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@SanDiegoCOE

Using Phenomena to Drive NGSS Lessons

SDNI-NNCI Annual Educational Symposium 2020

bit.ly/SDCOE-NNCI

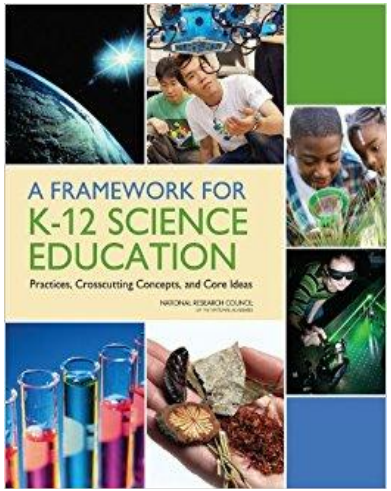
Scientific Phenomena Defined

Scientific phenomena are occurrences in the natural and human-made world that can be observed and which cause one to wonder and ask questions.

National Research Council

"The actual **doing of science** or engineering can pique students' curiosity, capture their interest, and motivate their continued study."

"Any education that focuses predominantly on the detailed products of scientific labor – the facts of science – without **developing an understanding of how those facts were established** or that ignores the many important applications of science in the world misrepresents science and marginalizes the importance of engineering."

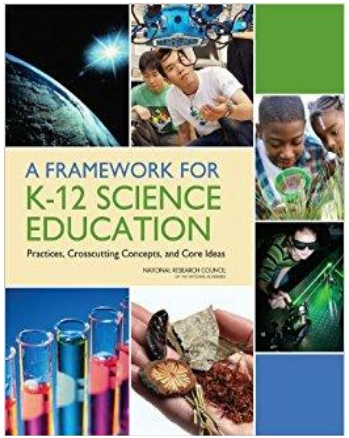


NRC Framework, 2012, p. 42, 43

Why is NGSS Important?

ALL students...

- have some appreciation of the beauty and wonder of science
- possess sufficient knowledge of science and engineering to engage in public discussion on related issues
- are careful consumers of scientific and technological information related to their everyday lives
- are able to continue to learn about science outside school
- have the skills to enter careers of their choice, including (but not limited to) careers in science, engineering, and technology."

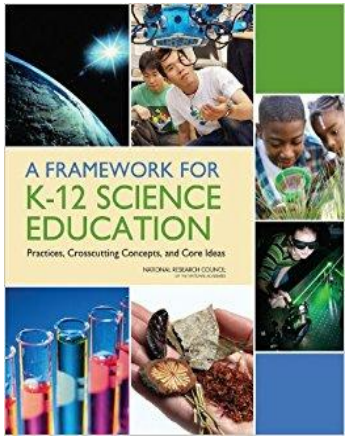


NRC Framework, 2012, p. 1

Why is NGSS Important?

"…a vision for education in the sciences and engineering in which students, over multiple years of school, actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields."

NRC Framework, 2012, p. 8



Three dimensions of the NGSS

Science and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts

- Patterns
- Cause and effect: Mechanism and explanation
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: Flows, cycles, and conservation
- Structure and function
- Stability and change

Disciplinary Core Ideas

Physical Sciences

PS1: Matter and its interactions
PS2: Motion and stability: Forces and interactions
PS3: Energy
PS4: Waves and their applications in technologies for information transfer

Life Sciences

LS1: From molecules to organisms: Structures and processes
LS2: Ecosystems: Interactions, energy, and dynamics
LS3: Heredity: Inheritance and variation of traits
LS4: Biological evolution: Unity and diversity

Earth and Space Science

ESS1: Earth's place in the universe
ESS2: Earth's systems
ESS3: Earth and human activity

Engineering, Technology, and Applications of Science

ETS1: Engineering design
ETS2: Links among engineering, technology, science, and society

Next Generation Science Standards

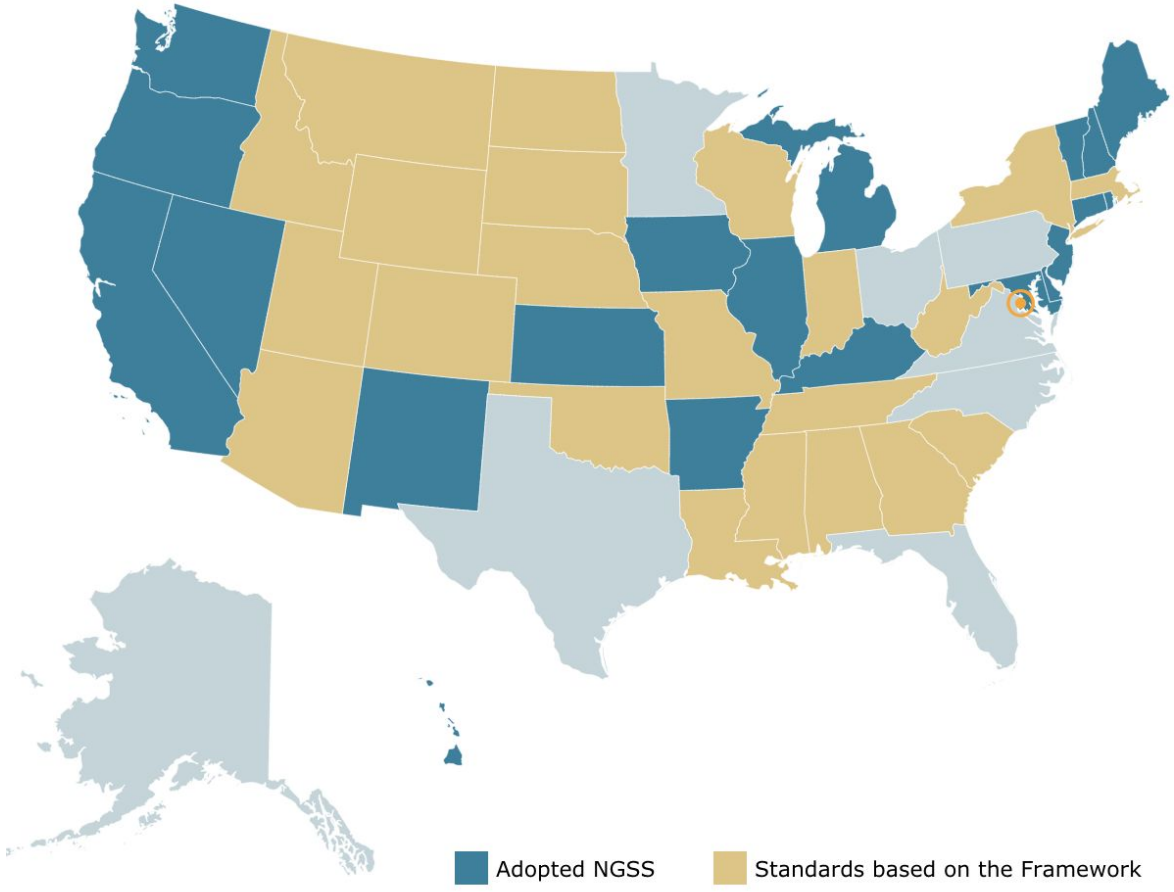
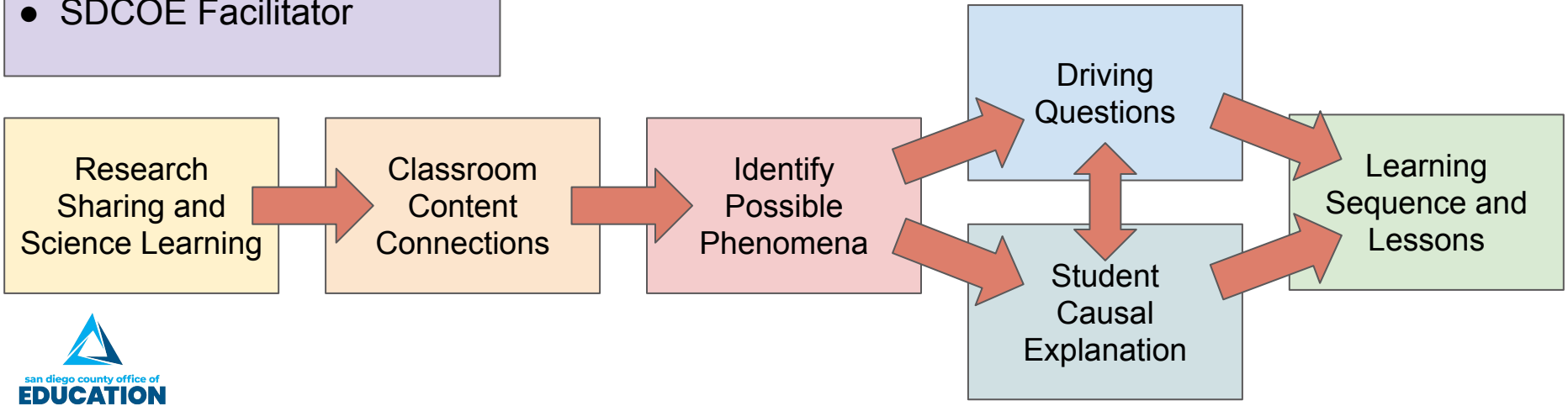


Image Source:
https://ngss.nsta.org/About.aspx

Design Team Approach

Design Team Organization

- Scientists and Experts
- Classroom Teachers
- SDCOE Facilitator



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Planning with Phenomena

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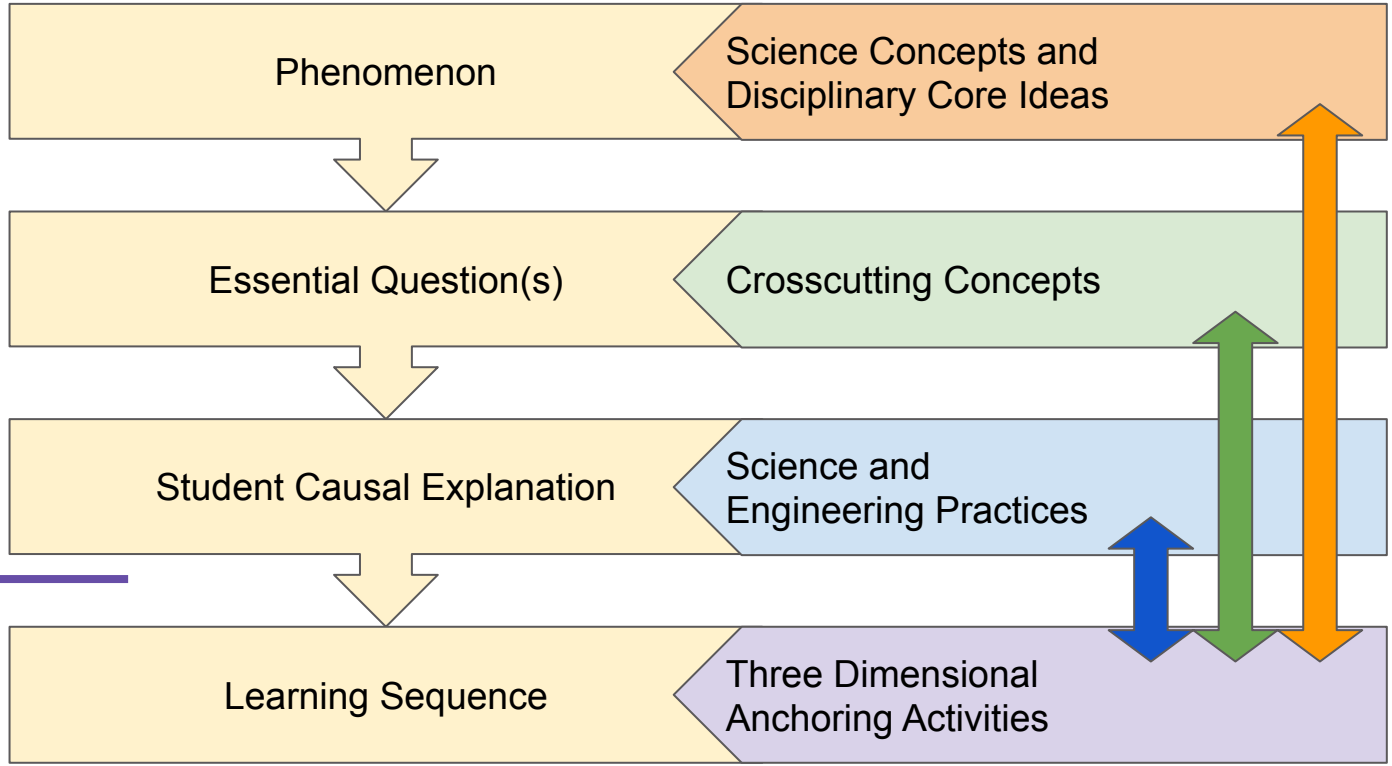
#ProjectPhenomena



Phenomena resources

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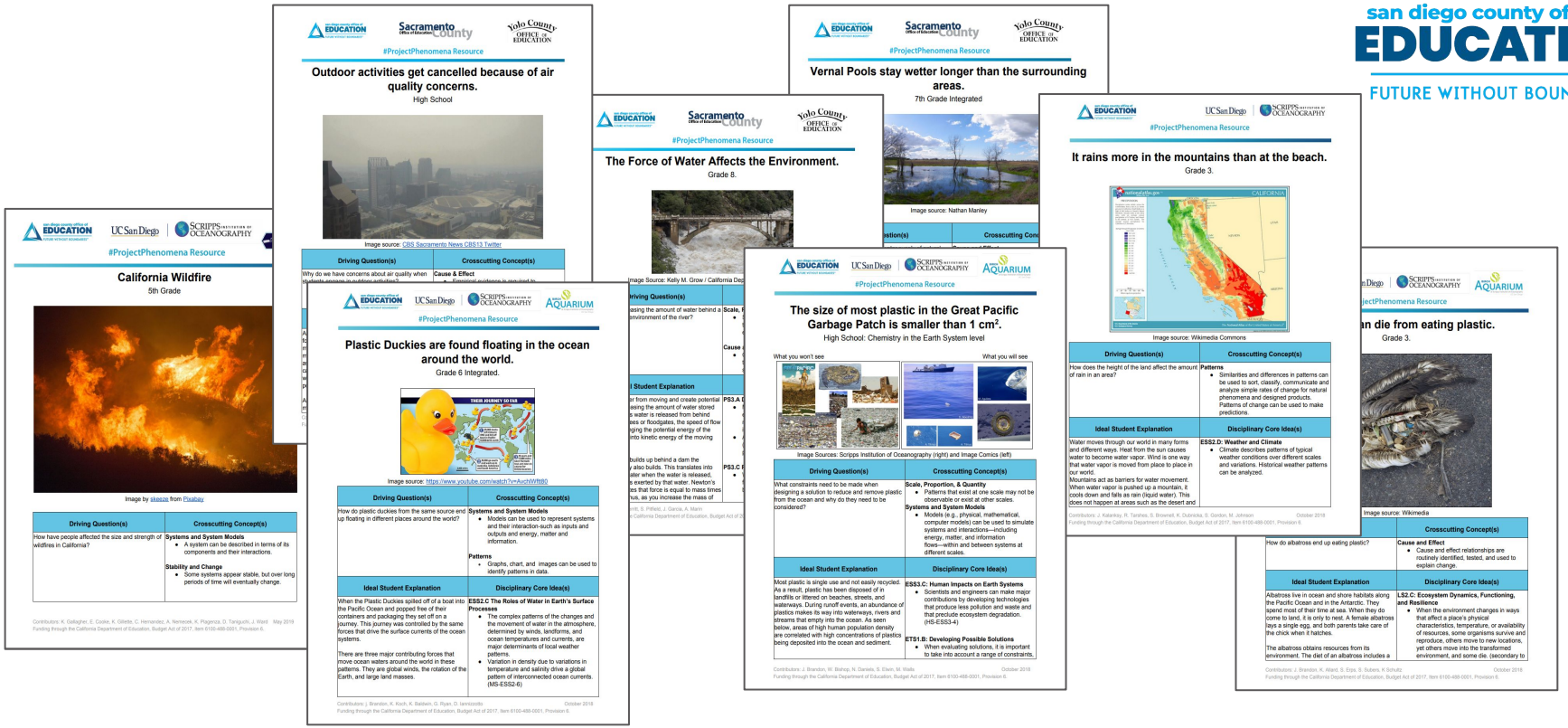

ngss.sdcoe.net (Environmental Literacy tab)

From Phenomenon to Lessons: Examples

Grade 8 - Sound

Anchoring Phenomenon:
Cochlear implants allow people to hear.

Driving Question:
How do the sound patterns in music get transferred to a cochlear implant?

Grade 8 - Forces and Energy

Anchoring Phenomenon:
A mantis shrimp uses a raptorial appendage to strike and break a shell.

Driving Question:
How is a mantis shrimp able to use its raptorial appendage to break a shell?

Grade 7: Ecosystems

Anchoring Phenomenon:
The population of wolverines, who used to live throughout the Sierra Nevada Mountains, has declined and are now exceedingly rare.

Driving Question:
How do the interactions of different populations of organisms in an ecosystem cause organisms like the wolverine to decline in population?

Biology: Genetics

Anchoring Phenomenon:
Genetically, 0.5% (a half of a percent!) of your DNA makes *you* uniquely *you*.

Driving Questions:
What does it mean to be human? How does our DNA make us human? How does DNA make each human unique?

Physics: Galaxies Collide

Anchoring Phenomenon:
Galaxies in the universe interact with each other and sometimes collide.

Driving Questions:
How do galaxies interact with each other when they collide? What evidence do scientists use to understand the interactions of objects in the universe?

Physics: Energy and Electricity

Anchoring Phenomenon:
The electric grid is the means through which power is generated, transmitted, and distributed to consumers.

Driving Questions:
How do power plants convert energy to generate electricity? In what ways does pollution contribute to public health and environmental issues?

Other lesson modules can be found at: **bit.ly/SDCOE-Learn**

Questions?

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