Class: Physics 12

Lesson Title: Exploring Abstract Concepts – Students Choose

Class Size: **16**
Time: **60 mins**

Curriculum Outcomes:
114-2 explain the roles of evidence, theories, and paradigm in the development of scientific knowledge
XYZ – AB Depending on the topic the students choose, they may meet one or more of the specific unit outcomes, aimed at describing and determining processes, differences, or phenomena.

Learning Objectives:
1. Students will demonstrate an understanding of various abstract physics processes or phenomena.
2. Students will show clear thought process, planning, and initiation in simulating physics concepts.

Materials (completely up to you):
Some suggestions:
- Bouncy balls, plastic cups, plastic pylons, hula hoops, duct tape, flash lights, masking tape, springs, slinkies, pinnies, dollar store fans, blank paper with string tied to it, scissors, markers, Bristol board, roll of string, projectiles (bean bags, sports balls, paper airplanes), slingshots, chairs, elastics, etc.

Preparation beforehand:
- Have an abundance of materials available for students to be creative with
- Preferably have the activity take place in an open area (field, gym, large classroom with desks moved) so that obstacles do not restrict student creativity

Introduction:
1. Have students suggest concepts in physics that are rather difficult to "see" in a classroom setting on the board (projectile motion, Newton's laws, spring constants, etc.).
2. Explain what a kinulation is (broken up into kinesthetic and simulation). Tell them that these are used to help students learn difficult concepts that are otherwise difficult to picture. It allows students to become part of the demonstration, and therefore easier to remember and learn. Ask students if they would like to try one.

Electric Circuits demonstration (warm-up):
1. Have students participate in a quick example of a Kinulation on electric circuits.
2. Students can either act as atoms of some conductive metal, or as the electrons of that metal.
    a. If students choose to act as atoms, you will need something to represent electrons (balls, crumpled paper, etc.) that will be passed along.
    b. If students choose to act as electrons of the atoms, then you will not need anything to pass along as students will be doing the movement of the electrons (preferable).
3. Discuss the charge of electrons, and how they are "motivated" to move (i.e. positive attraction, or negative repulsion of a battery). Two students can then be designated as positive and negative ends of a battery. Students must then rotate either the balls, or themselves in the correct direction.
4. This will bring up the idea that some work needs to be done (resistors) in order to not have a short circuit.
5. Resistors (lights, fans, motors, etc.) can then be added into the circuit and students can proceed to "turn the circuit on" and rotate the balls or themselves (as electrons).
6. Students can then be asked to posit how they would overcome a faulty resistor in a circuit so as to not shutdown the rest of the circuit (parallel setup).
7. This activity can be tailored to include as much or as little about electric circuits as necessary. It is simply to get students in the Kinulation mind-frame, and get ideas flowing.

Students choose:
1. Students should be divided into two or more groups.
2. Each group will be responsible for creating a kinulation demonstration of some abstract or concrete physics concept. They may use whatever materials you have available to assist them in their endeavors.
3. Give the groups enough time to rehearse their ideas.
4. Groups will then present their demonstrations without any introduction or explanation. If the demonstrations are strong enough, the viewers should be able to understand what is going on.

5. After each demonstration, have the rest of the class explain what was shown, and have the group explain their intentions.
6. Allow each group to present.
7. **Variation**: if you wish, you may want to have the demonstrations restricted to a particle topic you are working on in your unit.

Conclusion – Possible wrap-up questions:

1. What benefits do you see in becoming part of the demonstration of the concept?
2. Is anything clearer to you because of watching your peers teach you?
3. Questions can be tailored to be specific to the unit you are working in. You could ask students to make inference on a concept based on the rendition in class.