# Great Minds® was founded on the belief that *every* child is capable of greatness.

To help them achieve it, children need access to high-quality, knowledge-building curricula. They need an approach to learning that takes them beyond the rote memorization that education publishers have relied on for years.

Answering the call for a new science curriculum to support the needed pedagogical changes, our teacher–writers and experts created *PhD Science*®, a phenomenon-based program in which teachers facilitate the learning, but students own it. With *PhD Science*, students rigorously engage in learning that coherently builds their understanding of science.

- **Knowledge Building:** Through hands-on investigations and evidence-based learning, students develop a deep, lasting understanding of science concepts that they can apply far beyond the anchor phenomenon of each module.
- **Coherent Storyline:** Each lesson builds on the lessons before it, so students develop their understanding of science concepts in the context of the anchor phenomenon.
- **Rigorous Engagement:** Students actively engage in a learning cycle of asking questions and sharing initial ideas about phenomena they study, investigating those questions, developing evidence-based explanations, and transferring their new knowledge to explain different phenomena. Supported by differentiation strategies the curriculum provides, all students engage with rigorous content through hands-on investigations, collaborative conversations, and analysis of authentic texts and media.

**Activity Before Concept, Concept Before Terminology**

Rather than simply memorizing definitions, *PhD Science* students develop deep, lasting comprehension of scientific concepts through hands-on investigations and evidence-based learning about the phenomena they are exploring *before* they learn related terminology.

# Three-Dimensional Teaching and Learning with Every Lesson

With *PhD Science*, students build understanding of Disciplinary Core Ideas (DCIs) by engaging in Science and Engineering Practices (SEPs) and applying the lens of Crosscutting Concepts (CCs). Through inquiry and three-dimensional learning, students build enduring knowledge across science domains.

Simply representing the three dimensions in each lesson does not constitute three-dimensional learning. Three-dimensional teaching and integration can only occur when the three dimensions are applied in concert to explain a phenomenon or solve a problem.

| CONTENT STAGES | STUDENT ACTIONS AND CORRESPONDING SCIENCE AND ENGINEERING PRACTICES | Strongly Related 7E Phases* |
|---|---|---|
| WONDER | • Observe a rich phenomenon and generate questions.<br>• Connect prior understanding to the phenomenon. (SEP.1) | Elicit<br>Engage |
| ORGANIZE | • Develop an initial explanation of the phenomenon.<br>• Focus on a question to investigate. (SEP.2 and SEP.6) | Explore |
| REVEAL | • Explore the question through investigation.<br>• Analyze data to gather evidence relevant to the question. (SEP.3–5) | Explore |
| DISTILL | • Apply evidence and reasoning to revise the explanation of the phenomenon.<br>• Communicate new knowledge. Compare and synthesize with prior understanding and other information. (SEP.2 and SEP.6–8) | Explain |
| KNOW | • Generate new questions.<br>• Apply knowledge to explain a different phenomenon or to solve a problem in a different context.<br>• Connect knowledge across contexts to develop fundamental science conceptual understanding. (SEP.1 and SEP.6) | Elaborate<br>Extend |
| ALL | | Evaluate |

*Although the Elicit and Engage phases both relate to the Wonder stage and the Elaborate and Extend phases both relate to the Know stage, each 7E phase includes unique elements that should not be conflated in instruction.

## The *PhD Science* Approach to the Learning Cycle

Throughout each module, students engage in the learning cycle to make sense of and explain authentic phenomena.

They begin each module by generating questions and developing an initial explanation of the anchor phenomenon. Then students investigate various supporting phenomena to better understand the anchor phenomenon. Students periodically return to the anchor phenomenon to revise their explanation by applying evidence gathered through their investigations and data analysis.

At the end of the module, students participate in a Socratic Seminar to reflect on the conceptual understanding they have developed and used to explain multiple phenomena. Students transfer that knowledge to explain a new phenomenon in the End-of-Module Assessment.

The table on the left shows how particular student actions, Science and Engineering Practices, and the 7E phases relate to each stage of the *PhD Science* learning cycle.

PhD SCIENCE

*Inspiring* students to wonder about the world and *empowering* them to makes sense of it.

| LEVEL | | MODULE 1 | MODULE 2 | MODULE 3 | MODULE 4 |
|---|---|---|---|---|---|
| K | Title | Weather | Pushes and Pulls | Life | Environments |
| | Anchor Phenomenon | Cliff Dwellings at Mesa Verde | Tugboats Moving Cargo Ships | Life in the Mojave Desert | Life in a Longleaf Pine Forest |
| | Essential Question | *How did the cliff dwellings at Mesa Verde protect people from the weather?* | *How do tugboats move cargo ships through a Harbor?* | *How is Mara different from the Wonderland of Rocks?* | *Why are gopher tortoises disappearing?* |
| | Performance Expectations | K-ESS2-1<br>K-ESS3-2<br>K-PS3-1<br>K-PS3-2<br>K–2-ETS1-1 | K-PS2-1<br>K-PS2-2<br>K–2-ETS1-2 | K-LS1-1<br>K-ESS3-1 | K-ESS2-2<br>K-ESS3-3<br>K–2-ETS1-3 |
| | Instructional Text(s) | *Snow Day!* | *Tugboat* | *A Day and Night in the Desert* | *At Home with the Gopher Tortoise: The Story of a Keystone Species* |
| 1 | Title | Survival | Light | Sound | Sky |
| | Anchor Phenomenon | Life at a Pond | Wayang Shadow Puppetry | The Recycled Orchestra of Cateura | Polynesian Navigation |
| | Essential Question | *How do pond plants and pond animals survive in their environment?* | *How do puppeteers use light to tell stories during wayang shows?* | *How does the Recycled Orchestra make music?* | *How did the Polynesians use observations of the Sun, stars, and the Moon to navigate from island to island?* |
| | Performance Expectations | 1-LS1-1<br>1-LS1-2<br>1-LS3-1<br>K–2-ETS1-1 | 1-PS4-2<br>1-PS4-3 | 1-PS4-1<br>1-PS4-4<br>K–2-ETS1-2<br>K–2-ETS1-3 | 1-ESS1-1<br>1-ESS1-2 |
| | Instructional Text(s) | *Over and Under the Pond* | *Blackout* | *Moses Goes to a Concert* | *Island Below the Star: How the First People Came to Hawai'i* |
| 2 | Title | Matter | Earth Changes | Plants | Biomes |
| | Anchor Phenomenon | Birds Building Nests | Transformation of Surtsey | Plant Recovery Around Mount St. Helens | Environments on and below Mount Everest |
| | Essential Question | *Why do different kinds of birds use certain materials to build their nests?* | *How can the island of Surtsey change shape over time?* | *How did local plants recover after the eruption of Mount St. Helens?* | *Why do so many kinds of plants and animals live below Mount Everest but so few live on it?* |
| | Performance Expectations | 2-PS1-1<br>2-PS1-4<br>2-PS1-2<br>2-PS1-3<br>K–2-ETS1-1 | 2-ESS1-1<br>2-ESS2-1<br>K–2-ETS1-3 | 2-LS2-1<br>2-LS2-2<br>K–2-ETS1-2 | 2-LS4-1<br>2-ESS2-2<br>2-ESS2-3 |
| | Instructional Text(s) | *A Nest Is Noisy* \| *The Crayon Man: The True Story of the Invention of Crayola Crayons* | *Life on Surtsey: Iceland's Upstart Island* \| *World Traveler: The Sphinx* \| *An Island Grows* | *Seeds Move!* \| *Volcano: The Eruption and Healing of Mount St. Helens* | *Beastly Biomes* \| *World of Wonder: Mountains* |

**Physical Science Focus** **Earth Science Focus** **Life Science Focus**

**PhD SCIENCE®**

*Inspiring* students to wonder about the world and *empowering* them to makes sense of it.

| LEVEL | | MODULE 1 | MODULE 2 | MODULE 3 | MODULE 4 |
|---|---|---|---|---|---|
| 3 | **Title** | Weather and Climate | Survival | Traits | Forces and Motion |
| | **Anchor Phenomenon** | 1900 Galveston Hurricane | Butterfly Survival | Individual Variation in Humpback Whales | Motion in Space |
| | **Essential Question** | *How can we prevent a storm from becoming a disaster?* | *How do butterflies survive over time in a changing environment?* | *What makes an individual humpback whale unique?* | *Why do objects move differently in space than they do on Earth?* |
| | **Performance Expectations** | 3-ESS2-1 3-ESS2-2 3-ESS3-1 3–5-ETS1-1 | 3-LS2-1 3-LS4-1 3-LS4-3 3-LS4-4 3–5-ETS1-2 | 3-LS1-1 3-LS3-1 3-LS3-2 3-LS4-2 | 3-PS2-1 3-PS2-2 3-PS2-3 3-PS2-4 3–5-ETS1-3 |
| | **Instructional Text(s)** | *Hurricanes!* \| *Tornadoes!* \| *Marvelous Mattie: How Margaret E. Knight Became an Inventor* | *A Butterfly is Patient* \| *Amos & Boris* | *Here Come the Humpbacks!* | *Moonshot: The Flight of Apollo 11* |
| 4 | **Title** | Earth Features | Energy | Sense and Response | Light |
| | **Anchor Phenomenon** | Formation of the Grand Canyon's Features | Windmills at Work | Elephants Sensing Distant Rainstorms | Visibility of and Communication to Howland Island |
| | **Essential Question** | *How did the Grand Canyon's features form?* | *How do windmills change wind to light?* | *How do elephants sense rainstorms from more than 100 miles away?* | *Why didn't Amelia Earhart complete her journey?* |
| | **Performance Expectations** | 4-ESS1-1 4-ESS2-1 4-ESS2-2 4-ESS3-1 4-ESS3-2 3–5-ETS1-2 | 4-PS3-1 4-PS3-2 4-PS3-3 4-PS3-4 3–5-ETS1-1 | 4-LS1-1 4-LS1-2 4-PS4-1 | 4-PS4-2 4-PS4-3 3–5-ETS1-2 3–5-ETS1-3 |
| | **Instructional Text(s)** | *Grand Canyon* \| *Who Were the Wright Brothers?* | *The Boy Who Harnessed the Wind* | *The Elephant Scientist* | *Amelia Lost: The Life and Disappearance of Amelia Earhart* |
| 5 | **Title** | Matter | Ecosystems | Earth Systems | Orbit and Rotation |
| | **Anchor Phenomenon** | Changes to the Statue of Liberty's Appearance | Life Around a Mangrove Tree | Balinese Rice Farming | Views from Earth and Space |
| | **Essential Question** | *What caused the Statue of Liberty to change over time?* | *How can trees support so much life?* | *How has Balinese rice farming endured for 1,000 years?* | *How can we explain our observations of the Sun, the Moon, and stars from Earth?* |
| | **Performance Expectations** | 5-PS1-1 5-PS1-2 5-PS1-3 5-PS1-4 3–5-ETS1-3 | 5-LS1-1 5-LS2-1 5-PS3-1 3–5-ETS1-1 | 5-ESS2-1 5-ESS2-2 5-ESS3-1 3–5-ETS1-2 | 5-ESS1-1 5-ESS1-2 5-PS2-1 |
| | **Instructional Text(s)** | *Statue of Liberty: A Tale of Two Countries* | *The Mangrove Tree: Planting Trees to Feed Families* \| *Living Sunlight* | *Cycle of Rice, Cycle of Life* \| *The Buffalo Are Back* | *Look to the Stars* \| *Look Up! Henrietta Leavitt, Pioneering Woman Astronomer* |

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Learn more at greatminds.org/science