SBI 4U - EVALUATING WITH AN EXPOSITORY / PICTORIAL ESSAY - "THE BIG QUESTION"

LORI MACLEOD (/USERS/LORI-MACLEOD-ERINDALE-SS-2322)

SBI 4U0 Classroom Catalyst "The Big Question"

Overview:

Using an ***expository / pictorial essay*** on evaluations, to link course concepts and somewhat "spiral the curriculum."

Specifics:

- Provide students (ahead of the unit test date) with a "Big Question" involving a concept that can be applied to much of the unit material.
- Allow students a few days to prepare their answer before the test.
- Possibly provide them with a list of terms to explain and include in their answer.
- Require diagrams to be included in their answer, as well as text.
- Provide a ledger size piece of paper to be used to practice their answer.
- During the test, students are provided with the list of terms again to prompt them to write out the answer they prepared. (They are not allowed to bring their practice paper to use).
- Optional: allow students to prepare their own list of terms (pre-approved by teacher)

Skills Involved:

- Brainstorming
- Development of ideas
- Graphic organization
- Choosing key ideas
- Ranking of Importance
- Sequencing
- Informing
- Explaining
- Comparing
- Describing
- Showing cause and effect
- Linking problem and solution
- Incorporating supporting material and evidence
- Extended definition
- Conciseness
- Clarity
- Logic

- Reduction of memorization (showcasing understanding instead)

Overall Expectations:

A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including

tables, flow charts, graphs, and/or diagrams

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, three-dimensional molecular models), and appropriate units of measurement (e.g., SI and imperial units)

Specific Expectations:

- Will depend on the question asked!

Examples of "Big Questions"

Biochemistry:

- Explain how difference components of the cell membrane structure allow the cell to control what materials are transported into and out of the cell
- Explain how the sequence of amino acids (and thus protein structure) allow a protein to be embedded into the cell membrane and what variety of functions these integral proteins serve the cell

Metabolic Processes:

- Using the mechanics of metabolic processes as a framework, explain in detail, how a disorder that reduces the efficiency of ATP synthase by 50% would affect the organism's production and/or consumption of glucose
- Using the mechanics of cellular respiration as a framework, explain in detail how NADH + H^+ is generated and why its production during glycolysis and the Kreb's cycle is more significant than ATP production
- Most of the ATP generated from cellular respiration comes from the mitochondria. Starting from glucose, explain in detail how the Kreb's Cycle and Electron Transport Chain produce enough ATP to keep us alive.

Genetics:

- Use the provided DNA template strand sequence and codon chart, describe and explain how DNA is transcribed and translated to yield a functional protein.
- Use the provided DNA template strand sequence for insulin and codon chart, describe and explain how the cells of the pancreas respond to high blood sugar by transcribing and translating the insulin gene. Include a specific example of a mutation that might result in the secretion of non-functional proinsulin instead of insulin.
- Using the provided DNA template strand sequence for insulin, identify a specific mutation that would prevent the removal of the C-peptide but still allow the protein to be fully synthesized. Show how your mutation would affect the protein sequence and impact the processing of the protein to make a fully functioning insulin molecule.

Homeostasis:

- Outline an example a stimulus-response in the body. You must include nervous and endocrine pathways, feedback, and a resulting disease/disorder if the pathways do not work optimally.
- Explain how neurons in a reflex arc are used and coordinate various methods of membrane transport to perform their function.

Final Exam:

- Describe and explain how/why membrane transport could be considered an overriding theme in the course
- Describe and explain how/why the function and interaction of macromolecules could be considered an overriding theme in the course
- Describe and explain how/why proteins could be considered an overriding theme in the course

Personal notes:

I give credit to Karrilyn McPhee and Steve MacDougall from Georgetown District High School for the basis for this idea. My son attended this school and I was intrigued by this style of questioning.

I decided to incorporate this type of essay question into my unit and final evaluations. Overall I feel that this is a great way to have students synthesize information and link information together, rather than the traditional memorization questions usually used on unit tests.

The students appreciated knowing ahead of time what was on the test and exam. They appreciated being able to plan out an answer. They were grateful for a list of terms to prompt them in what to include.

It was interesting seeing the various forms of answers. Some students are very visual with many diagrams included, whereas some students write mostly full sentences of text. Some enjoy colour-coding their work. I could really see differences in learning styles and organization and delivery of information.

One of the challenges I had was deciding on the questions. Sometimes it was difficult to spiral curriculum ideas and link concepts together. Also, since this was my first time trying this, I had no rubric to go by and thus my marking was quite subjective. I tried to estimate a mark out of 10 for Communication, based on clear diagrams, flow between ideas and answering the question correctly. Then I tried to estimate a mark out of 15 for Application, based on defining terms correctly and including relevant examples and ideas. In the future I would like to use clear rubrics with criteria defined.

Also I did not try this question style for the Population Dynamics unit.

If anyone decides to try this as well, I am certainly open to suggestions for Big Questions (especially Populations) and rubrics/marking schemes etc.

Lori MacLeod

Biology Teacher

Erindale Secondary School

2021 Dundas St. W. Mississauga, ON

Lori.macleod@peelsb.com (mailto:Lori.macleod@peelsb.com)

P0061276@pdsb.net (mailto:P0061276@pdsb.net)

905-828-7206

RESOURCES

- Biochemistry Big Q exemplar (https://connex.stao.ca/sites/default/files/biochemistry.pdf)
- Homeostasis Big Q exemplar (https://connex.stao.ca/sites/default/files/homeostasis.pdf)
- Metabolic Big Q exemplar (https://connex.stao.ca/sites/default/files/metabolic.pdf)
- Final exam Big Q exemplar (https://connex.stao.ca/sites/default/files/final.pdf)
- Genetics Big Q exemplar (https://connex.stao.ca/sites/default/files/genetics.pdf)

ELEMENT

- Critical Thinking (/expert-elements/critical-thinking)

(/classroom-catalysts) RETURN TO CATALYSTS (/classroom-catalysts)

GOOGLE+ (https://plus.google.com/u/0/+ScienceTeachersAssociationofOntarioDresden/about)
INSTAGRAM (https://instagram.com/staoapso/)