Promoting student engagement through active learning in science classrooms

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Aim of the workshop

Research has validated that there is a strong correlation between student's engagement in the learning process and their practicing higher-level critical thinking skills that promote meaningful learning experiences. Accordingly, the purpose of this workshop is to introduce techniques that enhance science classroom dynamics by creating challenging and enriching educational experiences.
Definition of student engagement

“The involvement of the minds of all learners with that which is to be learned.”
Activity-1

• Work in groups of four- Learning routine: think-pair-square-share

• Answer in your group the question:

  How can we define an engaged student?

  Share your answers please.
Levels of student engagement

REBELLIOUSNESS

Behavior Problem
What does a rebellious student look like?

The Rebellious Student usually:

• Scores Below Basic
• Scores Far Below Basic
• Scores Advanced
• Rejects the task overtly
• Feels self-conscious about lack of ability
• Thinks he/she is smarter than the teacher
Levels of student engagement

RETREATISM

Rejection
What does a Retreatist student look like?

The Retreatist Student usually:

• Scores Below Basic

• Scores Far Below Basic

• Tries not to be noticed (not a rebel)

• Does minimal classwork or homework

• Is frequently absent or tardy

• Wishes you would leave him/her alone
Levels of student engagement

PASSIVE COMPLIANCE:

Majority of our students
What does a Passive Compliant student look like?

The Passive Compliant Student usually:

• Scores Below Basic or Basic
• Does enough homework to avoid a missing assignment card
• Wants to pass your class
• Answers questions when asked
• Avoids volunteering for anything
• Earns C and D grades
Levels of student engagement

RITUAL ENGAGEMENTS:

We need to move our students here.
What does a Ritual Engager look like?

The Ritual Engager usually:

- Scores Basic or Proficient
- Wants to earn an A or a B in your class
- Wants to get into college
- Volunteers responses to earn points
- Uses “extra-credit” opportunities to make up for occasional lapses in effort
- Forgets about your class once the period is over beyond what is due the next day
Levels of student engagement

AUTHENTIC ENGAGEMENT:
That kid who stands out in the crowd
What does a Authentic Engager look like?

The Authentic Engager usually:

- Scores Proficient or Advanced
- Loves learning for the sake of learning
- Wants to earn an A in your class...and will!
- Wants to get into a competitive college
- Volunteers responses to show understanding
- Uses “extra-credit” opportunities to earn >100%
- Thinks and talks about your class long after the period has ended out of genuine interest
Model of student engagement

Motivation

Active learning

Transformative Learning
Definition of Active Learning

Doing what we think and thinking about what we are doing

• Active learning is defined as “any instructional method that engages students in the learning process. Active learning requires students to do meaningful learning activities and think about what they are doing
Definition of Motivation

• We want our students to share our enthusiasm for our academic discipline and find our courses so compelling that they willingly devote their hearts and minds to the learning process.
Activity-2
Improving memory skills to enhance motivation

• Work in pairs - Learning routine: elbow exchange
• I will give you a series of letters
• You will have 5 seconds to memorize them
• The letters are:

ISFB AU AUSG RE IRB
Importance of chunking and sorting

- Ask a number of students to provide the letters
- Why are some of the answers wrong?
- What can you do to help you remember the letters?
- The correct answer is ISF BAU AUS GRE IRB
Importance of chunking and sorting - Concept map

• A given textbook chapter or lecture session contains several concepts, a dozen vocabulary words, and scores of supporting details.

For students, the hierarchy of information is subtle, and each bit of information can appear unrelated to others.

• Activities that help students organize concepts and terminology can illustrate how to make sense from information that may otherwise seem overwhelming.

• Example: A concept map is one tool for organizing information.
• **What is needed for Photosynthesis?**
  • To make food, plants need not just one but **all of the following**: carbon dioxide, water, sunlight.
  • Let’s take a look at how these are collected by plants.
  • Carbon dioxide from the air passes through small pores (holes) in the leaves. These pores are called stomata.
  • Water is absorbed by the roots and passes through vessels in the stem on its way to the leaves.
  • Sunlight is absorbed by a green chemical in the leaves.
  • The photosynthesis process takes place in the leaves of plants. The leaves are made up of very small cells. Chlorophyll absorbs the sun’s energy.
  • Oxygen is released from the leaves into the atmosphere.
  • Hydrogen and carbon dioxide are used to form glucose or food for plants.
The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly” (Ausubel)
Importance of prior learning- Diagnostic assessment

Activity-3
Diagnostic Assessment – Learning routine: Domino Discover
(Add and repeat)

• What are the constituents of an atomic nucleus.
• Write the symbol of a nucleus.
• Define isotopes and give example if possible.
• How do you imagine the shape of the nucleus? Determine its volume and density.
• What kind of forces occur inside the nucleus (attractive or repulsive)?
• Deduce about the existence of a force that keeps the nucleus stable.
STRATEGIES THAT PROMOTE ACTIVE LEARNING

• Help students to chunk information
• Activate students’ prior learning
• Be clear about your goals and course learning outcomes
• Clarify your role and orient students to their new roles
• Help students develop learning strategies

• Use rubrics to give learners frequent and useful feedback
• Use flipped learning
• Use interactive lectures.
• Teach for retention: emotional connection, sense, and relevancy.
Promoting active learning- Competition

Activity-4  Math puzzle
Learning routine: Think-pair-square share

• Answer the following questions:
• 1. How many triangles are hidden in the pattern?
• 2. What strategy might you use to count them all to ensure you do not miss any out?
Conclusion from activity

• Solving puzzle-like problems in a relatively competitive environment increases students’ intrinsic motivation.

• Solution:
Promoting active learning- Competition

Activity-5  **UNUSUAL U-TUBE**
Learning routine: Think-pair-square share

- This is an unusual u-tube that behaves differently from other tubes!

**What do we conclude from this activity?**
Discrepant events create disequilibrium and challenge students to think hard to address the problem resulting in motivation to learn.
Promoting active learning- COUNTERINTUITIVE INFORMATION

Activity-6 hammer and feather fall

Learning routine: Think-pair-square share

• How comes that a ball and a feather of different weights fall at the same rate!!!

What do we conclude from this activity?
Counterintuitive information creates disequilibrium and challenges students to think hard to understand the problem, resulting in motivation to learn.
Another examples on COUNTERINTUITIVE INFORMATION in science

What do we conclude from this activity?
Counterintuitive information creates disequilibrium and challenges students to think hard to understand the problem, resulting in motivation to learn.
Model of student engagement

- Motivation
- Active learning
- Transformative Learning
Model of student engagement

Engagement Rooted In Motivation

• Engaged students really care about what they are learning, they want to learn
• When student are engaged they exceed expectation, they go beyond what is required

Engagement Rooted in Active Learning

• Engaged student are trying to make meaning of what they are learning
• Engaged student are involved in the academic task at hand and are using higher order thinking skills such as analyzing information and solving problems
Model of student engagement

Motivation and active learning work together synergistically to contribute to increased engagement.

- Engagement may be described as a double helix in which active learning and motivation are spirals working together synergistically thus resulting in a phenomenon that is greater than the sum of their individual effects.
Promoting synergy between motivation and active learning

- Conditions

Creating a sense of classroom community
- Helping students to work at their optimal level through:
  - Assessment and feedback
  - Teaching metacognitive skills
  - Integrating the cognitive, affective and psychomotor domains
Transformative learning

**Transformative learning** (or transformational learning) is a process of getting beyond gaining factual knowledge alone to instead become changed by what one learns in some meaningful way. It involves questioning assumptions, beliefs and values, and considering multiple points of view, while always seeking to verify reasoning.

Student
Audience Feedback - Questions

- Hadi Basma holds a PHD in materials science and an MS in teaching physics. He works as an academic director of guidance and counselling-department of physics at the ministry of education and higher education –Lebanon and he is an active professor, educational coach, trainer and researcher at Beirut Arab University.