Main (new learning including assessment)**
- **Phase 3: Plenary/Reflection (Learner and teacher)**

The starter sets the tone. Activities which engage learners get them thinking and provide a clear focus on learning, creates a purposeful atmosphere in which the teacher is in charge and the students are ready and willing to work. As learners are learning a new game, song, rhyme and the related concepts, it may be necessary to go a little slower. However, teachers should quickly pick up the pace so that learners become faster and faster at accessing these important concepts. The goal is to maintain a lively pace and provide an energetic start to the class.

It is important to review and reinforce concepts covered in previous weeks or classes as part of the starters. For these reason, the weekly scheme of work outline short, fun games and activities teachers can do to reinforce understanding. Teachers should strive to do at least short starter activities per lesson.

The bulk of the main (new learning including assessment) phase in a lesson plan should be

devoted to having all learners:

- Explore the new beginning areas for the day
- Work in pairs or groups to carry out differentiated tasks
- Work with resources or tools to carry out differentiated tasks
- Share and discuss their result and strategies
- Develop relevant core competencies (i.e problem solving, critical thinking, communication, digital literacy, collaboration etc.)

In addition to the above, and for the purpose of assessment, in each lesson, time should be set aside for learners to work independently or collaboratively on problems. During this time, the teacher should move around, look at and check learners' work

The Plenary/Reflection phase is a fantastic opportunity to reflect on and consolidate the learning that has happened in the day's lesson. They can also be used to introduce ideas that will be visited in the next lesson forming a bridge for continuous learning. Ideally, an effective plenary.

- Usually occurs at the end of a lesson but can also be used at other points in the lesson. If appropriate.
- Brings the whole group together to participate
- Is used by the teacher (and to an extent by the learners) to check on learning so far and to identify any misconception that need to be recreated.
- Direct students to the next phase of learning.
- Help learners to understand not only what they have learned, but also how they learned it.

Note: always finish on time so that you don't miss out the plenary in your lesson plan. It should be very clear to any observer that learners have made progress in learning and can demonstrate it. Where insufficient progress has been made it should be clear what the plan of action will be used to addressed this next lesson. One of the most common criticism is that teachers don't use assessment outcomes top inform future planning. Make it clear that you can see what each and every learner and what the next steps are to secure progress.

8.9.2 Some Components of the Lesson Plan

- **Week Ending**: this refers to the date of the last day of the working week for which the notes are meant. The working week starts on Monday and ends on Friday.
- **Subject**: this refers to the particular subject(s) for which the lesson notes are prepared e.g Mathematics, Integrated Science, Ghanaian Language, Environmental Studies etc.

- **Reference**: this term refers to the various sources from which the teacher gathers information for the lesson. Such sources include but are not limited to the stipulated textbooks, Teacher handbook and syllabus. A statement of reference should include Title, Chapter, Unit or Text, Lesson and page number of books.
- **Day/Date/Duration**: It is the particular day and date of the week for which a lesson is meant. The duration is a specification of the length of time allocated to the lesson. E.g. 30 minutes, 60 minutes.
- **Teaching and Learning Materials (TLMs)**: Teaching and Learning Materials refer to the specific items that the teacher should be use during the lesson to explain concepts and information presented to the pupils. These are: concrete objects and other materials that the teacher and pupils should use in the course of the lesson to facilitate teaching and learning processes. Materials can include physical objects such as countess; charts; maps; pictures; etc. which the teacher might exhibit and refer to during the lesson
- **Strands** are the broad areas/sections of the science content to be studied
- **Sub-Strands** are the topics within each strand which the content is organized
- **Content Standards** refers to the pre-determined level of knowledge, skill and/or attitude that a learner attains by a set of education.
- **Indicator** is a clear outcome or milestone that learners have to exhibit in each year to meet the content standard expectation. The indicators represent the minimum expected standard in a year.
- **Exemplar:** support and guidance which clearly explains the expected outcomes of an indicator and suggests what teaching and learning activities could take, to support the facilitators/teachers in the delivery of the curriculum.
- **Assessment**
- **Key Words**
- **Core competencies:** Core competences describe a body of skills that teachers at all levels should seek to develop in their learners. The competences presented here describe a connected body of core skills that are acquired throughout the processes

of teaching and learning. Core competences include the following:

- Critical thinking and Problem solving (CP)
- Creativity and Innovation (CI)
- Communication and Collaboration (CC)
- Cultural Identity and Global Citizenship (CG)
- Personal Development and Leadership (PL)
- Digital Literacy (DL)

Activity 10:

- Mention and discuss any two advantages of using a lesson plan.

8.10 IMPORTANCE OF LESSON PLAN

1. It helps the teacher to present the materials systematically and in a logical order
2. It helps to direct the teacher's attention to methods of teaching
3. It helps to make the teacher more confident in front of the class
4. In the absence of the teachers from school, the lesson plan enables any other teacher to take the lesson
5. A lesson plan shows the extent of the teacher's preparedness for the lesson.

Activity 11: Prepare a Science lesson plan using your own sub-strand.

8.11 SAMPLE WEEKLY LESSON PLANS

8.11.1 LESSON PLAN 1

WEEK ENDING:	6th Week Ending 21st February, 2020
CLASS	Three (3)
SUBJECT	Integrated Science
REFERENCES	M.O.E (2019), *Science Curriculum For Primary Schools (Basic 1 –3)* Accra-Ghana, NaCCA, p.66
LEARNING INDICATOR	B3.5.1.1.1
PERFORMANCE INDICATOR:	Learners can describe ways of keeping the environment clean
STRAND	HUMANS AND THE ENVIRONMENT
SUB-STRAND	Personal Hygiene and Sanitation
TEACHING/LEARNING RESOURCES	School surrounding, cutlass, rake, hoe, broom, scrubbing brush, mop, detergent (OMO), and bucket of water.
CORE COMPETENCIES:	Critical thinking and problem solving, collaboration and communication,

DAY	PHASE 1: STARTER (10MINS) (Preparing The Brain For Learning)	PHASE 2: MAIN (40 MINUTES) (New Learning Including Assessment)	PHASE 3: PLENARY / REFLECTION (10MINS) (Learner And Teacher)
TUESDAY <u>DATE</u> 18/02/2020	- Learners sing songs and recite familiar rhymes. - Learners tell what they do to keep the home and school	- Learners go for a nature walk around the school compound to observe clean and dirty area in the environment.	What have we learnt today?

	clean.	- Learners brainstorm on the definition of sanitation. - Learners explain the need to keep the compound clean. **Assessment** (i) Learners define sanitation (ii) Learners give three (3) importance of keeping our environment clean.	Learners summarize the main points in the lesson.
WEDNESDAY DATE 19/02/2020	Learners sing songs and recite familiar rhymes.	- Learners identify the correct materials used in keeping the compound clean. Example; Broom, Hoe, Rake, Cutlass, Dust bin, and others. - Learners demonstrate ways of keeping the compound clean in groups. **Assessment** (i) Mention three (3) materials used in keeping the compound clean. (ii) State four (4) ways of keeping the compound clean.	- Review the lesson with learners. - Learners talk about what was interesting and made meaning to them in the lesson.

8.11.2 LESSON PLAN 2

WEEK ENDING:	2nd Week Ending 24th January, 2020
CLASS	CLASS: Four
SUBJECT	Integrated Science
REFERENCES	M.O.E (2019), *Science Curriculum For Primary Schools (Basic 4 – 6)* Accra-Ghana, NaCCA, p.24
LEARNING INDICATOR	B4.1.2.2.1
PERFORMANCE INDICATOR:	Learners will separate mixtures using the appropriate methods
STRAND	Diversity of matter
SUB-STRAND	Materials: Mixtures

TEACHING/LEARNING RESOURCES	Empty bottles, gari, salt, sand, nails, magnet, powdered chalk, water, maize with chaff, improvised funnel and beaker, tomato tin, coal pot and stirrer.		
CORE COMPETENCIES:	Creativity and Innovation, Communication and Collaboration, Personal development and Leadership, Critical Thinking and Problem Solving		
DAYS	PHASE 1: STARTER (10MINS) (Preparing The Brain For Learning)	PHASE 2: MAIN (40 MINUTES) (New Learning Including Assessment)	PHASE 3: REFLECTIONS 10MINS (Learners And Teacher)
THURSDAY 23/01/2020	Brainstorm learners on the activities they do in the house which involve the mixing of two or more things.	- Learners discuss the meaning of mixture. - In group of five learners prepare different types of mixture with the aid of a work sheet. - Learners discuss their observations and identify other types of mixtures.	Ask learners what they have learnt today.
FRIDAY 24/01/2020	Learners recite a rhyme to begin the lesson. "Gari, esikyire, nkatse……"	- Learners identify types of mixtures given - Learners discuss how the mixtures given could be separated. - Learners separate mixtures using the	Learners summarize the important points of the lesson.

		appropriate method. - Learners mention some uses of mixtures. **Assessment:** Learners define mixtures; identify the types of mixtures and separate mixtures using appropriate methods.	

8.11.3 LESSON PLAN 3

WEEK ENDING:	6th Week Ending 21st February, 2020
CLASS	Six (6)
SUBJECT	Integrated Science
REFERENCES	M.O.E (2019), *Science Curriculum For Primary Schools (Basic 4 – 6)* Accra-Ghana, NaCCA, p.64
LEARNING INDICATOR	B6. 5.1.1.1
PERFORMANCE INDICATOR:	Learners will prevent odour
STRAND	Humans and the Environment
SUB-STRAND	Personal Hygiene and Sanitation

TEACHING/LEARNING RESOURCES	Deodorants, Lime, Detol, Soap, Manila Card.		
CORE COMPETENCIES:	Critical thinking and Problem Solving skills, Collaboration and Communication, Personal Development and leadership, Digital Literacy		
DAYS	PHASE 1: STARTER (10MINS) (Preparing The Brain For Learning)	PHASE 2: MAIN (40 MINUTES) (New Learning Including Assessment)	PHASE 3: REFLECTIONS 10MINS (Learner And Teacher)
MONDAY 17/02/2020	Engage learners to recite familiar poems and sing songs.	- Learners in groups discuss the meaning of body odour and identify some parts of the body that can cause body odour. **ASSESSMENT** • Define body odour • Mention two parts of the body that causes body odour.	What have you learnt today? Ask learners to summarize the main points in the lesson.
WEDNESDAY 19/02/2020	Engage learners to sing songs and recite familiar poems and rhymes.	- Learners in groups brainstorm the causes of body odour - Learners discuss the effects of body odour and write their answers on a paper and present it to the class. -	What have you learnt today? Ask learners to summarize the main points in the lesson.

		ASSESSMENT • Mention two causes and one effect of body odour	
THURSDAY 20/02/2020	Engage learners to sing songs and recite familiar poems	- Learners in groups mention some items used to remove body odour. - Learners discuss how to prevent body odour. - Learners demonstrate the correct use of the items to remove body odour. **ASSESSMENT** • Explain how you prevent body odour	What have you learnt today? Ask learners to summarize the main points in the lesson.

UNIT 8: SUMMARY

This unit discusses the following sub-topics:

8.1 Meaning of Lesson Plan / Lesson Notes Or Expanded Scheme Of Work

8.2 General Considerations in Preparing Lesson Notes/Plans

8.3 Specific Steps in Preparing Good Lesson Notes

8.4 The Scheme of Learning

8.5 Factors Influencing the Preparation of a Scheme of Work

8.6 Importance of Scheme of Work

8.7 Scheme of Learning for an Academic Term

8.8 Template for Planning Daily Lesson and Weekly Lesson

8.9 Features of Daily and Weekly Lesson Plans

8.10 Importance of Lesson Plan

8.11 Sample Weekly Lesson Plans