Using Technology to Integrate the NGSS

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Bernards Township School District
About the Presenter

- **District Science & Technology Supervisors**
  - Bernards Township Public Schools, Basking Ridge, NJ

- **Prior:**
  - High School Science Teacher
    - Hillsborough High School, Hillsborough, NJ
      - Chemistry, Physics, Geophysical Science & Environmental Science
  - 6-12 Supervisor of Mathematics, Science, World Languages, Business & Technology
    - Clark Public Schools, Clark, NJ

- **NGSS Professional Development Presentations**
  - Princeton & Rider Universities (multiple)
  - New Jersey Science Convention (multiple)
  - New Jersey Association for Middle Level Education (multiple)
  - New Jersey School Boards’ Association (multiple)
Agenda

- Brief overview of NGSS
- Curriculum Highlights
- Mock “Lesson”
  - More a “unit” w/ timing adjusted
  - Will utilize a number of technology integrations
  - Interjections of key aspects of instruction for NGSS alignment throughout
    - Marked as “Presentation Notes”
  - Formative assessments throughout
  - Culminates with summative assessment
Section 1: NGSS Overview
NGSS now Student Learning Standards (SLS) in NJ

<table>
<thead>
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<th>Students who demonstrate understanding can:</th>
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<td><strong>K-PS2.1.</strong> Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]</td>
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| **K-PS2.2.** Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.* [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.] |

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

<table>
<thead>
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<th>New Jersey Student Learning Standards</th>
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<td><strong>SCIENCE</strong></td>
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Taken from NJDOE website for SLS

Taken from NGSS site
NGSS

- Three components that are intertwined
  - Science & Engineering Practices
  - Crosscutting Concepts
  - Disciplinary Core Ideas (DCIs)

- Based upon the type of learning exercise/activity, *what the students are doing falls* into at least one of these three components

- The “overarching standard” is the Performance Expectation which denotes the “minimum nature” of a formative assessment
HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. [Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.]
NGSS: Inquiry Based

- Consider the verbiage in the NGSS:
  - Student-centered
  - Skills/Application Based

- To begin any lesson/unit/chapter that is aligned to NGSS there should be a “phenomenon”
  - The phenomenon is a specific, observable event/series of events
  - Science content, often with the help of engineering practices to propose solutions to issues generated by phenomena, is used to explain and predict phenomena
  - In “good curriculum,” the investigation of the phenomena is intertwined with the essential questions
Examples of Phenomena

- Pictures/ Audio/ Video
- Lab/ Activity Demonstrations
- A thought-provoking literary source such as an article or excerpt from a text
Section 2: Curricular Examples
Curriculum Guides

The Universe

- Compare the relative sizes and distances between objects in the universe.
- Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
- Explain the transformation of energy from Hydrogen in a star to sunlight that reaches the Earth.
- Using knowledge of properties of stars, students will be able to construct an explanation as to why some objects in the sky are brighter than others.

Earth Sun Moon System

- Develop and use a model of the Earth Sun Moon system to describe the cyclic patterns of lunar phases, eclipse of the sun and moon, and the changing seasons.
- Utilize their model to predict moon phases, eclipses, and seasons, given the relative positions of the Earth sun and moon.
- Using knowledge of forces and gravity, develop and use a model to predict the motion of planetary objects.
- Calculate the relative size and distance of various solar system objects using data from Earth-based and space-based instruments.

- Screenshot from Grade 8 Bernards Township Curriculum
- Correlations to NGSS/SLS
  - Blue: Science & Engineering Practices
  - Green: Crosscutting Concepts
  - Orange: DCIs
This is artificial

There is no way to demonstrate every type of technology integration available in a single lesson

- I will interject information throughout this lesson (unlike a “true teacher in the classroom”)
  - Key aspects about the standards
  - Options/variations on the tech
  - “Break Points” in an “actual lesson”

- I will also “cut the lesson” so that we can move through as much as possible in the time allotted
Let’s Get Started

- If you have a Google account you may join a Google Classroom created for this presentation
  - Enrollment Key: 1tn9cz

- If not, please use your browser to go to the following web address:
  - https://docs.google.com/document/d/1z_Triv5XwZRdbHM2yI39qo9El6InxdNEcuDTYpWL4yQ/edit?usp=sharing

- You will have 5 minutes to post a response before we discuss
Presentation Note:

- PHENOMENA!
- The graph/data provided in the assignment link is the phenomena to launch this unit
Let’s review the comments and see if we can’t create a class consensus
In this presentation I added notes to the previous slide using the “Start Inking” feature available under “Review”
  - This feature is available in both Power Point and Word

This can be comparably done using some other options:
  - Epson Projector (Bright Link) software
  - SMART Board & SMART notebook
  - iPads & Apple TV
How do we test our “consensus?”

- In your groups, propose a viable method to model our proposed class explanation
  - This model should enable us to test and either prove or disprove

- You will be given 10-15 minutes to devise a model and post it to Google Classroom
  - Presentation Note - we may not actually take 10-15 minutes due to a need to stay within our time provided
Reporting Out (again)

- Presentation Notes-
  - discussion/reporting out is an important part of the students driving the lesson
  - Like before, notes were created using “start inking”

- What common thoughts/ideas do we have on testing our class’s explanation?
Time for Lab

- **Link to procedure:**
  - [https://docs.google.com/document/d/1ORxHG79f1zAM_OlAE8WBxU8iAz8vzVMWq-K1qHFIPXA/edit?usp=sharing](https://docs.google.com/document/d/1ORxHG79f1zAM_OlAE8WBxU8iAz8vzVMWq-K1qHFIPXA/edit?usp=sharing)

- **Link to Class Data Sheet:**
  - [https://docs.google.com/spreadsheets/d/1y2kKlvkIwCcb3APH6U5_qFcYzAc5cTSzxs4XbomahLY/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1y2kKlvkIwCcb3APH6U5_qFcYzAc5cTSzxs4XbomahLY/edit?usp=sharing)

- **Presenter Note**
  - The engineering/design aspect was hit by our discussion
    - Identified key components to address/research/investigate
    - Noted parameters for viability
  - Reflect on this:
    - How many aspects of the NGSS would be missed if:
      - This was not introduced with a phenomenon?
      - The lesson/unit began with the lab handout?
Post-Lab Discussion
Tonight for Homework (Flipped Classroom Approach)

**Presenter Notes**

- When I ran through this I felt “silly” being in the room while my “students” watched a video of me.
- There are a lot of Apps out there - many of my staff use “PlayPauseIt”
  - They record a lecture during a prep as though there are students in the room.
- I will deliver “flipped content” via direct instruction
  - Similar to the example, the corresponding slides could be pushed up to classroom and actually assigned for homework in a “true instructional setting”
- Homework Link:
  - [https://docs.google.com/document/d/1Rg29r1BZl6A1Qk2Cxo5fm8n0s-KrTT-E34jILVx4824/edit?usp=sharing](https://docs.google.com/document/d/1Rg29r1BZl6A1Qk2Cxo5fm8n0s-KrTT-E34jILVx4824/edit?usp=sharing)

**Benefits of Flipped Approach**

- Students may watch multiple times (for introduction or review)
- Parents/Guardians/tutors may watch as well to provide student with support at home.
Nuclear Reactions are the only reactions that allow an atom of one element to be converted into an atom of a different element.

Even in these transformations mass is conserved.

Key Terms:
- Half Life - the amount of time required for approximately half of a radioactive substance to undergo decay.
- Fusion - nuclear reaction where two or more nuclei combine
  - AKA - particle capture
- Fission - nuclear reaction where one nucleus splits into two or more particles
  - AKA - particle emission
"Flipped Approach" continued

- These are the types of particles that can be absorbed or released during a nuclear reaction
- In the coming examples remember- mass is conserved!


"Flipped Approach" continued

<table>
<thead>
<tr>
<th>Alpha Particle</th>
<th>Beta Plus Particle</th>
<th>Beta Minus Particle</th>
<th>Neutron</th>
<th>Gamma Particle</th>
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<tr>
<td>$^4_2\text{He}$</td>
<td>$^0_1\text{e}$</td>
<td>$^0_{-1}\text{e}$</td>
<td>$^1_0\text{n}$</td>
<td>$^0_0\gamma$</td>
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$^{244}_{94}\text{Pu} \rightarrow ^4_2\text{He} + _____$

$^{221}_{86}\text{Rn} + _____ \rightarrow ^{225}_{88}\text{Ra}$

$^{28}_{15}\text{P} \rightarrow ^0_1\text{e} + _____$
As we learned in our lab, radioactive material decays into stable “daughter” material in predictable intervals.

These intervals are called half-lives.

Using this information, we can make calculations to predict:

- The amount of time that has elapsed given an initial and final amount of radioactive material
  - Amount can be in mass or percent
- The amount of starting material noting elapsed time and final amount of radioactive material
  - Again- amount in mass or percent
- The final amount of radioactive material given the initial amount and elapsed time
  - Amount in mass or percent
"Flipped Approach" (continued)

- amount remaining = initial amount \( \frac{1}{2} \) \( \frac{t}{1/K} \)

  - Amount remaining: This is the final amount of radioactive materials
    - Again- mass or percent
  - Initial amount: the starting amount of radioactive material
    - Mass or percent
  - K: the length of a half-life
  - T: the total amount of time that has elapsed
“Flipped Approach” (continued)

- amount remaining = initial amount \( \frac{t}{1/k} \)
- After 370 years, a radioactive material has decayed from 1.5kg to 187.5kg. What is the half-life of this material?

- At this point, what mass of stable daughter material must exist?
End of the “Flipped Approach”

- Using what you have learned complete the assigned homework
  - https://docs.google.com/document/d/1Rg29r1BZl6A1Qk2Cxo5fm8n0s-KrTT-E34jLVx4824/edit?usp=sharing
Do Now

- **Presenter Notes**
  - To assess & address misconceptions from the flipped approach

- **Plickers:**
  - A tech integration that allows use of smart device (tablet, PC, or phone - anything with a camera) to poll student responses to a question

- **For Pu-239 to decay into U-235, what type of particle is released?**
  - A: Alpha
  - B: Beta +
  - C: Beta –
  - D: Gamma
The Impending Summative Assessment

- Nothing has been graded as of yet
- Students have been assessed & feedback has been given in a “no risk” environment
- Following completion of any review (based upon feedback from students)
  - Fill in the blank on nuclear equations
  - Multiple choice regarding scenarios
  - Mathematical open-ended on half-life & decay
  - And the most important part:
    - Free Response with Engineering/Design Strand Embedded:

Link to online assessment:

https://goo.gl/forms/6KzbBFQWPEeR99Lu1
Thank you very much

Contact:
tmisiak@bernardsboe.com