

Training on Teachers Enhanced
Skills on the Construction and use
of Improvised Materials for
Practical Science Subject Teaching
(Biology) 06th – 10th NOVEMBER 2017;
FACULTY OF SCIENCE, UNIVERSITY OF
LAGOS

- Welcome
- Introduction of facilitator- Dr. O.M Buraimoh
- Introduction of participants

Building Rapport with Trainees

- Relaxed learning environment:
 - Making mistakes is OK
 - Participation and asking of questions is allowed
 - Disagreement and debate is allowed
- Explanation of goals for the session—with their input—and stress the benefits.
- Logistics:
 - Schedule
 - Duration of sessions and breaks
 - Arrangements for refreshments and lunches
 - Where are the washrooms

- Definition of Education: Process of knowledge acquisition
- Education
 - – Broad sense
 - - Strict sense e.g. through school
 - -Teaching
 - -Learning
 - -Discipline

- Essentially, individual is being educated to:
 - Have the right kind of values and behaviors
 - Acquire skills
 - Be versatile (Broad outlook)
 - Be literate (Read and write)
 - Be able to handle numbers, do some calculations
 - Be sociable and peaceful co- existence
 - Respect the Law
 - Recognize dignity of labour
 - Be dynamic, innovative, not conservative

- For education to be balanced, the three (3) domain of education must be attained:

1. Cognitive domain

2. The effective domain

3. Psychomotor domain

- All three can only be achieved through an effective teacher (**Also – curriculum, facilities**)

- **Questionnaire**

1. Have you ever used improvised materials to teach biology subject?
2. Topics? What material did you use? – Describe it!
3. Do you avoid topics that require the use of improvised materials?
4. Are you anxious to teach topics that requires improvised materials?
5. Do you have standardized materials in your school? Mention them if yes
6. Are you still conversant with the standardized materials?
7. As a biology teacher , the use of improvised materials make my job interesting- yes/No
8. It is cumbersome, tedious and time consuming- Yes/No?
9. Does the school head complains of no money each time you need to improvise?
10. Can the use of improvised materials lead to the ignorance of the standard ones?
11. Does it take much time, money, energy?
12. Does it make students lazy?
13. Were the students interested?, How many students in your class?

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- **Exercise Brainstorming**
- What is the meaning of effective science teaching?
- What are the advantages of effective science teaching?
- What does it mean to improvise material?
- Write on a sheet of paper what comes into your mind and **submit**

- **How can you be effective as a teacher?**
 - Sufficient use of improvised materials (take and chalk method should be reduced)
 - **To improvise- to originate a new tool, instrument or device or modifying an existing one for the purpose of teaching and learning**
 - It Is an essential part of laboratory management purposely for maximizing the use of available resources/ simulating when not available.
 - Teaching aids and instructional materials

- Substitution of instructional materials
 1. Bunsen burner ---- Kerosine stove
 2. Plant press----Old newspaper filled with heavy support e.g. wood or heavy metals to provide pressure
 3. Reagent bottles-----Clear colourless bottles filled with cork
 4. Fixed slides of plant cell--- Students can prepare their own

- **Simulation**- Photosynthesis experiment using bottles, plant and lime water
 - Construction of items, apparatus, equipment for reason of cost e.g.
 - -Incubator
 - -Water bath
 - - Shaker
 - -Skeleton

- **Needs or reasons for improvising**
 - Total absence of lab equipment
 - Cost of purchasing/importation- leading to short supply
 - Inadequate funding by government
 - Inflation
 - Poor maintenance culture
 - Attitude of teachers and school heads

- **What to consider before improvising**

1. What is to be taught
2. Objectives of the lesson
3. What background knowledge do students have on the subject matter
4. How durable is the improvised material
5. Cost

- The degree of sophistication of the improvised material will be determined by what it is to be taught and the objectives of the lesson

- **Influence of improvisation in teaching and learning biology**

1. Provides a cognitive bridge between abstract and reality to the students
2. Present next to real situation to students
3. Save cost

- **Attributes of improvising**

1. Appropriateness of teaching aids to the age group of the learners
2. Clarity and simplicity
3. Relevance to lesson
4. Should be interesting to learners
5. Durable

- Influence of teacher very important

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- **Advantages of Improvising**

- Improvised materials- cheap, easily available and faster methods
- Senses are stimulated faster (and **retained longer practically**)
- Collection of teaching materials involves the students, hence rewarding, interesting and stimulating.
- Pictures and images are impressed in the heart of students
- Can lead to discovery of new knowledge
- Contribute to community relationship
- Talents in the students are discovered

- **Disadvantages of improvisation**

- Lack of adequate training
- Demands - adventure, creativity, curiosity and perseverance by teachers
- Lack of funds
- Exposure to accident/ hazards eg. Ebola, Lassa fever

• **OTHER TEACHING RESOURCES**

- 1. Use of online learning management system** where customizable teaching- learning and assessment digital tools are in one place
e.g. Department of biology, University of Utah uses canvas online management system, DLI

- 2. Active learning tools-** Teaching method that engages students in activities such as reflection, divisions, problem solving, data analysis- to promote high order of thinking e.g. to assess if students have retained knowledge from previous lessons or lessons just delivered (about 2-5 mins).
 - Can be used for attendance
 - To give credit

Class-scribe – Involving students in consistent self assessment- class “scribe job”- a student spends 1 to 3 min for recapping of last activities-
on rotation basis

- For credit
- For warm up
 - e.g. what will you like to add to....topic?
 - What is your opinion of---- subject?
 - How does.....and.....relate to today's lesson?

Paired activities

a. Active listening - students pay attention to their peers

- It keeps students on their toes
- Makes them attentive

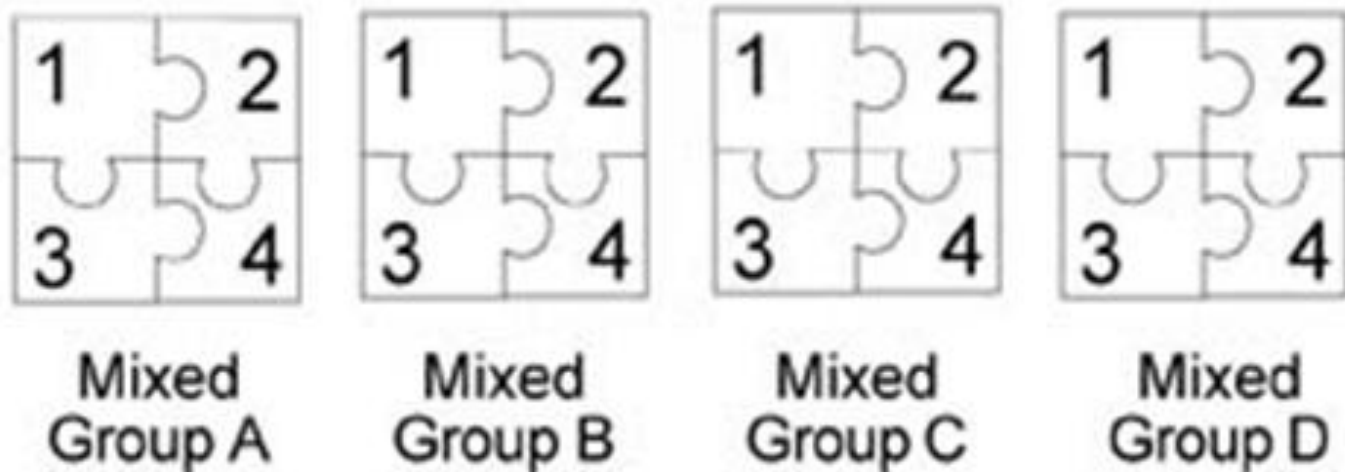
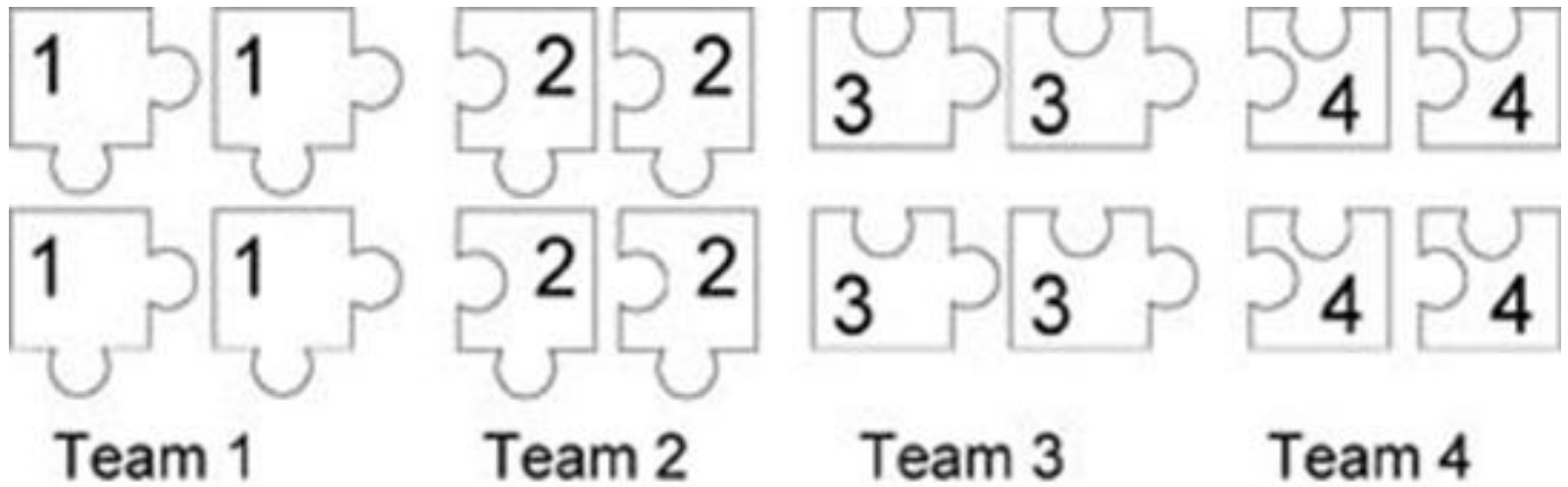
a. Think - pair – share – Decide on an open ended topic/question that applies to your learning objectives- let them think or write for a couple of minutes, pair them then they should discuss

- Then you follow up

Group activities

a. Use of jigsaw

- It involves moving around
- It involves interaction with pairs



Jigsaw Image source: [Tweskbury, Barbara, "The Jigsaw Technique."](#)

- **Collaborative Quiz**

- Quizzes are a fairly old-fashioned way to assess students, but there are ways to make them more entertaining.

- You can have students work in groups or individually.

- Start by coming up with True/False or Yes/No type questions for your class.

- A group quiz allows you to immediately gauge the class' knowledge.

- Use this activity to see if you've accomplished key objectives.

- **Visualization**
- **Concept Mapping**
- By having students create a *concept map*, instructors can encourage them to process information on a deeper level. Start with a core idea e.g.
- It is synonymous to a gate keeper, guardian /border guard
- It is only 6 to 8 nanometer thick
- Visible only through an electron microscope
- What is it?

- **Lists (Pro/Con)**
- Students compose a list and then discuss it with their peers
- Encouraging students to discuss with their peers challenges them to defend their ideas.

1. Extension: Elaborate on a previous point.

1. How does _____ relate to what we studied earlier?
2. How is this topic similar and different to what we studied earlier?

2. Hypothetical: Consider alternative or speculative ideas.

1. If _____ had happened instead of _____, what would the outcome be?
2. How would _____ change if _____ occurred?

3. Priority: Decide what is most important.

1. What is the most important cause of _____?
2. What should we do first?

4. Summary: Synthesize discussions, lessons, and ideas.

5.

1. What are the key points that we have discussed?
2. What themes are starting to emerge?

• Questions to Ask Yourself when Planning Classroom Discussions

1. What are my learning objectives for the class discussion?

- Before determining your discussion questions, determine your learning objectives. (plan your discussion questions in order to strategically emphasize specific levels of learning as defined by your learning objectives).

2. What types of questions will I ask?

- Learning objectives can lead you to the best types of questions to ask your students. E.g., if your learning objectives for the class is about remembering content, exploratory questions may be appropriate. But, if your learning objectives involve analysis, cause-and-effect questions may be more appropriate.

3. How many discussion questions should I plan in advance?

- Plan more questions than you anticipate you will need.

4. What order should I pose the discussion questions?

- Initial questions should encourage students to participate.
- You may choose to organize questions from simple to complex, easy to difficult, or conceptually.
- The key to successful discussions is to make students feel comfortable and confident, which improves the likelihood of participation.

5. How will I structure the discussion?

Consider the following:

- The goals of your discussion,
- the sizes of your groups,
- how you will call on students,
- the arrangement of your classroom.
- Your structure, expectations, and participation rules can influence the success of your discussion.
- For example, you may structure a brainstorming discussion with students sitting in a circle and each student sequentially shares an idea. You may design a debate with teams of students facing each other to represent two sides of an issue.

6. How focused are my discussion questions?

- Questions should not be too broad because it can lead to vague answers and discussions that stray away from main objectives. Questions should be focus to keep discussions on topic.

7. How will I capture the essence of the discussion?

- It is important to determine how you will capture the lessons that were learned through the discussion. You could have 1-2 students take notes, synthesize ideas, and share them with the class in written or verbal form.

- **Using clickers** (Engaging students in the classroom using audience response Systems)
- Clickers or audience response systems can be used to promote active learning in the classroom by facilitating rapid collection of answers or feedback from every students

- Clicker questions can be used for the following purposes – below are just a few ideas for use:
 - - Quiz on the reading assigned in preparation for class
 - - Test recall of previous lecture points
 - - To reveal pre-existing thinking or to correct misconceptions
 - - Test conceptual understanding
 - - Apply ideas in new context
 - - Predict results of lecture demo, experiment, or simulation

- **Learn Before Lecture: Making More Time for Active Learning in Class**

- Using before-class short assignments and online quizzes (due before class) to actively increase student learning
- A useful strategy for any topic where students need factual knowledge to discuss a set of ideas or concepts.
- Learning the basic knowledge before lecture creates time in class for guided application or problem-solving using this knowledge.

• **Use of Physical Models to Illustrate Biological Processes**

- The flipped classroom is a teaching model in which students study traditional lecture material outside of class and instructors use class time to guide activities traditionally assigned as homework. Flipping the classroom allows instructors to repurpose class time or student questions about lecture content, hands-on application of knowledge, and interaction with classmates around course material.

- **Animation Sites**

- **[BioVisions](#)**, by Harvard University
- **Biological Animations**, by John Giannini, St. Olaf College, MN – Short animations of biological processes ([View Website](#))
- **Biology Animation**, from Carnegie Mellon University – Carnegie Mellon's Office of Technology for Education and Department of Biological Sciences create multimedia materials for teaching and learning Biology. ([View Website](#))
- **Biology Videos**, , from UT Southwestern STARS program, funded by HHMI. Videos on cell membranes, evolution, photosynthesis, and genetic diseases (in progress) are available. Ten to 15 chapters on each subject can be watched and downloaded for the classroom. ([View Website](#))
- **Biology Animation Library**, from Dolan DNA Learning Center – A collection of biology animations. ([View Website](#))
- **CELLS alive!** – Represents 30 years of capturing film and computer-enhanced images of living cells and organisms for education and medical research. ([View Website](#))
- **Cell Biology Animations**, by John Kyrk – A collection of cell biology animations ([View Website](#))
- **Maxanimation** – Animations in physiology, biochemistry, genetics, immunology, microbiology ([View Website](#))

- **Image and Video Galleries**
- **BioMEDIA ASSOCIATES** BioMEDIA ASSOCIATES is a group of biologists, teachers, educational designers and film-makers who collaborate to make learning programs for biology.
- **The Cell: An Image Library™** – A freely accessible, easy-to-search, public repository of reviewed and annotated images, videos, and animations of cells from a variety of organisms, showcasing cell architecture, intracellular functionalities, and both normal and abnormal processes. The purpose of this database is to advance research, education, and training, with the ultimate goal of improving human health. ([View Website](#))
- **Biology Videos** – A collection of biology videos from Davidson College ([View Website](#))
- **BioMEDIA ASSOCIATES** – A group of biologists, teachers, educational designers and film-makers who collaborate to make learning programs for biology. ([View Website](#))
- **Free Science Videos and Lectures** – A Collection of free science videos and lectures ([View Website](#))
- **Cellular Imaging Facility Core**, by the University of Arizona – An on-line collection of images

. **Teaching Tools**

- . **Bioliteracy Project** – Aiming to develop and distribute tools to assess whether students are learning what teachers think they are teaching. ([View Website](#))
- . **The Biology Project** – An online interactive resource for learning biology, by The University of Arizona. ([View Website](#))
- . **BioScience Educational Network** – Provides access to education resources from BEN Collaborators and is managed by the American Association for the Advancement of Science (AAAS). ([View Website](#))

- **AP Biology I: National Repository of Online Courses** – This curriculum covers all of the material outlined by the College Board as necessary to prepare students to pass the AP* Biology exam. ([View Website](#))
- **AP Biology II: National Repository of Online Courses** – This curriculum covers all of the material outlined by the College Board as necessary to prepare students to pass the AP* Biology exam. ([View Website](#))
- **Biology Binder** – This site includes notes / study guides, interactive quizzes, online activities, printable labs / worksheets, and numerous science links relating to all biology topics. ([View Website](#))
- **CellServ** – Innovative, inexpensive self-contained kits for unique hands-on laboratory experiences and instruction in biology, genetics, cancer, and biotechnology, from Foundation for Advanced Education in the Sciences, Inc., NIH ([View Website](#))
- **Gallant's Biology Stuff** – 11th, 12th and AP Biology course outlines, lab materials and graphics from Trevor Gallant, Kennebecasis Valley HS, New Brunswick, Canada ([View Website](#))

EVIDENCE-BASED TEACHING

- Validated Tools

e.g. Practical Observation Rubric To Assess Active Learning, (PORTAAL) that documents the extent to which instructors incorporate these practices into their classrooms.

- THANK YOU FOR YOUR TIME