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Practicum in STEM Leadership

Leadership Proposal: Engagement, Argumentation and Engineering Design in the Secondary Science Classroom

Rationale: Throughout my Methods of STEM Education - Secondary and Astronomy and Space Science courses, I encountered teaching materials, academic articles, NGSS curricula and comments from other educators that made me rethink how I approach science education. I have been teaching for many years and I have always tried to incorporate inquiry-based and hands-on activities to engage students in learning science. I have realized that student's making their own meaning, writing their own explanations and imagining solutions to design problems and then communicating these ideas is necessary for them to learn and have ownership of knowing science. The three methods that I encountered in my courses that I have found most relevant are using anchoring events (phenomena) to create student engagement, having students generate explanations from evidence using data and using design challenges to introduce engineering.

In addition to growth in my understanding of more engaging teaching methods, I became informed of new advances in fields such as astrobiology, exoplanets and new Mars missions. These high interest topics incorporate content from Biology, Earth Science and Physics.

Proposed audience: The science department at New Rochelle High School has about 30 teachers. We teach all of the NYS Regents course, all AP Science Courses and electives (Marine Science, Astronomy, Forensics, etc). Every teacher has somewhere between 80-120 students depending on the types of courses they teach. Our entire student body is over 3400 students and almost all students have a science class every year.

When and Where: Monday, February 3rd, our district has a half day and the afternoon has been designated as Departmental Professional Development. My workshop will run from 12:45 to 3:00 pm at my school. Teachers will have access to Chromebooks and all digital materials and links will be shared through our department's Google Classroom page.

Learning Goals:

- 1) Teachers will be given multiple examples of anchoring events and real world phenomena that can drive instruction
Example lesson: Using phenomena with white boards
Resource: Planning for Engagement with Important Science Ideas by Ambitious Science Teaching
Group work: Break out groups by subject area to explore phenomena provided by presenter and teachers can add phenomena
- 2) Teachers will have a facilitated discussion of the NGSS Science and Engineering practices: Constructing explanations (for science) and designing solutions (for engineering) and Engaging in argument from evidence. Teachers will be introduced to the Claims-Evidence Reasoning Model and

Example Lessons: Can people live on Mars? (Earth Science and Chemistry), Exoplanet Detection and Measurement (Physics), Vampire Finches in the Galapagos (Living Environment)
Resource: Mars Facts, Exploring Exoplanets with Kepler, Vampire Finches in the Galapagos
Group work: Teachers work in subject area groups to use the Claims-Evidence-Reasoning model to evaluate a current science event
- 3) Teachers will be shown examples of engineering and design challenges and asked to generate subject specific engineering and design challenges,
Example lessons: Rover Races, Hot coffee challenge and Cardboard Rovers
Resources: Student created materials and photos of student work,
Group work: Brainstorm and present examples of engineering challenges that could be used in a science classroom

Materials:

White boards with markers
Copies of resources where needed
Internet access
Chromebooks

Resources:

Exploring Exoplanets with Kepler

<https://www.jpl.nasa.gov/edu/teach/activity/exploring-exoplanets-with-kepler/>

Mars Facts

<https://mars.nasa.gov/all-about-mars/facts/>

The Vampire Finches in the Galapagos have exciting inner lives

<https://www.nytimes.com/2019/06/08/science/vampire-birds-galapagos.html>

Rover Races Activity

<https://www.nasa.gov/stem-ed-resources/rover-races-activity.html>

Build a thermos lesson

<https://betterlesson.com/lesson/resource/3125724/build-a-thermos-workbook>

Make a cardboard rover

<https://www.jpl.nasa.gov/edu/learn/project/make-a-cardboard-rover/>

Outcome and Follow up:

In a future department meeting, teachers can share out engineering practices they have used in their classrooms. There are many opportunities for less formal collaboration with members of my department. I can create a digital space for teachers to share their work: shared google doc.