UC Group 1: Implementation Notes, 05 Aug 2020

Chrystel Wells   Oak Hills High School Aug. 5, 2020

This lesson would be part of a unit on research and application of data – most likely in a research class or as a long term project in astronomy, integrated science, geology or science methods course. This lesson can also be applied to a history of science unit to address the question of “how do scientists know that?” Having a comprehensive license, I can see using this in a variety of the courses I can be asked to teach.

I want to try to have my students work with large sets of real-world data. Ideally I would like to develop a notebook using the Ohio State Byrd polar ice core data to map peaks in variables such as N(x)O(y) compounds, snowfall data, and spectroscopy/color and have them plot out the changes over time. These could then be evaluated against data about supernovae explosions in recorded history (and possibly extrapolate to prehistoric events); against data about climate change (temperatures) both directly against historical data and extrapolate to prehistoric data and possibly establishing patterns for future conditions; and against volcanic eruption data (when and what magnitude/type of eruption/or location of eruption) to see what correlations can be found.

A) The first part of the lesson would be an introduction to the ice core project and any relevant chemistry/physics related to each variable’s measurement

1) Chemistry of N_2 and O_2 radiation in the upper atmosphere, along with the mechanism of deposition in the ice sheet/glacier.

2) Brief history of temperature data, effects of global temperature changes on ice formation discussion – what would that look like in an ice core.

3) Colorimetry/Spectroscopy and basic information about volcanic eruptions.

4) Discourse on where to find historical data.

B) The second part of the lesson would be an introduction to the Jupyter Notebook. I believe I would need to provide a more detailed set up for my students (in general) with an introduction similar to what Adam provided us with this week.

C) The third part of this lesson would see groups taking different variables to compare, accessing the data from Byrd, and adjusting their notebooks to fit the specifics of what they were investigating.

** I’m not settled into a format for how each group would package their research, and by which format they would present it to their peers.

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Cross Curricular Implications – this lesson brings together geology, coding, history, astronomy and chemistry. I can also see some applications to biology and English, depending on where students want to take it.

How I will Use the General Knowledge I Have Gained During this Quarknet Session:

* I will use the Notebooks as much as I can as a way for my students to process class sets of data. Any time we share data to get a larger picture of an experiment, I will try to implement CoLab to graph and evaluate the data. Acceleration labs, projectile labs, Hooke's Law labs and pendulum labs come to mind as those that will best fit this format.

* I will use the penny flip activity to help my students understand how to look at data, and to provide them with an introduction to coding and using python

* I am interested in being able to use CoLab with our VernierGo carts. (motion, acceleration)

* I am interested in learning how to use and then evaluate some of the data collection platforms we looked at today including Tracker, Physics Toolkit and Google Lab Journal

(** Just a thought for inclusion and differentiation – the Google Lab Journal app that allows acceleration to be represented by sound would be a great thing to use with sight-impaired students!)

Overall, this workshop has served to open my eyes to many tools I can be using with my classes, both in person and via distance learning. With such a short time to learn this week, I am still struggling to assimilate it all make sense of it.

SR ANITA   COVINGTON LATIN SCHOOL

Curriculum to be added to Algebra II (Sophomore Class)
Purpose:
To get the students interested in programming and to work with basic probability concepts
To allow students to make histogram
To give the students experience in changing variables
To get the students to be able to look analytically at the code and make changes
To give the students of experience of working in pairs or triples as a team
One Day to introduce Jupyter
One Day to simulate the flipping of coin and changing to 6 sided die, dice, and various mutations of that!

Curriculum to be added to AP Physics I (Senior Class)

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Purpose: To get the students to be able to analyze motion concepts while also learning about some programming skills

Challenge: To be able to do these activities without doing more basic ones and for the students not to be concerned about the coding instead of the physics concepts.
TIME LINE: Unknown due to at least two variable: Prior knowledge of the students to pick up the coding, teacher has no prior knowledge as to the student's ability and even prior course content.

Advantage: The students all have chrome books and are probably good with technology.

Zac Patterson, The Arts & College Preparatory Academy (Columbus, OH)

Lesson: Probability & Data Analysis
Purpose: Introduce students to techniques used to collect and analyze data
Resources: Probability Colab notebook ->
https://colab.research.google.com/drive/1H65OPKNnMJMldB2c5cLorQXgQNBJT7Bt?usp=sharing
Details: This lesson will be implemented early in the school year and used to both introduce students to data analysis/collection and also as an introduction to coding. A great extension opportunity could involve opening this lesson to student-lead inquiry. Asking them to find an activity that would involve using probability data collection. Then, using the Google Colab they used for the initial probability activity and adjusting it to fit their new data set.

Lesson(s): Kinematic Graph Analysis
Purpose: Create and analyze motion graphs
Resources: Position graphs Colab notebook, Velocity graphs Colab notebook, Projectile in Air Colab notebook
Details: Once students are introduced to the Colab notebooks via the probability and data analysis lesson they can use the notebooks to create and analyze kinematic graphs (position-time, velocity-time, acceleration-time) and two-dimensional motion (horizontally-launched projectiles, projectiles launched at an angle). Most physics classrooms have plenty of material on these topics. Using the notebooks will both enhance analysis and increase student skillset using Colab. I usually teach 1-D motion after introductory content and 2-D motion after that, so I would implement these lessons early in the school year during the Fall.

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Martin Wells

<u>Quarknet Implementation Plan</u>

Martin Wells

Summit Country Day School, Cincinnati OH

Electric Potential Due to Point Charges (AP Physics C)

· Notes

 o We have discussed electric potential in terms of circuits. Discuss what they already know.

 o There is an electric potential at any point in space around a point charge. A positive charge want to move from higher potential to lower potential.

 o Formula for the electric potential due to a point charge.

· Electric Potential CoLab notebook

 o A single charge on the x axis

  § Graph the potential vs. x

  § Students use the notebook to learn to manipulate the parameters of the graph and the effect of changing the increment in the loop

 o A single charge on the x-y plan.

  § Make a 3-D graph with potential on the z-axis

  § Students use the notebook to learn to manipulate the parameters of the graph and the effect of changing the increment in the loop

 o Extension

  § Student put two charges on the x-y plane and manipulate the code to graph the potential due to both charges.

· Potential Mapping

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- Do the traditional potential mapping activity with the conductive paper and two charges. This generates the equipotential lines on the x-y plane.

- Compare the map of equipotential lines to the potential graph made on the notebook.

- What do you see? (Contour lines analogy should be obvious.