Introduction to Innovation

Millis Science Center 328
Case Western Reserve University
July 18-22, 2022

INSTRUCTIONAL STAFF 2022

Bill Badders, Cleveland Metropolitan School District (retired), and former president, NSTA
Sarah Diamond, Ph.D., Associate Professor, Department of Biology
Eric Prileson, master's student, Department of Biology
Osmary Medina-Baez, Ph.D. student, Department of Biology
Michael Fu, Ph.D., Timothy E. and Allison L. Schroeder Assistant Professorship in Computer and Data Sciences, Assistant Professor, Department of Electrical, Computer, and Systems Engineering
Luis Flores, Ph.D. candidate, Department of Electrical, Computer, and Systems Engineering
Chirag Kharangate, Ph.D., Assistant Professor, Department of Mechanical and Aerospace Engineering
Michael Hore, Ph.D., Assistant Professor, Department of Macromolecular Science & Engineering
Kimberly Gliebe, Ph.D student, Department of Materials Science and Engineering
Jim Bader, Department of Biology and Executive Director, Leonard Gelfand STEM Center

SCHEDULE

Monday July 18

Driving Question: Why are there no new chalta trees growing in the Bengal Tiger Reserve? (Bill Badders)
Learning Goals:

- Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants
- Make observations of habitats to compare the diversity of plants and animals that live there
- Design a habitat suitable for a specific organism
- Model effective science, engineering, and literacy integration

Activities:

- Welcome, introductions, background, and context
- Pre-workshop assessments
- Plant and Animal Relationships (Amplify Science)
- Daily assessment/reflection

Tuesday July 19

Driving Questions: Why are there no new chalta trees growing in the Bengal Tiger Reserve (BB)
How can we cool matter by boiling it? (Chirag Kharangate)
Learning Goals:

- Use technology to identify the similarities and differences among habitats (BB).
- Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. (CK)
- Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.(CK)

Activities

- Plant and Animal Relationships (cont.)
- Characterizing macro and microclimates
- Investigating phase changes of matter
- Kharangate lab tour
- Daily assessment/reflection

Wednesday July 20

Driving Question: How can we, as biomedical engineers, restore limb functions for humans who have sustained injury? (Michael Fu, Luis Flores)

Learning Goals:

- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electrical currents.
- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Observe the integration of science and engineering in a real-world application.

Activities:

- Energy concept map
- Energy transformations in the human body
- Digital nerve stimulation for haptic feedback
- Observation of stroke rehabilitation research study participants
- Daily assessment/reflection

Thursday July 21

Driving Question: How can we precisely measure the size and shape of irregular and unconventional objects, and how sure are we that we're right?

Learning Goals:

- Introduction to non-ruler based measurement techniques.
- Confidence in applying classroom measurement techniques.
- Understanding precision/accuracy, averages, probabilities, and sampling.
- Establishing and visualizing the dynamic nature of molecules.

Activities:

- Measuring various pasta shapes with conventional classroom implements. (Connection to science: molecules of life including small molecules and macromolecules)
- Ensembles in science and engineering: statistics, confidence, probability, and precision.
- Applying concepts of statistics to dynamic structures: spaghetti tester[n] ☺
- Visualizing and interactive with *real* dynamic molecules in mixed reality: Microsoft HoloLens activities at the Interactive Commons.

Friday July 22

Driving Questions: How is energy transformed in a simple toy? (Jim Bader, Kimberly Gliebe)
Why and how do organisms change over their life cycle? (Sarah Diamond, Eric Prileson, Osmary Medina-Baez)

Learning Goals:

- Conduct an investigation to illustrate energy is a property of an object which is associated with its motion, may be stored temporarily, and can be transferred from one object to another through a process known as work. (JB)
- Construct and interpret graphical displays of data. (KG)
- Develop models to describe that organisms have unique and diverse life cycles but all have common birth, growth, reproduction, and death. (SD)
- Use evidence to support the claim that traits can be influenced by the environment. (SD)

Activities:

- Addressing students' misconceptions about energy and work.
- Data training
- Fun with butterflies – basics of animal husbandry, classroom activities (characterizing growth and development, locomotor activities – caterpillar racing, environment matching)
- Daily assessment/reflection
- Post-workshop assessment