

“DALDIS – Writing Questions for Formative Assessment”

Training Workshop

Presentation Objectives

To provide an information guide for writing effective test questions in the context of formative assessment

To establish a common quality of testing encompassing:

- ❖ Formative Assessment
- ❖ Bloom's Taxonomy
- ❖ Building question sets using Bloom's Taxonomy
- ❖ Learning outcomes using backward design
- ❖ Feedback
- ❖ Selection of question types(Advantages and Disadvantages)
- ❖ General tips and techniques

Formative Assessment - What is it?

Definition:

“ Any interaction that generates data on student learning and is used to inform teaching and learning (Lane et al., 2019)

“A midstream tool to identify specific student misconceptions and mistakes while the material is being taught” (Kahl, 2005)

Discovering what students know or don't know for the purpose of enhancing teachers practices and further planning of instruction.

Technology Assisted Assessment

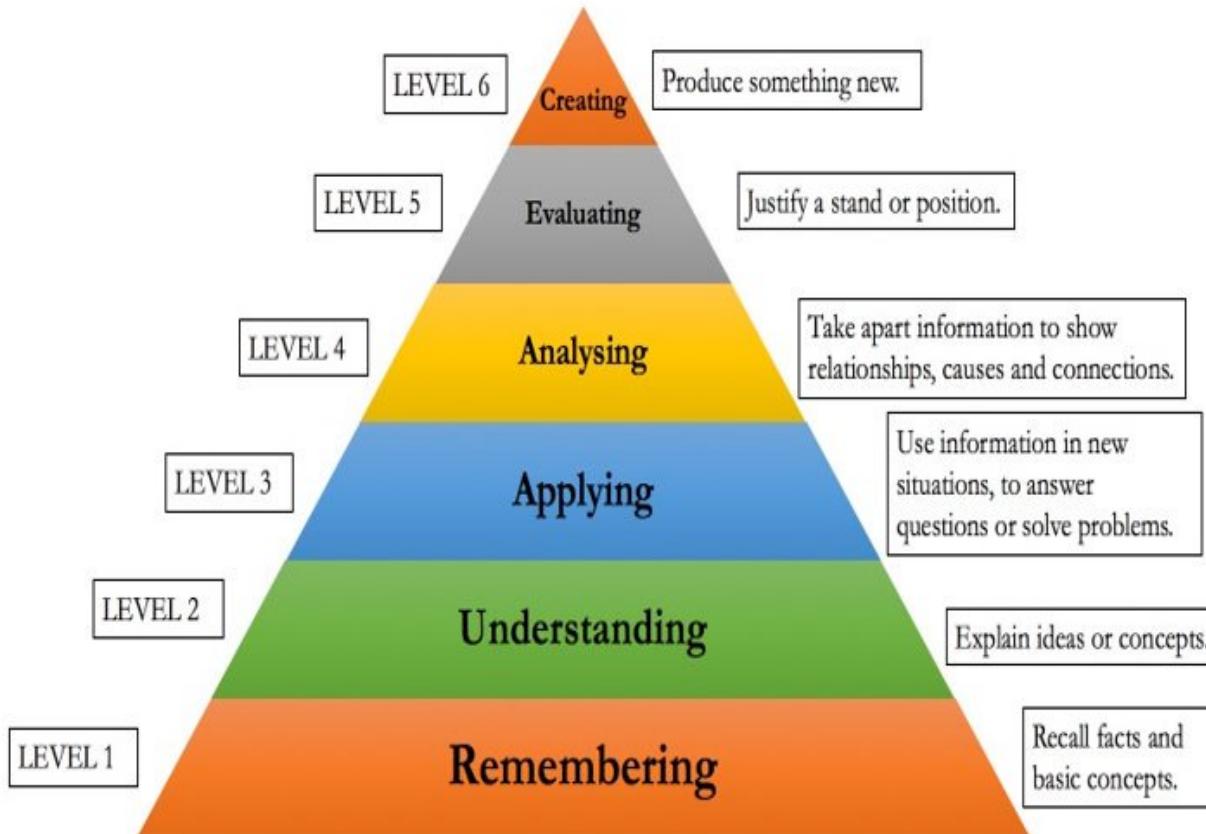
- ❖ Immediate data about students' understanding of a topic
- ❖ Repeatability
- ❖ Immediacy of response to the student
- ❖ Supports individualized learning
- ❖ No subjectivity in marking
- ❖ Timeliness - potential for assessments to be used at the most appropriate time
- ❖ Flexibility of access
- ❖ Encourages student interest and motivation
- ❖ Transforms the classroom from teacher-centred to student-centred

How we apply Bloom's Taxonomy when creating our question sets

- ❖ Carefully choose the action verb for use in the question

01	02	03	04	05	06
KNOWLEDGE: Define, Identify, Describe, Recognize, Tell, Explain, Recite, Memorize, Illustrate, Quote	UNDERSTAND: Summarize, Interpret, Classify, Compare, Contrast, Infer, Relate, Extract, Paraphrase, Cite	APPLY: Solve, Change, Relate, Complete, Use, Sketch, Teach, Articulate, Discover, Transfer	ANALYZE: Contrast, Connect, Relate, Devise, Correlate, Illustrate, Distill, Conclude, Categorize, Take Apart	EVALUATE: Criticize, Reframe, Judge, Defend, Appraise, Value, Prioritize, Plan, Grade, Reframe	CREATE: Design, Modify, Role-Play, Develop, Rewrite, Pivot, Modify, Collaborate, Invent, Write

- ❖ consider the level of learning we wish to be working within
- ❖ try to ensure questions include a range across the 6 levels



Remembering:

Which of these lists includes only foods which are a good source of **protein**?

Milk, eggs, bread and pasta

Poultry, fish, potatoes and pasta

Poultry, fish, nuts and eggs

Bread, pasta, rice and potatoes

The Functions of the Food Groups

Protein Functions: Growth and repair of cells

Fat Functions: Stores energy and provides insulation

Carbohydrate Functions: Provides energy

Vitamins Functions: Keep the body's systems working

Minerals Functions: Help the body to stay healthy

Understanding:

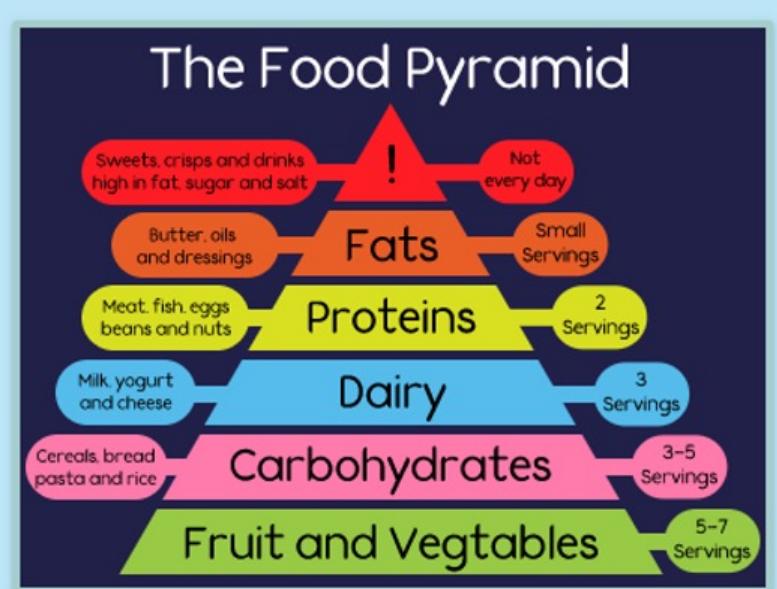
Which of the following items is **NOT** recommended for a balanced diet?

At least five portions of fruit and vegetables daily.

Plenty of water, approximately two litres a day.

Five portions of sugary food or drinks daily.

Foods that are low in saturated fats, sugar and salt.



Applying:

The student collected the following data for the boiling point of the solutions made when various masses of salt were dissolved in 60 cm³ of water.

Mass of salt (g)	Boiling point (°C)					Average boiling point (°C)
0	100	101	100	100	102	100.6
2	101	104	101	100	103	101.8
4	103	105	104	106	107	
6	106	108	107	107	108	107.2
8	108	110	109	111	110	109.6

- (e) Calculate the average boiling point when 4 g of salt was dissolved in 60 cm³ of water.

Calculation

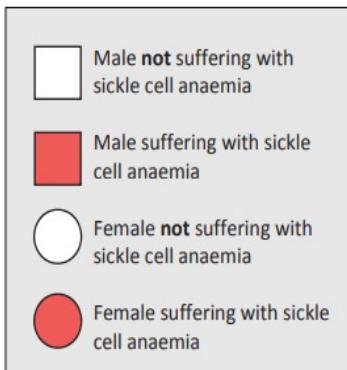
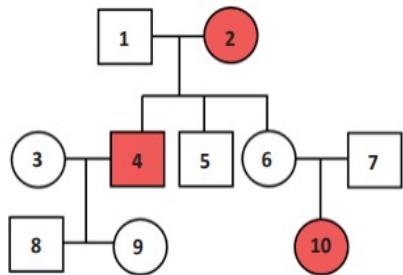
- (f) Suggest a reason why the student repeated the investigation five times for each mass of salt used.

Analysing:

Question 5

Sickle cell anaemia is an inherited human disease. It causes the body to produce red blood cells that have an irregular shape. The gene for the disease is passed on from generation to generation.

Examine the pattern of inheritance for sickle cell anaemia shown in the family tree below and answer the questions that follow.



- (a) Square 1 and circle 2 are a married couple. How many children did this couple have?

- (b) Some non-sufferers may be carriers of the disease. This means that they have inherited the sickle cell gene, but they don't suffer from the disease. What evidence is there from the diagram that persons 6 and 7 are both carriers?

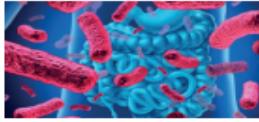
- (c) Suffering from sickle cell anaemia is an example of a genetically controlled characteristic. Classify the characteristics below as being either genetically controlled or **not** genetically controlled by placing a tick (✓) in the correct column in each case.

Characteristic	Genetically controlled	Not genetically controlled
Eye colour		
How to cycle a bike		

Evaluating:

UCC Study: High fibre foods ease stress effects

Interest has been growing in recent years in the link between gut bacteria and stress-related disorders. Researchers at University College Cork (UCC) have shown that micro-organisms in the gut (intestines) are really important for our brain health.



Bacteria in the gut produce fatty acids which are a source of nutrition for cells in this part of the body. Foods such as grains and vegetables contain high levels of fibre and will stimulate gut bacteria to produce these fatty acids.

The UCC study involved feeding mice the fatty acids normally produced by gut bacteria and then subjecting them to stress. Using behavioural tests, the mice were assessed for anxiety and depressive-like behaviour. The researchers found that there was a decreased level of this type of behaviour when fatty acids were consumed. These results provide new insights into mechanisms related to the impact of the gut bacteria on our brains and behaviour.

The Irish Examiner

- (a)** Name a type of food that is high in fibre.

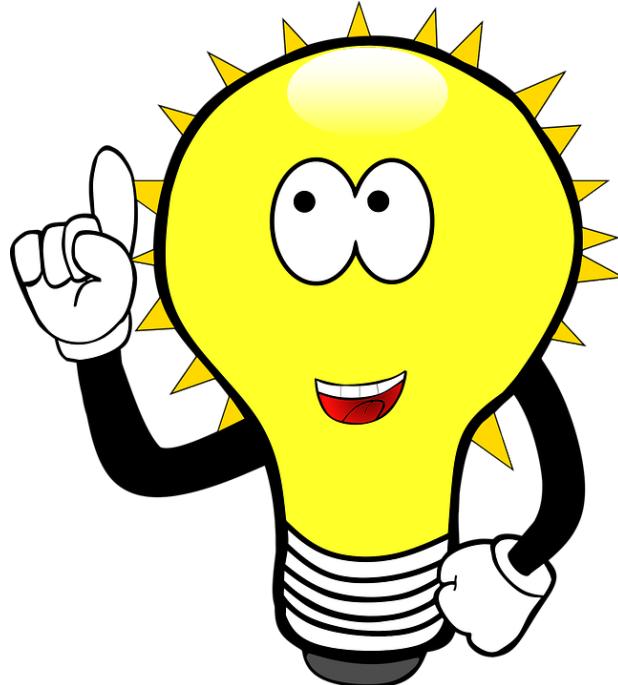
- (b)** The study involved feeding mice fatty acids and then subjecting them to stress. Describe a control experiment which the scientists could have used in this investigation.

- (c)** What observation did the scientists note about the behaviour of the mice after they had been fed fatty acids?

- (d)** Do you agree or disagree with the use of animals (such as mice) in scientific research? Explain your answer.

Creating:

Develop an idea for a science fair project that focuses on the effects of diet and exercise on the human body.



Learning Outcomes Using Backward Design

What do I want my students to know and understand?

Example:

Does the assessment align with national guidelines and standards?

What learning activities will lead students to the desired results?

Lesson Objectives:

Tell students what they will learn

“ Upon completion of this lesson students will be able to name.....”



Earth and Space

Students will develop a sense of the structure of the universe and some organising principles of astronomy, students explore relationships between many kinds of astronomical objects and evidence for the history of the universe. Students use data to discern patterns in the motion of the Sun, Moon, and stars and develop models to explain and predict phenomena such as day and night, seasons, and lunar phases.

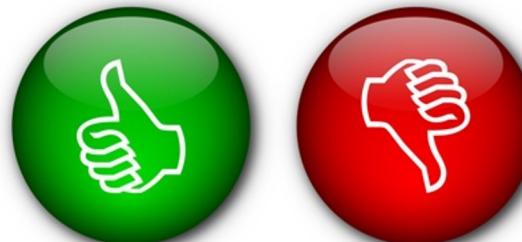
Feedback for Formative Assessment

- ❖ **Important things to remember about feedback:**
- ❖ Descriptive feedback is more valuable to the learner than to say an answer is simply right or wrong
- ❖ Feedback is more effective when it is perceived as low-level (rather than a high-level threat to self-esteem)
- ❖ Provides information that leads to greater possibilities for learning
- ❖ Feedback is most effective when it consists of progress information, creating both a realistic and a positive sense of progress to an objective
- ❖ Gives students a second chance to demonstrate success
- ❖ Provides specific details of how to improve the answer
- ❖ Provides the learner with two types of information:
 - ❖ verification (whether the answer is right or wrong)
 - ❖ elaboration that addresses the topic of the question

Negative Feedback

Feedback produces negative effects on learning when it:

- ❖ Is construed as critical
- ❖ Lacks information to improve performance
- ❖ Is too vague and lacking in detail
- ❖ Focuses only on the negative and areas of weakness
- ❖ Indicates student's standing relative to their peers (via scores or grades)



Example: Learning Screen with Feedback

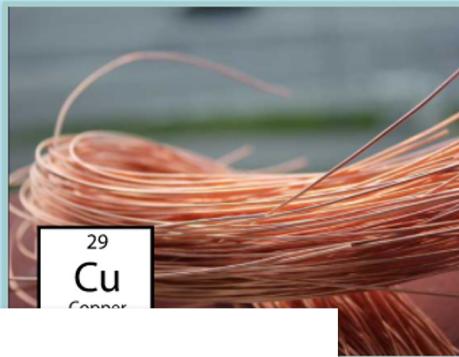
Topics Covered

- Properties of metals/non-metals
- Metals/non-metals/metaloids
- Alloys and their uses
- Rusting
- Reactivity series

Metals are said to be ductile. What does that mean?

Can be hammered into shape.

Make a clear ringing sound when hit.



Can be hammered into shape.

Try again! If a metal can be hammered into shape then it is **malleable**, not ductile.

Make a clear ringing sound when hit.

Try again! If a metal makes a clear ringing sound when hit this indicates that it is **sonorous**.

Break/snap/tear easily.

Try again! If a metal can break/snap or tear easily it is said to be **brittle**.

Can be stretched into a thin wire without them snapping.

Well done! **Ductile** means that a metal can be stretched into a thin wire without it snapping.

A clear simple question, with additional information about different properties of metals in each feedback

A good clear image with the Cu 'tile' from the periodic table as added information or 'hint'

Image helps reinforce the periodic table structure

Examples of Feedback for correct & incorrect answers

Which of these lists includes only foods which are a good source of **protein**?

Milk, eggs, bread and pasta

Poultry, fish, potatoes and pasta

Poultry, fish, nuts and eggs

Well done! **Poultry, fish, nuts** and **eggs** are all a good source of **protein**.

OK

Bread, pasta, rice and potatoes

Which of these lists includes only foods which are a good source of **protein**?

Milk, eggs, bread and pasta

Poultry, fish, potatoes and pasta

Try again! **Potatoes** and **pasta** are good sources of **carbohydrate** but not a good source of protein.

OK

Poultry, fish, nuts and eggs

Bread, pasta, rice and potatoes

Question Types

- ❖ True/False
- ❖ Multiple Choice Questions (MCQ)
- ❖ Multiple Correct Answer Multiple Choice(MMCQ)
- ❖ Match
- ❖ Cloze
- ❖ Short Text Answer (STA)



True/False Questions

True/false questions are those in which a statement is presented and the student indicates whether the statement is true or false.

Example:

The food we take in is broken down in two ways.

1. **Mechanical digestion:** the physical breaking down of food by the tongue, teeth and stomach. 2. **Chemical digestion:** enzymes and digestive juices are added to the food in the digestive system to help break it down. **Mechanical digestion is the breakdown of food by enzymes. True or False?**

Well done! **Chemical digestion** is the **break down of food by enzymes**.

OK

Try again! **Mechanical digestion** is the **break down of food by the tongue, teeth and stomach**.

OK

Advantages:

- ❖ Covers a lot of content in a short space of time
- ❖ Is easier to prepare compared to MCQ
- ❖ It is useful when there are two alternatives only
- ❖ Easy to construct

Disadvantages:

Limited only to low level of thinking such as recall

Suggestions for Writing True/False Questions

- ❖ Statements should be absolutely true or false
- ❖ Express the question item as simply and clearly as possible
- ❖ Express a single item in each question

Multiple Choice Questions (Learning Screen)

The multiple choice item consists of the stem which identifies the question or problem and the response alternatives or choices.

Example:

An atom is the smallest particle of an element that has properties of that element.

Shown here is an image of Bohr's Orbital Model, also known as Bohr's Atomic Model. What is the part labeled A?

The nucleus

An electron

A proton

An orbit, also known as a shell

Advantages:

- ❖ Very effective
- ❖ Versatile at all levels
- ❖ Guessing reduced
- ❖ Can cover a broad range of content

Disadvantages

- ❖ Difficult to come up with plausible distractors/alternate responses

Multiple Correct Answer

Provides students with several answer options

Example:

Correct Answers

- Rotation of the Earth
- Unequal heating at different latitudes
- Prevailing global winds

Topics Covered

- Composition
- Greenhouse effect
- Winds and their patterns
- Coriolis effect
- Cloud formation
- Precipitation
- Ocean currents

Which of the following cause ocean currents?



Rotation of the Earth

The greenhouse effect

Unequal heating at different latitudes

Prevailing global winds

Verify

Advantages:

- ❖ Increases the cognitive processes required to identify more than one answer
- ❖ Students can respond to many items permitting wider coverage of content
- ❖ Provides greater flexibility in questioning

Disadvantages:

- ❖ Questions can be challenging to construct

Suggestions for writing multiple test questions

- ❖ Use at least four alternatives for each alternative for each item to lower the probability of getting the correct item by guessing
- ❖ State the stem as a direct question rather than as an incomplete statement
 - ❖ Example:
 - ❖ How are alloys ordinarily produced?.....
 - ❖ NOT - Alloys are ordinarily produced by.....
- ❖ Eliminate irrelevant information from the stem
- ❖ Make the alternative responses plausible
- ❖ Each multiple choice question should have only one correct answer (unless the question says choose the best option)

Cloze Questions

A cloze test is a way of testing comprehension by removing words from a passage or sentence at regular intervals and then asking the student to supply the missing elements.

Example:

Topics Covered

- Parts and function of a microscope
- The Electron microscope
- Magnification

electron neutron light
fine focus beams objective
course focus multiplying

There are two main types of microscopes used today the light microscope and the [redacted] microscope. The light microscope uses [redacted] to allow us see the image, the electron microscope uses [redacted] of electrons. When looking through the microscope you can work out the total magnification used by reading the value on the eyepiece lens and the value on the [redacted] lens and then [redacted] them.

Verify



Advantages:

- ❖ Encourages the ability to understand context and the question in order to identify the correct response

Disadvantages:

- ❖ Can be challenging to determine whether a certain word is appropriate for the text.

Suggestions for writing Cloze Questions

- ❖ There should be **only one correct word** in the list of alternative words provided for each space.
- ❖ **Shuffle the words** around in the list to ensure that they are not in the order they need to be added.
- ❖ Avoid sentences which are correct when two words are inserted in different orders.
- ❖ **Avoid blanking out the same word twice** in the sentence or passage.
- ❖ Omit only significant words from the statement.

Match Questions

With Matching questions, students pair items in one column to items in another column

Example: Different fractions from crude oil have different uses:

Name of fraction	Typical use
Gases	Domestic heating and cooking
Diesel oil	Fuel for aircraft
Bitumen	Fuel for some cars and trains
	Fuel for large ships and some power stations
	Surfacing roads and roofs

Advantages:

- ❖ Some comprehension level required
- ❖ Valuable in content area that has a lot of facts.

Disadvantages:

- ❖ May not be appropriate for higher levels of learning

Suggestions :

- ❖ Use only items that share the same foundation of information
- ❖ Have more options than the given items

Short Text Answer (STA) (Still in Development)

An open-ended answer to a question requiring a sentence/paragraph response

Example: The Earth's earliest atmosphere was very different from the Earth's atmosphere today.

Question: Explain how the amount of water vapour decreased.

Advantages:

- ❖ Goes beyond simple recall or recognition
- ❖ Students less likely to guess
- ❖ Allows students to demonstrate knowledge

Disadvantages:

- ❖ Subjective, potentially leading to unreliable scoring

How to Avoid Student Prediction of Answers when using MCQ

- ❖ Student – if in doubt, guess
- ❖ **Strategy** – Use five alternatives instead of three or four
- ❖ Student - Pick the scientific answer
- ❖ **Strategy** – Use scientific jargon in wrong answers
- ❖ Student – Do not pick an answer which is too simple or obvious
- ❖ **Strategy** – Sometimes make the simple, obvious answer the correct one
- ❖ Student – pick the longest answer
- ❖ **Strategy** – make sure the longest answer is right about a fifth of the time (if there are five alternatives)

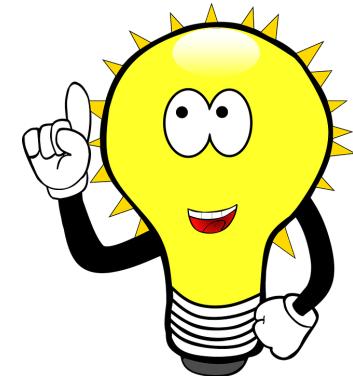
General Tips and Techniques

- ❖ **Make sure:**
- ❖ Language appropriate to the age group
- ❖ Language is familiar to the students
- ❖ Provide visual aids
- ❖ Do not use jargon or metaphorical language as this may pose problems for younger students
- ❖ Check for accuracy

Group Activity – Breakout rooms

❖ Work together to produce a question, following the design process:

1. Identify the Learning Outcomes
2. Consider which level of Bloom's Taxonomy at you wish to work
3. Choose the appropriate question type (true/ false, multiple choice)
4. Write (creative!) feedback for both correct and incorrect answers



- ❖ Choose a spokesperson for your group who will discuss your question design process with the whole group.
- ❖ You have 20 minutes to prepare your work.



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