

NGSS in K-8

Brookfield Public Schools



Smithsonian

SCIENCE
for the classroom



Smithsonian
Science Education Center

Thanks to:

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Evolution of Science Instruction: 3 Stage Metamorphosis

| | | |
|---|--|--|
| <p>Science = Words on a page + Images</p> <p>Problem: There were no gateway experiences</p> | <p>Science = Object-Based Learning: A good step forward!</p> <ul style="list-style-type: none">•Opportunities to engage w/physical objects in order to better : <ol style="list-style-type: none">1. Understand the properties of objects2. Construct learning based on perceptions of objects <p>Problem: Objects were removed from real-life phenomenon</p> | <p>Science = Phenomenon- based Learning</p> <p>Put the object (water) in a broader context and ask students to answer complex problems using the science.</p> |
|---|--|--|

Science = Textbook



Science = Water

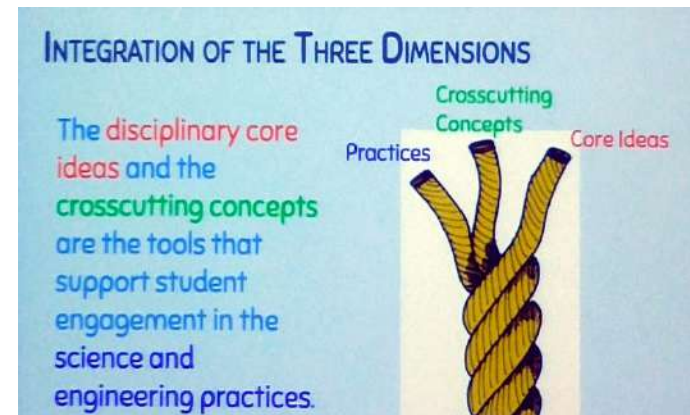


**We provide the SCIENCE
(water) and ask engaging
questions of the phenomenon**



NGSS Innovations

- **Explaining Phenomena & Designing Solutions:** Making sense of phenomena or designing solutions to problems drives student learning. Science education should reflect science as it is practiced and experienced in the real world.
- **Three Dimensional Learning:** Students making sense of phenomena or designing of solutions to problems *requires* student performances that integrate elements of the SEPs, CCCs, and DCIs in instruction and assessment.
 - All three dimensions valued
 - Three dimensions integrated
 - 3D Instruction and Assessment



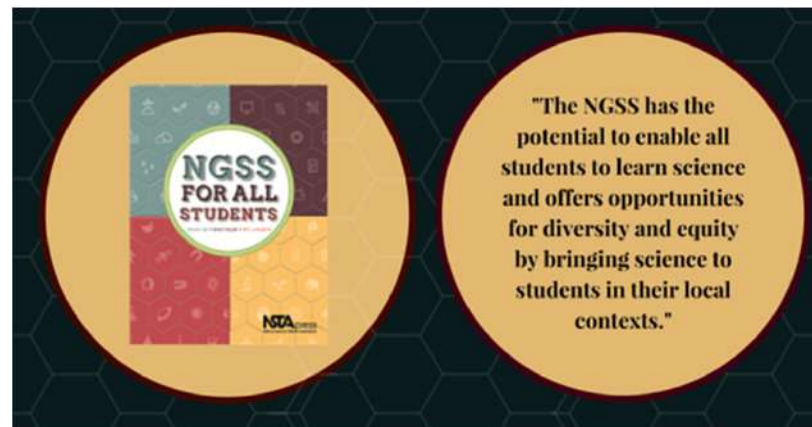
NGSS Innovations

- **Building K-12 Progressions:** Student three dimensional learning experiences are coordinated and coherent over time to ensure students build understanding of *all three dimensions* of the standards, the Nature of Science (NOS), and Engineering as expected by the standards.
- **Alignment with English Language Arts and mathematics:** Students engage in learning experiences with explicit connections to and alignment with English language arts (ELA) and mathematics.

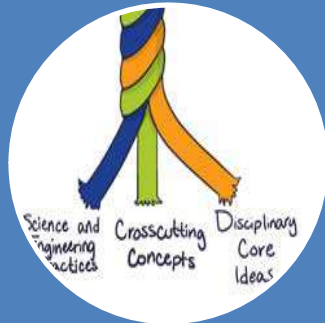


NGSS Innovations

- **All Standards, All Students:** These standards are designed to provide equitable opportunity to learn for all students to be productive citizens, not just a list of science information for those pursuing science-related careers.



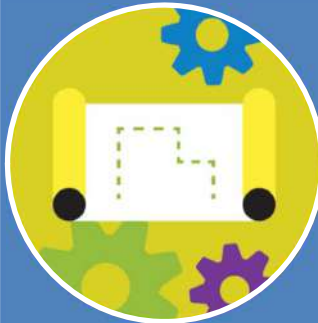
Five key innovations



K–12 science education reflects three-dimensional learning



Explaining phenomena and designing solutions



Incorporate engineering design and the nature of science



Build coherent learning progressions from kindergarten to grade 12



Connect to English language arts (ELA) and mathematics

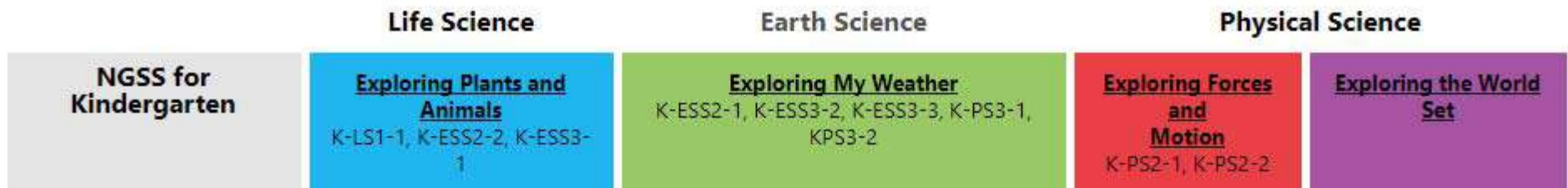


NGSS Instruction for Kindergarten from the Smithsonian, Rooted in Real-World Phenomena

Seeing and experiencing is believing, and learning! For kindergarteners, science phenomena IS the world around them. The Smithsonian's STC-Kindergarten utilizes children's natural curiosity and 3-dimensional learning to build cohesive, 15- to 20-minute lessons that meet the spirit and intent of NGSS.



STC-Kindergarten™ Learning Framework



| Life Science | Earth and Space Science | Physical Science | Engineering Design |
|--|---|--|---|
| Grade 1 | | | |
| How Do Animal Parents Keep Their Babies Safe? 1-LS1-1 • 1-LS1-2 • 1-LS3-1 • K-2-ETS1-1 Supporting: Engineering Design | Is a Day Always the Same Length? 1-ESS1-1 • 1-ESS1-2 • 1-PS4-2 Supporting: Physical Science | How Can We See Things in the Dark? 1-PS4-2 • 1-PS4-3 • 1-LS1-1 • K-2-ETS1-1 Supporting: Life Science and Engineering Design | How Can We Send a Message Using Sound? K-2-ETS1-1 • K-2-ETS1-2 • K-2-ETS1-3 • 1-PS4-1 • 1-PS4-4 Supporting: Physical Science |
| Grade 2 | | | |
| How Do Plants and Animals Need Each Other? 2-LS2-1 • 2-LS4-1 • 2-LS2-2 • K-2-ETS1-1 Supporting: Engineering Design | What Can Maps Tell Us About Water on Earth? 2-ESS2-2 • 2-ESS2-3 • 2-PS1-1 Supporting: Physical Science | How Do Heating and Cooling Change Things? 2-PS1-1 • 2-PS1-2 • 2-PS1-3 • 2-PS1-4 • K-2-ETS1-1 Supporting: Engineering Design | How Can We Stop Soil From Washing Away? K-2-ETS1-1 • K-2-ETS1-2 • K-2-ETS1-3 • 2-ESS2-1 • 2-ESS1-1 Supporting: Earth and Space Science |
| Grade 3 | | | |
| What Explains Similarities and Differences Between Organisms? 3-LS1-1 • 3-LS3-1 • 3-LS3-2 • 3-LS4-2 • 3-ESS2-2 Supporting: Earth and Space Science | How Do Weather and Climate Affect Our Lives? 3-ESS2-1 • 3-ESS2-2 • 3-ESS3-1 • 3-5-ETS1-1 Supporting: Engineering Design | How Can We Predict Patterns of Motion? 3-PS2-1 • 3-PS2-2 • 3-PS2-3 • 3-PS2-4 • 3-5-ETS1-1 Supporting: Engineering Design | How Can We Protect Animals When Their Habitat Changes? 3-5-ETS1-1 • 3-5-ETS1-2 • ETS1-3 • 3-LS4-1 • 3-LS2-1 • 3-LS4-3 • 3-LS4-4 Supporting: Life Science |
| Grade 4 | | | |
| How Can Animals Communicate with Light and Sound? 4-LS1-1 • 4-LS1-2 • 4-PS4-1 • 4-PS4-2 • 4-PS4-3 • 3-5-ETS1-1 Supporting: Physical Science and Engineering Design | How Is the Ring of Fire Evidence of a Changing Earth? 4-ESS1-1 • 4-ESS2-1 • 4-ESS2-2 • 4-ESS3-2 • 3-5-ETS1-1 Supporting: Engineering Design | How Does Motion Energy Change in a Collision? 4-PS3-1 • 4-PS3-3 • 4-LS1-1 • 3-5-ETS1-1 Supporting: Life Science and Engineering Design | How Can We Provide Energy to People's Homes? 3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 4-PS3-4 • 4-PS3-2 • 4-ESS3-1 Supporting: Physical Science and Earth and Space Science |
| Grade 5 | | | |
| How Can We Predict Change in Ecosystems? 5-LS1-1 • 5-LS2-1 • 5-PS3-1 Supporting: Physical Science | How Can the Sky Be Used to Navigate? 5-ESS1-1 • 5-ESS1-2 • 5-PS2-1 • 3-5-ETS1-1 Supporting: Physical Science and Engineering Design | What Happens When Materials Are Mixed? 5-PS1-1 • 5-PS1-2 • 5-PS1-3 • 5-PS1-4 • 5-LS2-1 Supporting: Life Science | How Can We Provide Freshwater to Those in Need? 3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 5-ESS2-1 • 5-ESS2-2 • 5-ESS3-1 Supporting: Earth and Space Science |

STCMS™ Learning Framework

| | Physical Science | Life Science | Earth/Space Science |
|-----------------------|---|---|--|
| Grades 6–8 | <u>Energy, Forces, and Motion</u> MS-PS2-1, MS-PS2-2, MS-PS2-3, MS-PS2-5, MS-PS3-1, MSPS3-2, MS-PS3-5, ETS1-1, ETS1-2, ETS1-3, ETS1-4 | <u>Ecosystems and Their Interactions</u> MS-LS1-5, MS-LS1-6, MS-LS1-7, MS-LS2-1, MS-LS2-2, MS-LS2-3, MS-LS2-4, MS-LS2-5, MS-LS4-4, MS-LS4-6, MS-ESS3-3, ETS1-1, ETS1-2 | <u>Weather and Climate Systems</u> MS-ESS2-4, MS-ESS2-5, MS-ESS2-6, MS-ESS3-2, MS-ESS3-4, MS-ESS3-5, PS3-4, ETS1-1, ETS1-2 |
| | <u>Matter and Its Interactions</u> MS-PS1-1, MS-PS1-2, MS-PS1-3, MS-PS1-4, MS-PS1-5, MSPS1-6, ETS1-1, ETS1-2, ETS1-3, ETS1-4 | <u>Structure and Function</u> MS-LS1-1, MS-LS1-2, MS-LS1-3, MS-LS1-6, MS-LS1-7, MS-LS1-8, MS-LS4-2, MS-LS4-3 | <u>Earth's Dynamic Systems</u> MS-LS4-1, MS-ESS1-4, MS-ESS2-1, MS-ESS2-2, MS-ESS2-3, MS-ESS3-1, MS-ESS3-2, ETS1-1, ETS1-2, ETS1-3, ETS1-4 |
| | <u>Electricity, Waves, and Information Transfer</u> MS-LS1-8, MS-PS2-3, MS-PS3-3, MS-PS3-5, MS-PS4-1, MS-PS4-2, MS-PS4-3, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4 | <u>Genes and Molecular Machines</u> MS-LS1-1, MS-LS1-4, MS-LS3-1, MS-LS3-2, MS-LS4-4, MS-LS4-5 | <u>Space Systems Exploration</u> MS-PS2-4, MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4 |

Each module/unit takes 1/3 of the school year

Unit Overview

- Essential Questions
- Big Ideas
- Concepts and Practices *Storyline*
- 10 Lessons per unit
 - Design challenge performance tasks are built into units (Lessons 9 & 10)
 - Lessons are:
 - 30 minutes (doable)
 - Hands-on
 - *Most* materials are provided
 - Connections to CCSS ELA & Math

Bundle the standards

Students who demonstrate understanding can:

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Students who demonstrate understanding can:

- 2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*
[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

Students who demonstrate understanding can:

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]

How Can We Stop Soil From Washing Away?

K-2-ETS1-1 • K-2-ETS1-2 •
K-2-ETS1-3 • 2-ESS2-1 •
2-ESS1-1

Supporting: Earth and
Space Science



Smithsonian
Science Education Center

Pilot Opportunity

- **Grades K-8**
- **Two classes**
- **One module**
- **All materials**
- **On site PD**
- **NO Charge**
- **Spring 2018**

**“In the face of overwhelming odds,
I’m left with only one option:**

•

I'm gonna have to science the
\$#!% out of this!"

Matt Damon as Mark Watney
The Martian (2015)

No random acts of science!