NGSX : Next Generation Science Standards Exemplar

Agenda:

1. Background
2. Present NGSX format
3. Experience NGSX as a student
4. Questions?
5. Brainstorm with departments

Next Generation Science Standards

- What are they?
  - K-12 science standards implemented in 2013
  - Identifies three dimensions of learning
- Why are they important?
  - To prepare students to think critically, analyze and solve complex problems
  - To prepares students for college & 21st century careers
- How were they developed?
  - Through collaboration with science supervisors from 26 states and a writing team comprised of teachers, scientists, and education researchers

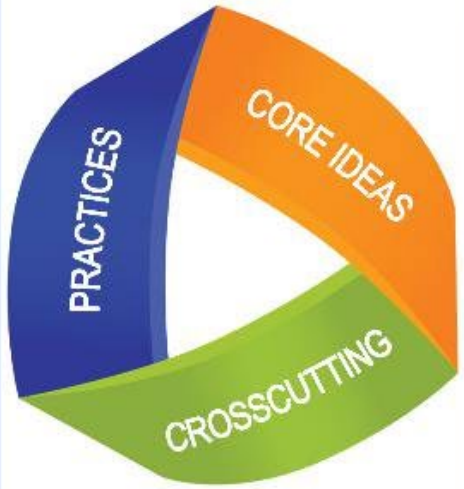
Three Dimensional Learning

Three Dimensions of Science Learning

A Framework of Standards for Exploring the Natural World and Human-Designed World

What Students Do:

- Ask questions
- Design investigations
- Collect, analyze, and interpret data
- Develop and use models
- Construct evidence-based arguments
- Define a design problem
- Apply knowledge to engineer solutions to a problem



What Students Know:
Disciplinary Core Ideas

Physical Science

- Matter and Its Interactions
- Motion and Stability; Forces and Interactions
- Energy
- Waves and Their Applications in Technologies for Information Transfer

Life Science

- From Molecules to Organisms: Structures and Processes
- Ecosystems: Interactions, Energy, and Dynamics
- Heredity: Inheritance and Variation of Traits
- Biological Evolution: Unity and Diversity

Earth Science

- Earth's Place in the Universe
- Earth's Systems
- Earth and Human Activity

Engineering, Technology, and Applicationon of Science

- *Engineering Design*

How Students Connect the Three Domains of Science:

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

Information is based on Next Generation Science Standards and the NJ Student Learning Standards for Science.

https://educatorpages.com/site/thesciencedive/pages/science-engineering-practices

What does the teacher do?

1. Identify relevant Disciplinary Core Idea for Unit (science) or Learning Objective (other disciplines)

Students who demonstrate understanding can:

HS-LS1-2. **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	**LS1.A: Structure and Function** • Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.	**Systems and System Models** • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

Connections to other DCIs in this grade-band: N/A

Articulation of DCIs across grade-bands:

MS.LS1.A

Common Core State Standards Connections:

ELA/Literacy -

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-LS1-2)*

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

The section entitled "Disciplinary Core Ideas" is reproduced verbatim from *A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas*. Integrated and reprinted with permission from the National Academy of Sciences.

What does the teacher do?

2. Finds an appropriate anchoring phenomenon for the storyline/unit. An anchoring phenomenon:
   a. is a complex, multi-faceted "puzzle"
   b. cannot be answered via a Google search
   c. has an explanation that is pieced together through many investigations, scientific principles, and evidence
3. Example of a phenomenon used this year: How do redwoods grow?

What does the teacher do?

3. Develops investigation/learning experience for students to model their understanding of the Disciplinary Core Idea (DCI). The learning experience:
   a. does not provide the answer or complete explanation for the phenomenon
   b. leads students to questions
   c. may already be something in your repertoire
   d. provides the opportunity for teacher to assess student understanding

What does the teacher do?

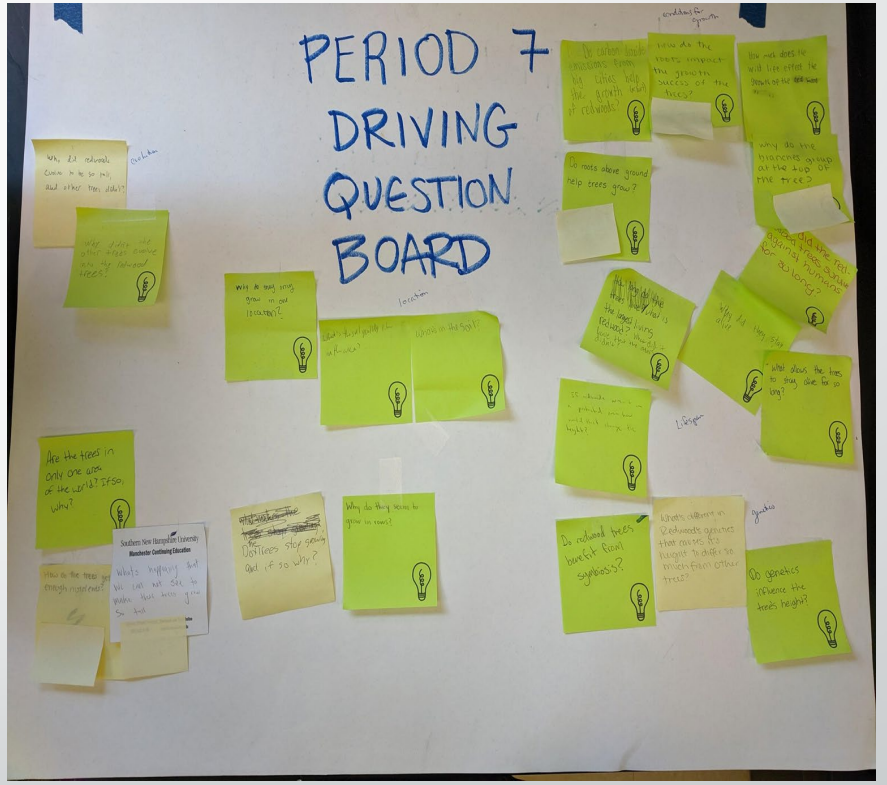
4. Prepare to use whiteboard and "talk moves" to facilitate learning
5. Works with students to develop and agree upon classroom norms

PERIOD 7 CLASSROOM NORMS:

1. Respect others' ideas and interests.
2. Be prepared for effective participation in the discussion using evidence to support your claims.
3. Stay focused.
4. Support your classmate's learning and don't be afraid to ask for help.

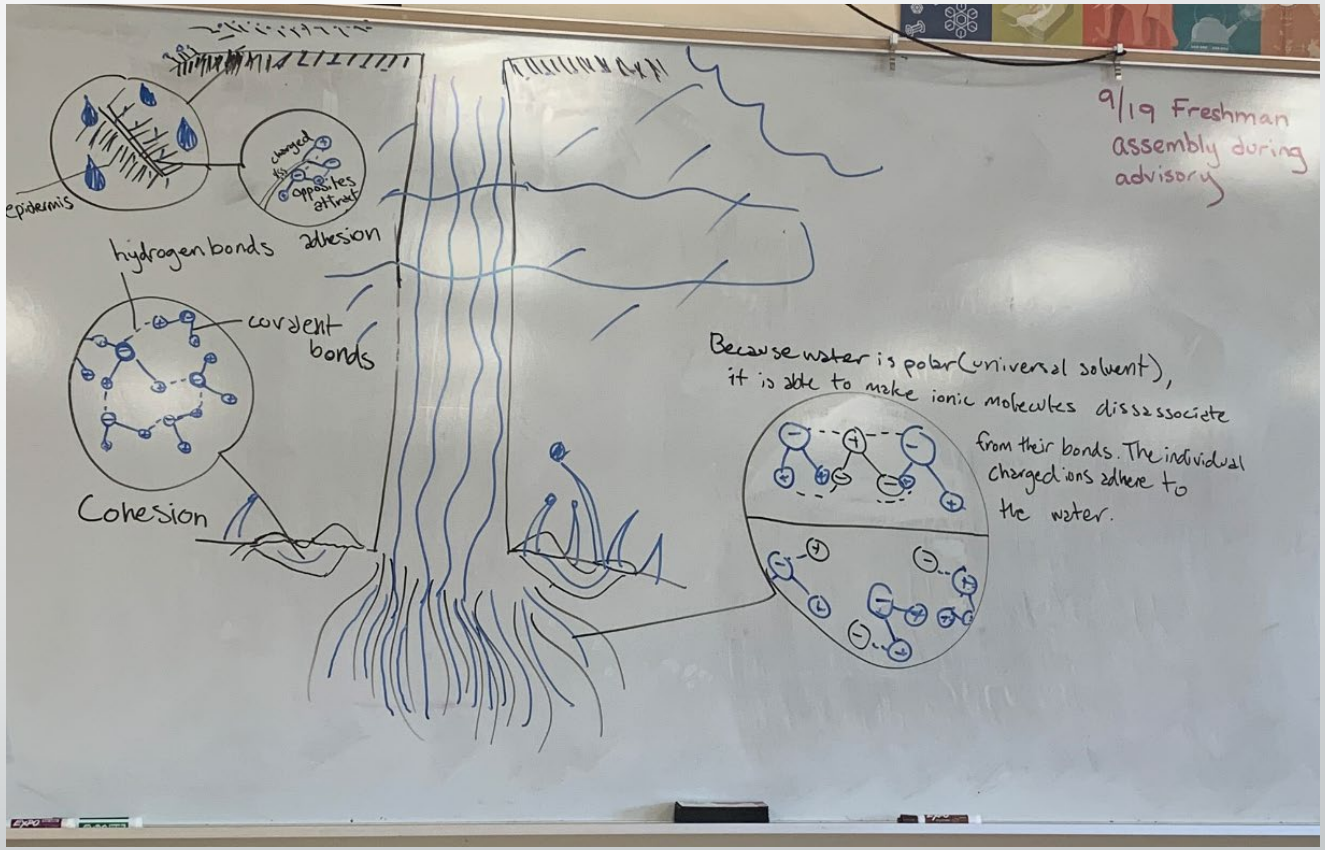
What does the teacher do?

5. Brings the class together to develop the "Driving Question Board":
   a. invites students to share the questions they wrote on the post-its
   b. attempts to group questions together into categories of concepts, indicating to students that the questions will provide the path for future learning



What does the teacher do?

6. You could bring students together as a class and ask for a volunteer to produce a "consensus model" on the board in which students assist in creating a class model of the question being investigated.



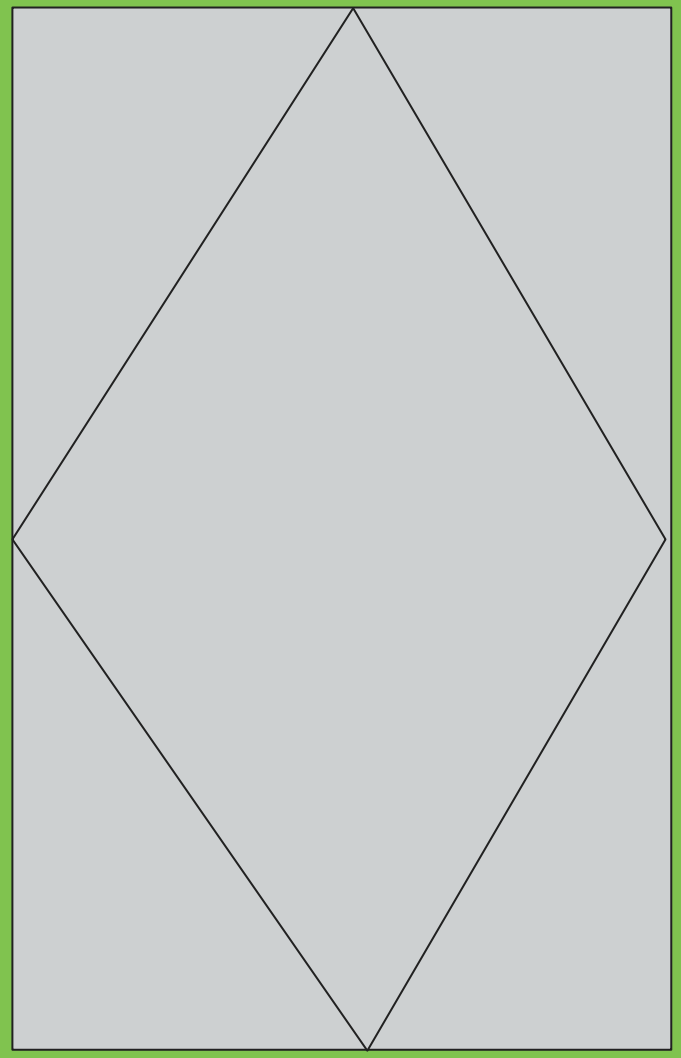
What does the teacher do?

7. Facilitates the completion of the Storyline Summary Board:
   a. allows students to reflect on their learning and consider future learning
   b. gives the structure for piecing together the puzzle explaining the anchor phenomenon
   c. lets you evaluate what they already know, what future learning experiences are needed to meet the learning objective or DCI

A	B	C	D	E
What did we do?	**What did we observe? What patterns did we notice?**	**What have we figured out?**	**How does this help us explain the phenomenon?**	**What questions do we have?**
How water & food coloring moves in flowers	Stem, leaves & petals turned the colors of the food coloring.	Water properties influence how water moves through the flowers. Water moves through the plant because of capillary action caused by polarity, cohesion & adhesion.	This helped us see the pattern for how water flows up a tree or plant. This helped us to see how the plant obtains nutrients because in this case the food coloring was like the nutrients (solutes).	What about the redwood makes it different from the flower? Does the shape of the leaf have anything to do with the difference?

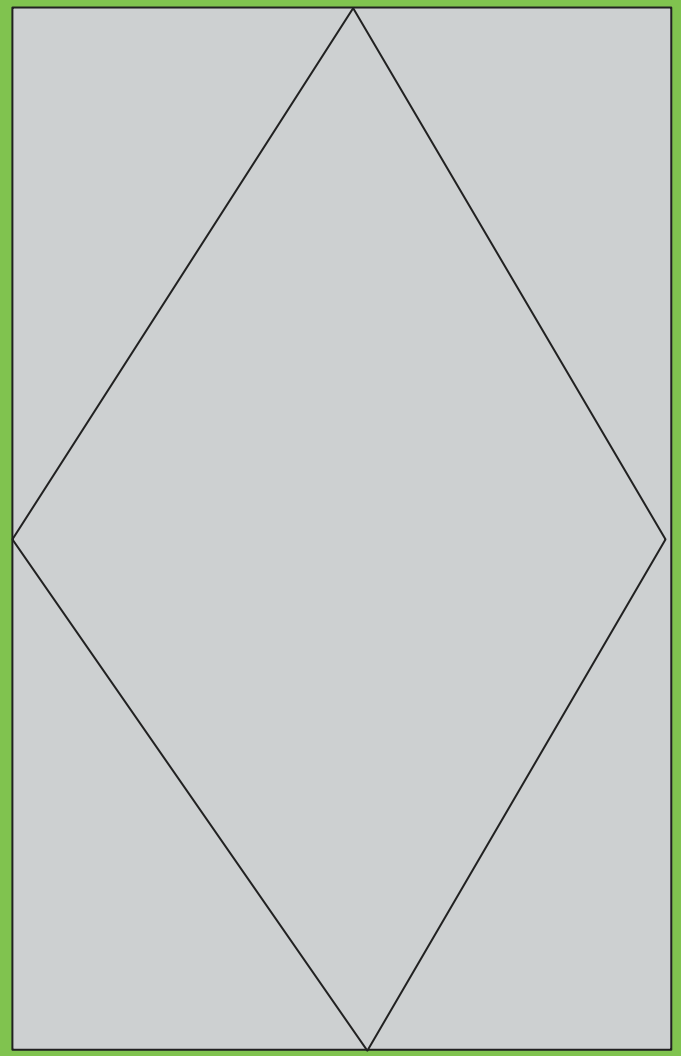
Now you are going to use an NGSX strategy to consider models you could use:

1. Draw a diamond/quadrilateral/rhombus on the whiteboard.
2. In your corner of the whiteboard, brainstorm a technique in your field that would allow students to build their own knowledge.
3. Include as much detail as you can in the time we give you.



Now you are going to collaborate to develop a group model of what this kind of classroom looks like:

1. In the center of your whiteboard, work together to produce a cohesive model of what would be happening in a classroom that uses these techniques.



“Gallery walk”: Take a few moments to walk around to see what the other groups have developed

1. Use the assessment tool provided to you to evaluate the products of other groups.
   a. What did the other group represent well?
   b. What did your group represent well?
   c. What would you add/subtract from your model if you were to do it again?

Resources for Science

NGSS Search Engine for DCI, CCC, and SEP with Clarification Statement

(scroll to bottom after putting in search criteria)

NGSS Hub for Information on Disciplinary Core Ideas (DCI)

Information on Talk Moves

#Project Phenomena Search Database

Help on Posting Daily Learning Objectives without Giving Away the Punchline

Tools for Choosing and Designing a Storyline