STEM Takes Flight Professional Development Workshop

Post workshop practices

Topic: Regulation of Gene expression and genomics in space

Presenter(s): Grace Ann Cellucci

Date: Thursday, September 7, 2018

Lesson Timeframe: One hour and fifteen minute classes

STEM Takes Flight Workshop Resources Used:

Introduction to NEO Orbits

https://cneos.jpl.nasa.gov/orbits/intro.html

Materials:

NASA's Open Data Portal – Near-Earth Comets – Orbital Elements

https://data.nasa.gov/Space-Science/Near-Earth-Comets-Orbital-Elements/b67r-rgxc

JPL Small Body Database Browser

https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=103P%2FHartley%202;old=0;orb=1;cov=0;log=0;cad=1#cad

Please explain why these workshop materials were used in this lesson:

The database provided an opportunity for the students to compare and select a comet to explore. The model then provided them an opportunity to visually see what the data expressed. The class presentation allowed them visually and numerically compare between approximately six options and discuss their research findings to determine the current and potential impact each small body has on the Earth.

Teacher level: MTH 154. Review the data chart first. Be comfortable with the vocabulary.
Student level: How to read a table. Understand basic concepts of astronomy. Conduct basic research. Use a model, Give a short presentation

Learning styles/intelligences supported:

Concrete Precise (Step-by-step instructions, Data matching, Research)

Concrete Imprecise (Low-level competition with other groups, Active - out of seat, Presentation)

Abstract Precise (Problem solving and making predictions for real-world problems, research with live data, using advanced vocabulary)

Abstract Imprecise (Visualize with the model, see the past and the future events, tells the story of meteor showers, catastrophic weather, and potential impact scenarios, potential impact is direct and meaningful to them)

Overview of the lesson:

The purpose of this lesson is to practice interpreting data from a chart and using this data to describe a physical system, make predictions about the system, and to use a model to aid in our interpretations and predictions.

To accomplish this, we will begin by learning about NASA's Near Earth Orbit program is designed to map and measure the approaches of 170 comets to Earth.

Lesson Objectives:

These objectives match out state defined objectives for the course.

a. Solve real-life problems requiring interpretation and comparison of complex numeric summaries, which extend beyond simple measures of center.

b. Through an examination of examples, develop an ability to study physical systems in the real world by using abstract mathematical equations or computer programs.

c. Make measurements of physical systems and relate them to the input values for functions or programs.

d. Compare the predictions of a mathematical model with actual measurements obtained.

Lesson Content:

Large Group

1. Visit the NEO site to learn about the program
2. Access the database from NASA's Open Data Portal
3. Discuss the data, along with establishing definitions of key words and symbols and choose one comet to explore in depth

   I chose 103P/Hartley 2. The class will learn *eccentricity*, *aphelion*, *perihelion*, *inclination* and *MOID*

4. We will use the Java orbital diagram found under the Small Body Data Base Browser to compare the information in the data table to the visual representation of the model in the orbital diagram

5. We will draw conclusions on how to interpret the data to determine the chances that our comet will strike the Earth. We will also determine what other factors may play a role in affecting the validity of the model

Small Group

1. Each group will choose a comet to explore on their own. A group member will write the name of their selected comet on the board so that each groups has a distinctive comet

2. The group will be able to describe their comet using the vocabulary introduced in the large group: *eccentricity*, *aphelion*, *perihelion*, *inclination* and *MOID*

3. The group will be able to use the data and the orbital diagram to present their findings and answer the question "*How can we use NASA data to help us predict if a Near Earth Comet is in danger of striking the Earth?"*

4. Each group will present their findings to the class, along with the data and the orbital diagram

Assessment:

Students will present their finding to the class in a group presentation

Approximately how many students do you anticipate this activity impacted?

24 students in 3 different classes = 72 total students

Additional comments:

The students enjoyed the lesson. Many had not been introduced to the five main vocabulary words, nor Ecliptic, Astronomical unit (AU) and basic concepts of special reasoning.

The lesson tied in nicely to our up-coming work in proportions and unit conversion. Especially since once they determined the MOID, they had to convert it to millions of miles in order to speak about the minimal distance in a relative framework that they understand.

Several students thanked me for class that day. Students that I spoke with said the material was overwhelming at first, but as we went through the activity in the large group and then the small groups, they became very comfortable with the vocabulary, the data, and the model. All groups were engaged and the presentations were enlightening. I left the data and the model up on the class site for independent exploration.

Follow up:

This activity served to introduce the students to NASA and their space programs. It also introduced them to large amounts of data that NASA collects. A great follow-up activity would then be to explore how NASA collects this data and create a Paper SAT project.

Quantitative Reasoning: NASA NEO Project

Sources
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Data source:
Near-Earth_Comets_-_Orbital_Elements.cvs
(attached in separate file)

Quantitative Reasoning Objectives

a. Solve real-life problems requiring interpretation and comparison of complex numeric summaries, which extend beyond simple measures of center.

b. Through an examination of examples, develop an ability to study physical systems in the real world by using abstract mathematical equations or computer programs.

c. Make measurements of physical systems and relate them to the input values for functions or programs.

d. Compare the predictions of a mathematical model with actual measurements obtained.

Question:
How can we use NASA data to help us predict if a Near Earth Comet is in danger of striking the Earth?

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