DIPLOMA IN EDUCATION LEADERSHIP AND MANAGEMENT
MODULE 7:LEADERSHIP IN SCIENCE, TECHOLOGY AND INNOVATION

UNIT 4:
INSTRUCTIONAL APPROACHES THAT PROMOTE SCIENCE, TECHNOLOGY AND INNOVATION

Introduction

- As you might be aware, different instructional approaches can translate into preferred methods of instruction. An instructional method can be defined as the process by which instruction occurs, whether it is a lecture, class discussion, small group discussion, simulation, inquiry-based learning, or individual project.
- In this unit, we shall deal only with instructional approaches that involve the learners and engage their critical thinking faculties as well as improve their skills and attitudes towards science, technology and innovation.
- The terminologies used vary markedly but sometimes overlap in practice; hence terminologies like active learning and experiential or participatory approaches are used within the same context.
- It could also involve the use of a multiplicity of sensory perceptions by the learner thus provoking stimulus variation. More critically, the learning approaches should stimulate curiosity that leads to problem-solving.



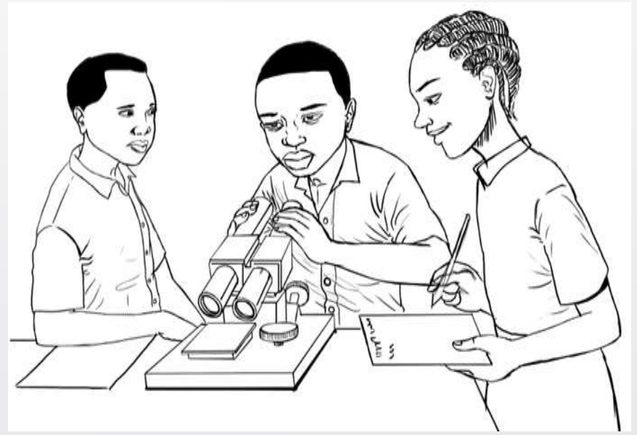
Upon completion of this unit, you will be able to:

i) Enhance knowledge and skills in instructional approaches that promote science, technology and innovation.

ii) Demonstrate understanding of instructional approaches in STEM education.

Approaches that enhance the development of scientific and technological

a) Active Learning



- Active learning refers to a process whereby learners are continuously engaged in the learning process. The learners, therefore, participate in a wide variety of activities which help them in doing things and thinking about what they are doing. This encourages critical and higher thinking skills which are critical for investigation and problem solving.

The rationale for Active Learning

- The need to practice active learning in our institutions is based on the fact that learners learn best through doing. As the Chinese saying goes:
- *I hear and I forget,*
- *I see and I remember*
- *I do and I learn*
- Based on this Chinese saying and other research on active learning, it is possible to conclude that the more senses that are used in acquiring knowledge, the deeper the impression that is made on the mind, and the surer we are that the knowledge will be retained (Jacinta & Regina 1981)

Benefits of Active Learning

1. **Enhances retention:**

Active learning helps in the retention of what has been learned. This is because it allows the learner to interact with the teacher, and peers, as well as teaching and learning resources.

- ***Creates interest*:** Learning by doing stimulates interest in what is being learned. Learners are allowed to ask questions for clarification. They are also encouraged to manipulate and use various teaching and learning resources. In this way, learning becomes a real and enjoyable process.

2. **Promotes good teacher-learner relationship:**

Active learning involves a lot of interaction between the learners and the teacher. This happens as teachers give instructions on what needs to be done, distribute teaching and learning materials, answer questions, intervene in learners' areas of weakness as well as reward correct responses from learners.

This helps to enhance a good relationship between the teacher and the learners. This good relationship helps learners seek more help and guidance freely from their teachers, while teachers also feel happy to assist the learners.

3. **Application of new skills:**

Earning by doing helps learners to apply skills, during learning activities. For example, problem-solving skills can be applied to solve similar or related problems using the same approach.

4. **Enhances creativity and imagination:**

Active learning enables learners, to interact with the learning environment. This gives rise to insightful learning where the learner finally says 'Aha' this is how it works. To reach such a conclusion, the learner would have to be creative and imaginative

b) Discussion Method

- Discussion is a method that involves a teacher posing a problem, and initiating interaction.
- The students are allowed to discuss among themselves with a view to arriving at possible solutions to the problem.
- Discussions should be well planned and allow for a free exchange of ideas, facts and opinions.
- In the process of discussing, aspects of a certain subject and ideas are gathered and clarified. Sometimes, conclusions that are acceptable to all members are reached.

c) Discovery Method or Inquiry-Based Learning

- The Discovery method is a process through which learners are presented with a proposition or a hypothesis. They then proceed to perform experiments by collecting data related to the proposition, testing it and finally drawing conclusions based on their findings. After this, they can either agree or disagree with what was stated in the proposition. The approach allows learners to find out answers to problems by themselves.
- When students use the inquiry approach, they utilize processes that allow them to demonstrate the mental and physical behaviours of scientists. In the process, they learn more than discreet science concepts and skills. They learn a practical, useful approach to solving problems and answering questions. The inquiry process involves the following steps.
  - ❑ Observe a process or event.
  - ❑ Formulate questions based on observations.
  - ❑ Develop a workable hypothesis.
  - ❑ Devise a strategy for testing it.
  - ❑ Analyze and draw conclusions from collected data.
  - ❑ Communicate findings to others.

Identifying Inquiry-Based Activities in Your Classroom

Inquiry-based instruction involves creating situations in which students take the role of scientists. These types of learning situations typically occur along a continuum.

As you read the following descriptions, think about where your classroom activities fall along the continuum. Can you identify ways to increase the level of inquiry for your students?

Structured Inquiry		***Guided Inquiry***		***Student-Initiated Inquiry***
Students follow precise teacher instructions to complete a hands-on activity.	⟷	Students develop the procedure to investigate a teacher-selected question.	⟷	Students generate questions about a teacher-selected topic and design their own investigations.

Incorporating the Inquiry Approach into Instruction

Inquiry-based instruction requires a unique approach. As with all classroom activities, however, the use of sound instructional techniques is critical to maximizing student learning. Consider the following strategies when implementing the inquiry approach with your students.

i. Help students become aware of each phase of the process. All scientific study involves a design phase, an investigation phase, and a period devoted to constructing meaning from the data that has been collected.

ii. Be aware of and correctly interpret student behaviours and comments. The inquiry approach can be frustrating for some students, particularly for those who are most comfortable following teacher directions without question. Most students will occasionally need a nudge or hint to point them in a productive direction.

iii. Establish, enforce, and model high standards for work, communication, and behaviour. Giving control of the investigative process to students does not mean losing control of the classroom. Students must follow the management and safety expectations you establish. You must provide instruction about and also model effective use of time, collaboration with peers, and the safe and proper use of equipment.

iv. Help students learn to collaborate to solve problems. Working with and learning from others are integral parts of the scientific process. Students must work effectively with a group for inquiry-based instruction to be a success. Make your expectations for group work clear, and provide ongoing feedback based on your observations of student interactions.

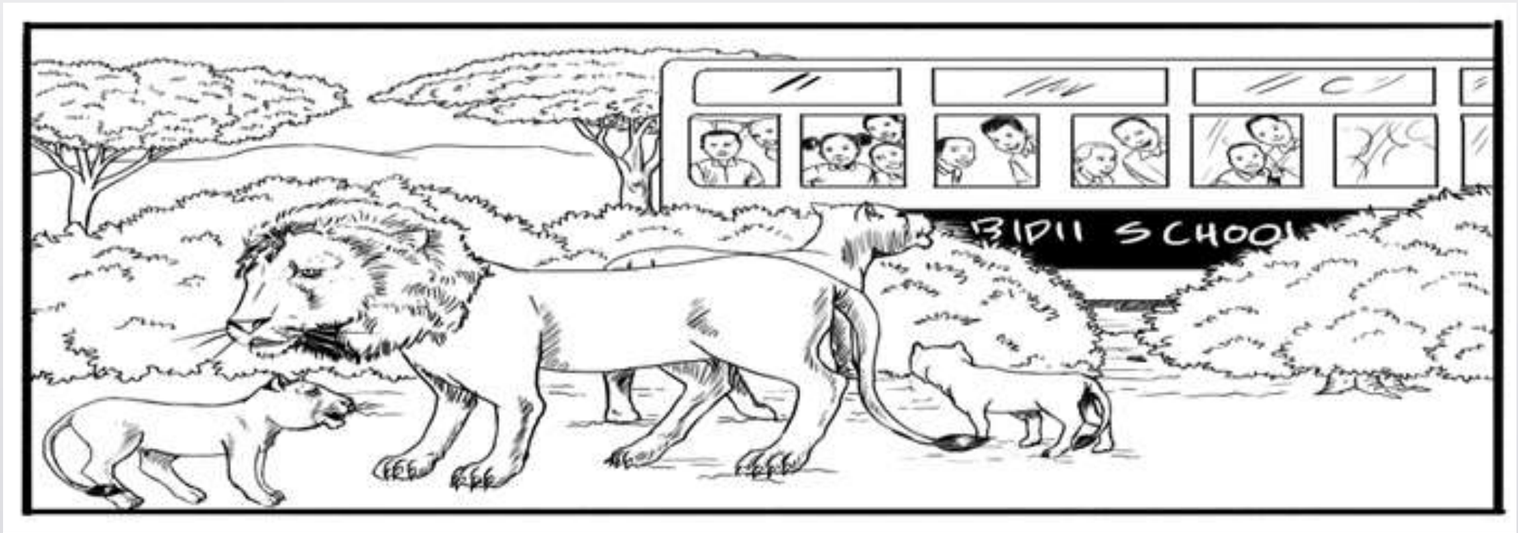
v. Monitor your instructions and minimize the responses. Because most students are familiar with traditional instructional models, they are accustomed to asking a question and being told an answer. Inquiry-based instruction requires a different approach. If you give too many hints, provide too many answers, or ask too many leading questions during an inquiry exercise, student interest is stifled

d) Demonstration Method

- You might have come up with the idea that demonstration involves teachers performing instructional activities as learners observe.
- Learners are, therefore, given an opportunity to see the practical display of various activities conducted by the teacher.
- At the same time, they are given a chance to ask questions and seek clarifications accordingly. Demonstrations are particularly useful when we want to illustrate new skills.
- It can also be used when illustrating ideas, principles and concepts. In Science, for example, the teacher may decide to display "how to fix a light bulb'' as a new skill.
- Learners observe as the teacher demonstrates and are required to do the same later. When learners repeat what has been illustrated, it can lead to mastery of the skill taught.
- He/she would then instruct the learners to follow the same procedure in order to perfect the skill. It is also important to use other learners in the demonstration so that their colleagues can do what they have displayed.
- Applying demonstration method is advantageous because it saves time, arouses interest and curiosity, involves learners, enhances retention, clarifies ideas and addresses individual needs of learners.

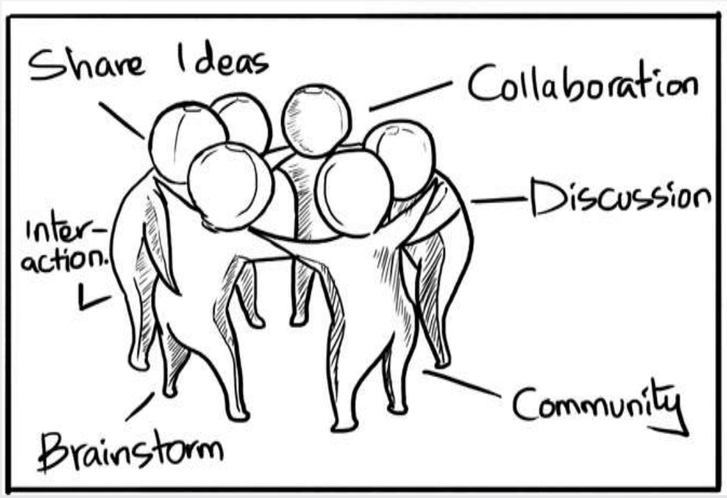
e) Educational Visits

The educational visit is a method through which we usually explore and gather information from the field. It refers to the learning that takes place outside the classroom and often outside the institution this is because we may want learners to have a clear connection between what happens in the classroom and the real-life situation; seeing theory being put into practice. For instance, we may want them to visit places of educational interest outside the classroom such as factories, National Museum, National Parks, game reserves, airports, hydro-electric generation sites, etc. These are the places where scientific principles and innovations are put into actual practice.



f) Collaborative Learning

- Collaborative learning is an umbrella term for a variety of approaches in education that involve a joint intellectual effort by learners and teachers. It refers to the methodologies and environment in which learners engage in a common task in which each individual depends on and is accountable to each other.
- Collaborative learning is a method of teaching and learning in which learners team together to explore a significant question or create a meaningful project. A group of learners discussing a lecture or learners from different schools working together over the internet on a shared assignment are both examples of collaborative learning. Various names have been given to this form of teaching, and there are some distinctions among these: Cooperative learning, collaborative learning, collective learning, team learning, learning communities, peer teaching, peer learning, reciprocal learning, study circles, and study groups and work groups.



- Learners learn best when they are actively involved in the process. Researchers report that, regardless of the subject matter, learners working in small groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats

g) Role-Play

- Role-play involves learners assuming roles of real people in real-life situations. Learners act scenes to illustrate activities involving such issues as trade. Some can role-play being shopkeepers while others act as customers who come to buy. This enables them to understand issues done with the money. Role-play can also be used in teaching stories and poems. Learners can take various parts of a story to learn the concept and steps in narration. Science topics are good sources of role-play activities. Role play engages the imagination and creativity of young learners.



Cont.

- The steps in planning and implementing a role-play activity include:
- Develop objectives you intend to accomplish at the end of the activity.
- Ensure that learners are assigned their specific roles in advance to allow adequate time to rehearse.
- Discuss the performance and let learners repeat where they did not do well.
- Make a summary of the main points covered in the role play.

Role play is suitable because of the approach:

- Helps to clarify new and unfamiliar concepts
- Enhances collaborative learning
- What is learned is easily retained
- Stimulates interest and curiosity among the learners
- Enhances creativity among learners

h) Projects

- The project method entails learners studying real-life situations.
- This method is based on studies by John Dewey who stressed the importance of learners drawing from their real-life experiences in their local environment.
- Dewey was of the view that meaningful learning must be linked to the activities of life.
- In farming, for example, learners can link with the nearby communities where they can visit them to study how they grow their crops or rear livestock.
- Resource persons from the surrounding community can be interviewed for further information while learners could also be observing the activities being carried out by the community.
- The project method enables learners to build upon what they have learned in school.
- As such, it is important to come up with a project which is relevant to the work being done during the school term.
- Topics such as transport, animals, plants, water, numbers, and shapes can be taught through projects and linked across various subjects.

Conclusion

- In this unit we have looked at various instructional approaches, which can promote STEM education, in used effectively.
- Teachers have to purposefully utilize these learning approaches as a way of encouraging the learners to be inquisitive, problem solvers, critical thinkers and creative and innovative .
- Such deliberate efforts by the teacher will ensure learners start appreciating STEM education and how it promotes learner centeredness.