PhD SCIENCE®

# The Journey to *knowledge*

Walk Through the Student Learning Experience

GREAT MINDS™

Every child is curious.

Every child has an active imagination.

Every child wants to learn.

At Great Minds®, we empower children with one of the most equalizing forces of all: *knowledge*.

With knowledge, they can do anything they set their minds to.

**Every child is capable of greatness.**

# Knowledge is *sticky*.

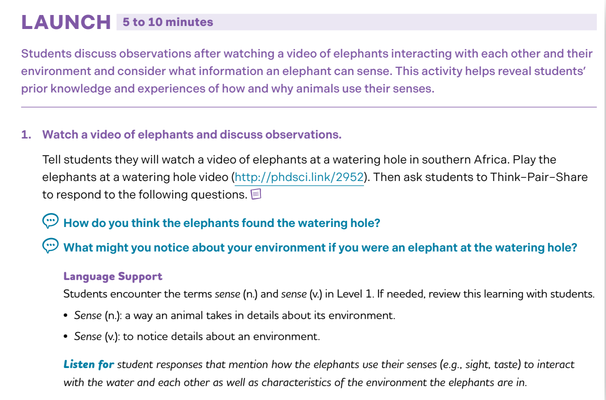
High-quality, knowledge-rich instructional materials are found to improve student learning where skills and strategies alone fail. Why? Because when students can build on a developing integrated body of knowledge, learning is simpler, less susceptible to errors, and less likely to be forgotten.

**What does a knowledge-building curriculum look like?**

It looks like students engaging with fine art and the history of math as they learn long division. English language arts (ELA) students learning about the circulatory system or the American west while they learn to write research-based informative essays. And young scientists reading about the journey of Amelia Earhart's flight to Howland Island as they learn about light, sight, and communication systems.

# Curriculum design is important to building *knowledge*.

Our curricula were developed with cognitive science research and learning sciences research guiding the instructional design. Each of our curricula intentionally follows a Launch, Learn, Land lesson structure to create the cognitive conditions that are optimal for student learning, retention of information, and building enduring knowledge.

**LAUNCH** 5 to 10 minutes

Students discuss observations after watching a video of elephants interacting with each other and their environment and consider what information an elephant can sense. This activity helps reveal students' prior knowledge and experiences of how and why animals use their senses.

1. **Watch a video of elephants and discuss observations.**

   Tell students they will watch a video of elephants at a watering hole in southern Africa. Play the elephants at a watering hole video (http://phdsci.link/2952). Then ask students to Think–Pair–Share to respond to the following questions.

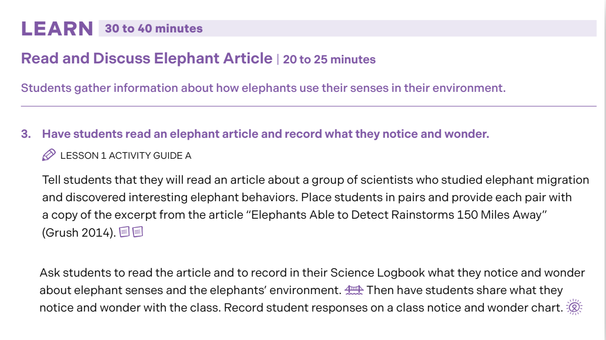
   **How do you think the elephants found the watering hole?**

   **What might you notice about your environment if you were an elephant at the watering hole?**

   **Language Support**
   Students encounter the terms *sense* (n.) and *sense* (v.) in Level 1. If needed, review this learning with students.
   - *Sense* (n.): a way an animal takes in details about its environment.
   - *Sense* (v.): to notice details about an environment.

   ***Listen for*** *student responses that mention how the elephants use their senses (e.g., sight, taste) to interact with the water and each other as well as characteristics of the environment the elephants are in.*

**LAUNCH** introduces the topic and activates prior knowledge.



**LEARN** 30 to 40 minutes

**Read and Discuss Elephant Article** | 20 to 25 minutes

Students gather information about how elephants use their senses in their environment.

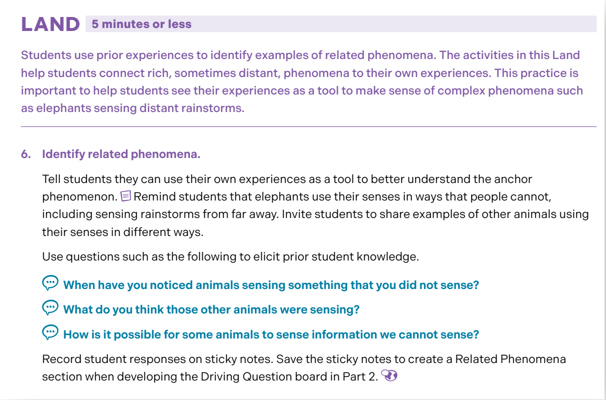
3. **Have students read an elephant article and record what they notice and wonder.**

   LESSON 1 ACTIVITY GUIDE A

   Tell students that they will read an article about a group of scientists who studied elephant migration and discovered interesting elephant behaviors. Place students in pairs and provide each pair with a copy of the excerpt from the article "Elephants Able to Detect Rainstorms 150 Miles Away" (Grush 2014).

   Ask students to read the article and to record in their Science Logbook what they notice and wonder about elephant senses and the elephants' environment. Then have students share what they notice and wonder with the class. Record student responses on a class notice and wonder chart.

**LEARN** engages students in accessing new knowledge, building on previous knowledge, and sharing what they have learned.



**LAND** 5 minutes or less

Students use prior experiences to identify examples of related phenomena. The activities in this Land help students connect rich, sometimes distant, phenomena to their own experiences. This practice is important to help students see their experiences as a tool to make sense of complex phenomena such as elephants sensing distant rainstorms.

6. **Identify related phenomena.**

   Tell students they can use their own experiences as a tool to better understand the anchor phenomenon. Remind students that elephants use their senses in ways that people cannot, including sensing rainstorms from far away. Invite students to share examples of other animals using their senses in different ways.

   Use questions such as the following to elicit prior student knowledge.

   **When have you noticed animals sensing something that you did not sense?**

   **What do you think those other animals were sensing?**

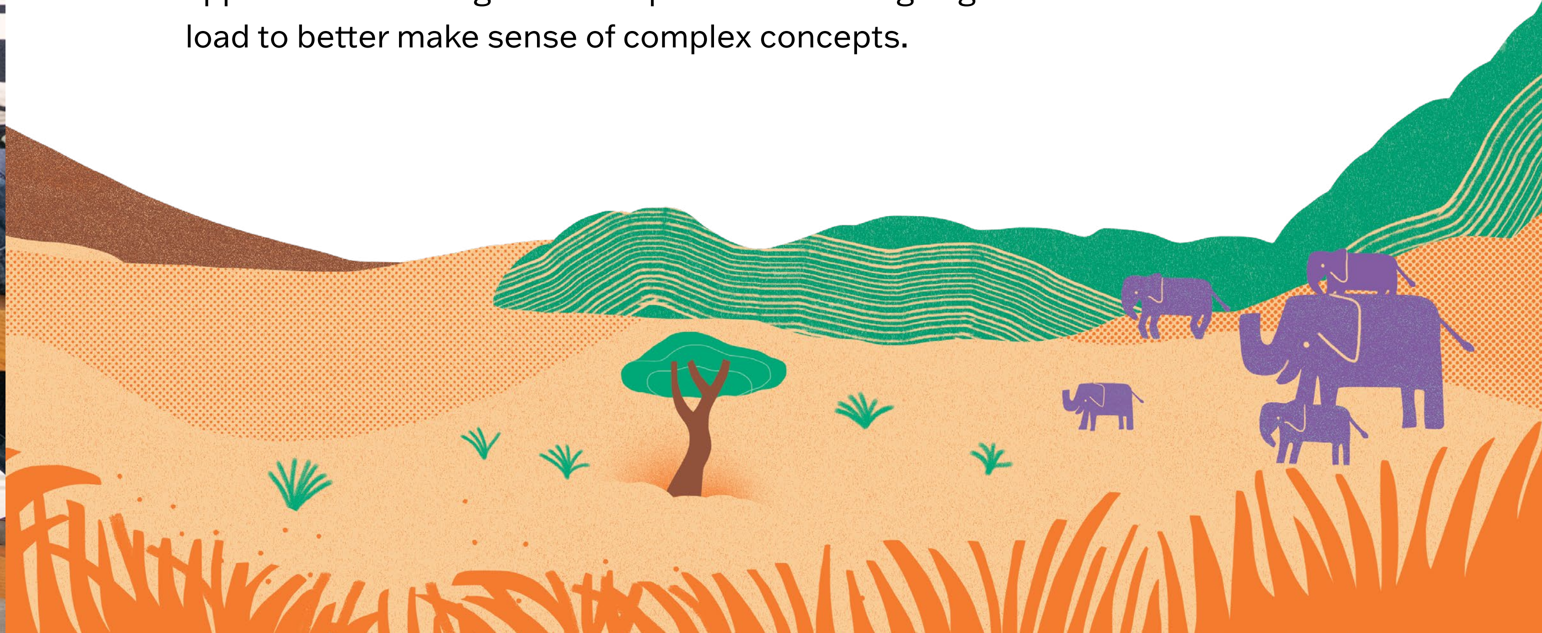
   **How is it possible for some animals to sense information we cannot sense?**

   Record student responses on sticky notes. Save the sticky notes to create a Related Phenomena section when developing the Driving Question board in Part 2.

**LAND** has students reflect on their learning and how their new knowledge fits into the larger context of the topic or module and real-life application.


# Student *engagement* solidifies knowledge and understanding.

Students lead conversations about the content through Socratic seminars, peer-to-peer discussion activities, discussion-based assessments, and other lesson activities. Consistent Instructional Routines drive a structured approach to thinking about a topic while reducing cognitive load to better make sense of complex concepts.



# What does knowledge building mean in *science*?

From a young age, children are curious and observant, and they need the opportunity to make sense of the world around them. Yet, when it comes to science instruction, students are too often left reading about scientific discoveries of the past and memorizing scientific facts instead of experiencing science.

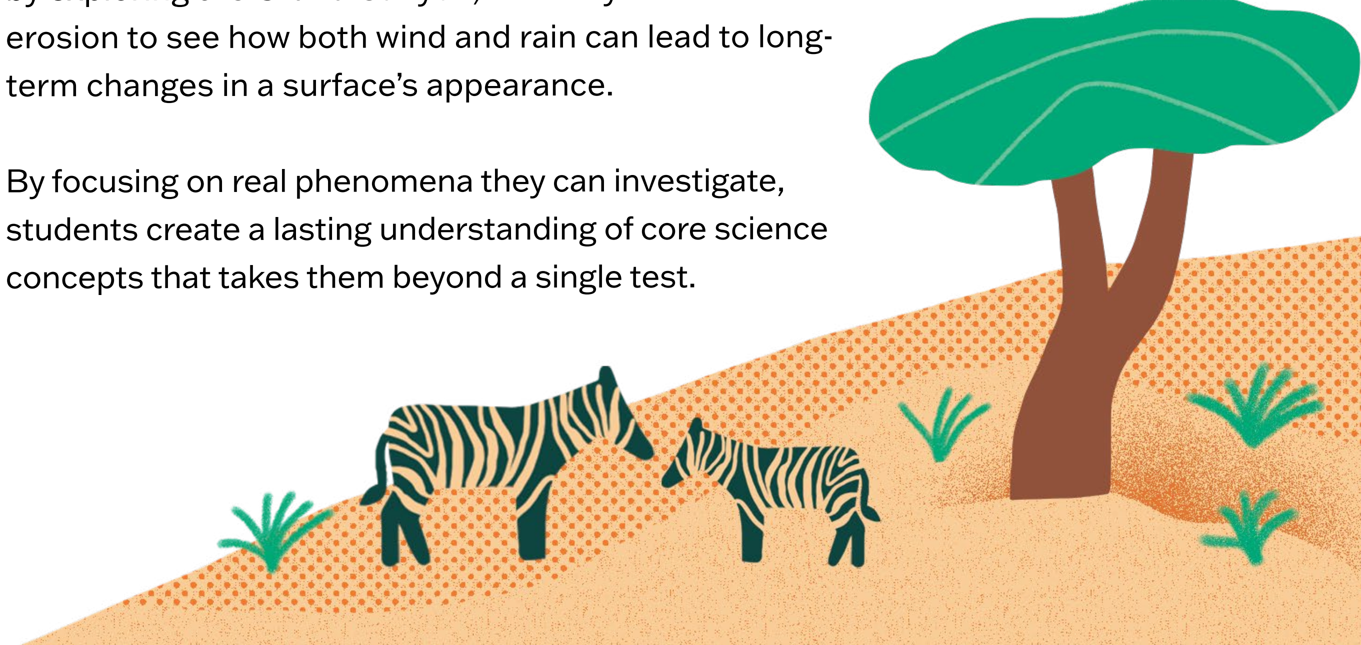
When the focus is on building enduring knowledge, the classroom becomes a learning lab. Students actively build knowledge by asking questions and investigating ideas. This engaging process builds a strong foundation for students as they develop their understanding of science concepts. By doing science, students develop problem-solving skills that can extend to other subjects and well beyond the classroom.

To help nurture each young student's natural curiosity, particularly at an age when many schools do not invest in a core science curriculum, *PhD Science*® is available as an open educational resource for grades K–2.

# The role of *authentic* phenomena.

Some science programs rely on fabricated locations or scenarios to teach science, denying students the opportunity to see and understand the science that's already a part of our natural world. By connecting science learning to authentic phenomena, *PhD Science* helps students truly know how science works in the world around them. They learn about Earth's changing features by exploring the Grand Canyon, and they model rock erosion to see how both wind and rain can lead to long-term changes in a surface's appearance.

By focusing on real phenomena they can investigate, students create a lasting understanding of core science concepts that takes them beyond a single test.



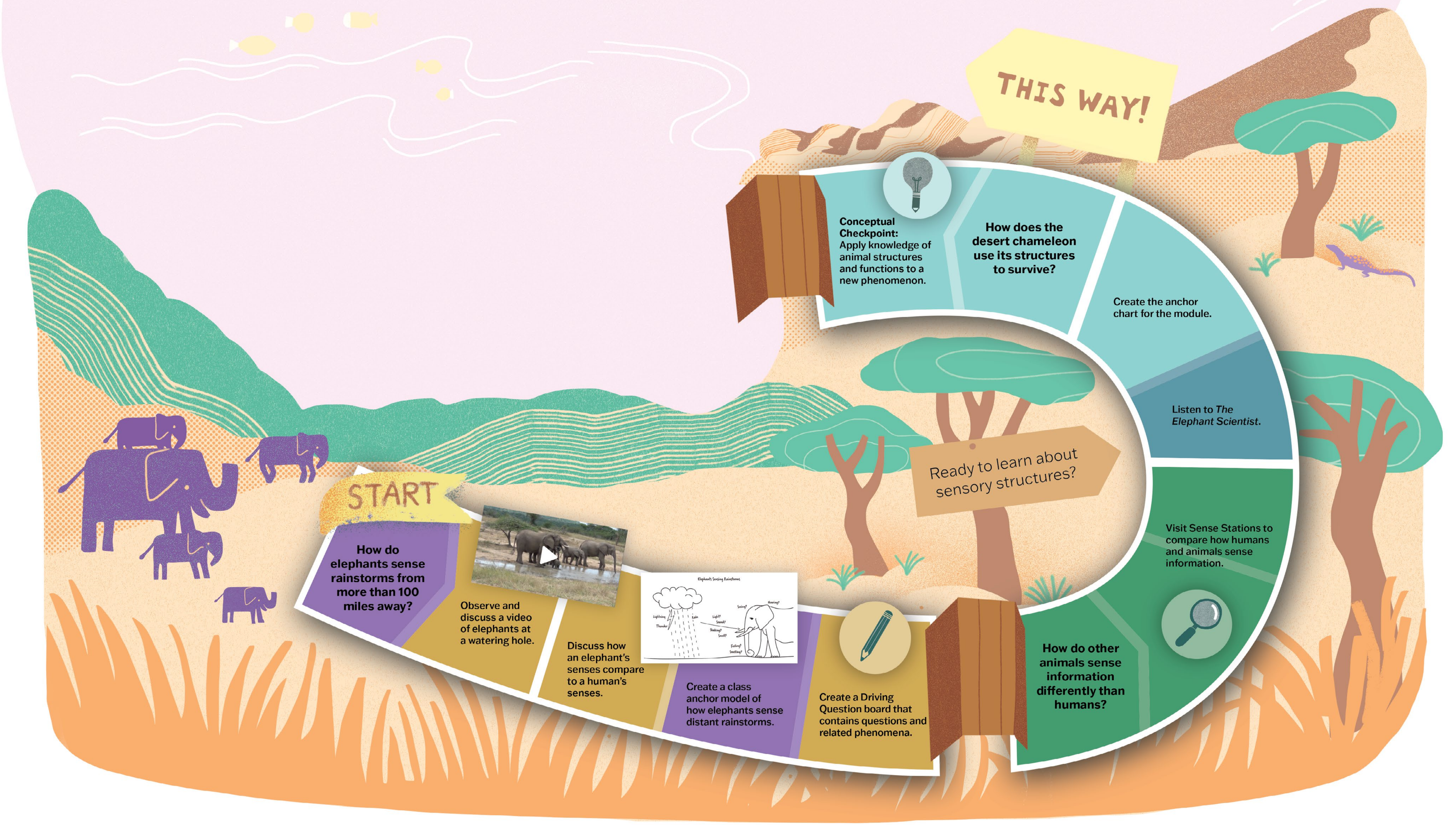
# A closer look: unfolding the student learning *experience*.

Each year, *PhD Science* students will explore four core science topics through the lens of an anchor phenomenon that connects the content to something they can see and experience in their own world. Over the course of the module, students will build extensive and enduring knowledge that they can then apply to new contexts to demonstrate their understanding.

**To understand the knowledge-building experience from a student's perspective, let's unfold Level 4 Module 3: *Sense and Response.***

**PhD SCIENCE®**

- READING
- INVESTIGATING
- ANALYZING DATA
- OBSERVING & DISCUSSING
- MODELING
- APPLYING KNOWLEDGE




PART 1

**PhD SCIENCE**®

- READING
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PART 2

# PhD SCIENCE®

- READING
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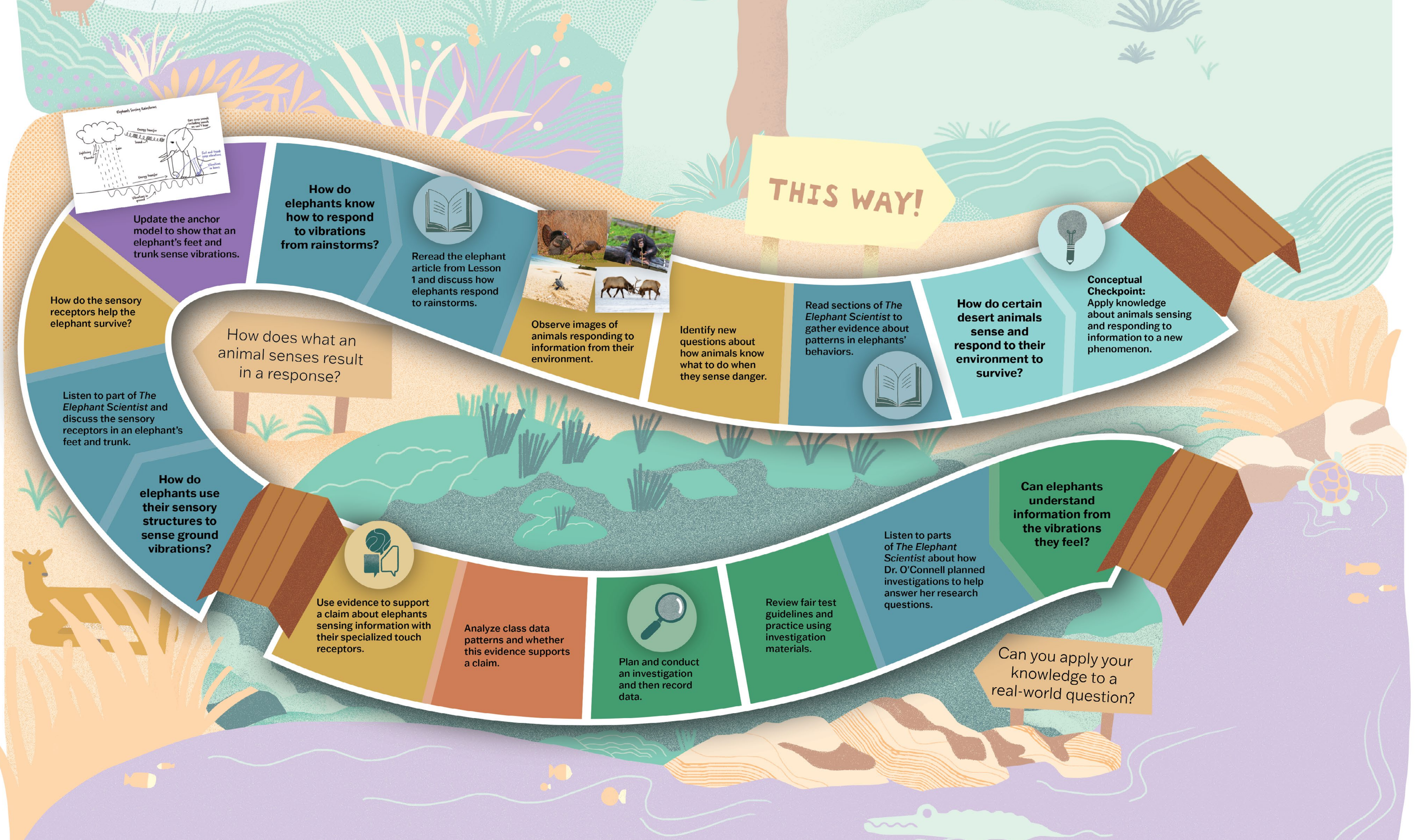


PART 3

READING

INVESTIGATING

ANALYZING DATA

OBSERVING & DISCUSSING

MODELING

APPLYING KNOWLEDGE


PART 4

PhD SCIENCE®

## Adventure Awaits

Have you ever wondered how small tugboats move huge ships?

Or how an island just appears in the middle of an ocean?

Or how the Grand Canyon was formed?

Learning science is an adventure because it’s everywhere—in books, fine art, math, English, and everyday real life.

**Ready to explore?**

**LEVEL 4 MODULES**

**Module 1** | Earth Features

**Module 2** | Energy

**Module 3** | **Sense and Response**

**Module 4** | Light and Communication

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**SAMPLE**

**ON THE COVER**

*Swifts: Paths of Movement + Dynamic Sequences*, 1913.

Giacomo Balla, Italian, 1871–1958

Oil on canvas.



GREAT MINDS™

every child is capable of greatness

# Thinking and acting like real *scientists*.

Hands-on experiences give students time to observe, imagine, and reason through their learning while applying their knowledge of scientific processes to understand phenomena. Like real scientists, students actively and collaboratively engage in a learning cycle of asking questions and sharing ideas about phenomena, investigating those questions, developing evidence-based explanations, and transferring their knowledge to explain different phenomena.

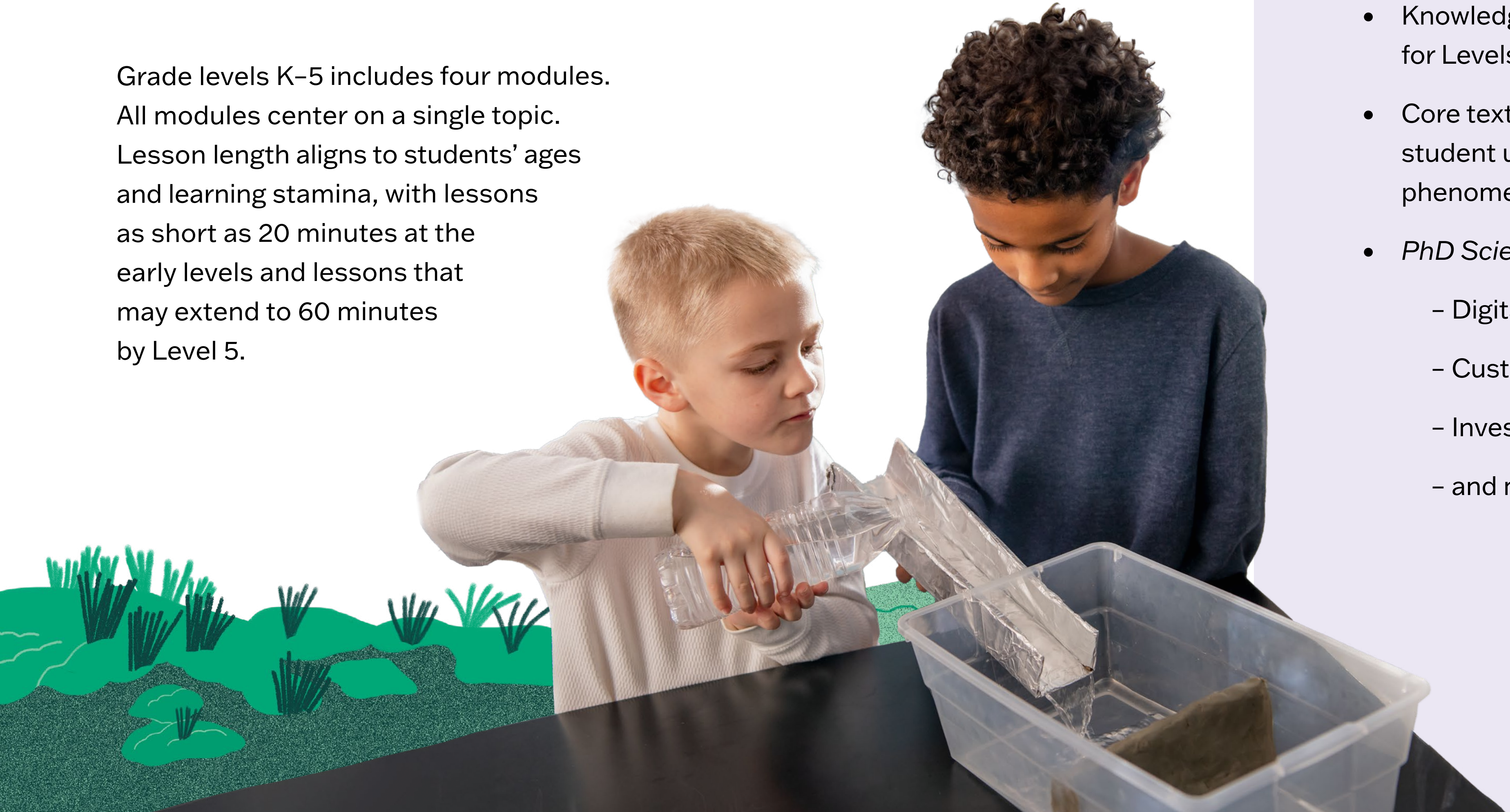
While videos and simulations can lead students to a foregone conclusion or create artificial constraints on learning, *PhD Science* students work directly with materials and observe how they react to forces in the real world in real time.

# Art opens up knowledge building for *all students*.

*PhD Science* students engage with significant works of art—including paintings, illustrations, prints, sculpture, architecture, and photographs—that provide diverse access points to a module's topic. The artwork provides students with a powerful opportunity to interact with scientific phenomena in a new and unique context while they practice key scientific skills—making observations, asking questions, and noticing patterns.

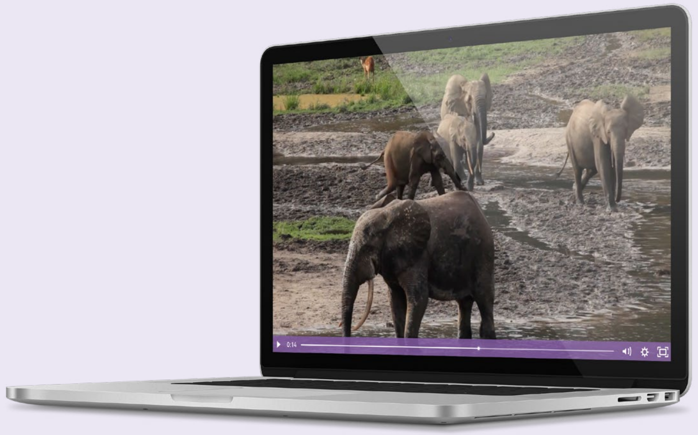
# A rigorous science program *empowers* students.

Grade levels K–5 includes four modules. All modules center on a single topic. Lesson length aligns to students' ages and learning stamina, with lessons as short as 20 minutes at the early levels and lessons that may extend to 60 minutes by Level 5.



**Curriculum Components**

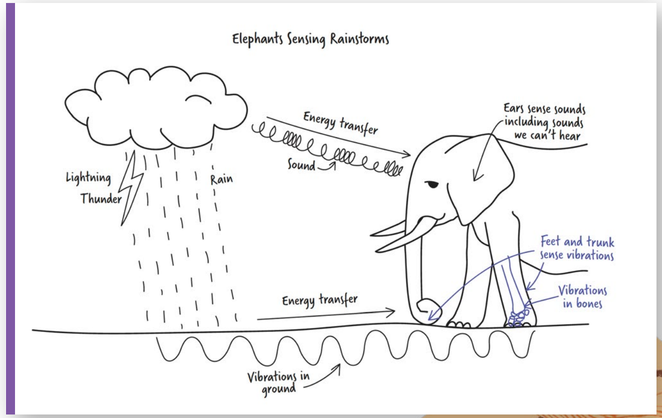
- *Teach* Books
- Science Logbooks
- Hands-on materials kits
- Knowledge Deck™ cards and posters for Levels K–2
- Core texts (trade books that further student understanding of the anchor phenomenon)
- *PhD Science* digital license to access:
  - – Digital version of *Teach* Book
  - – Customizable presentation slides
  - – Investigation videos
  - – and much more

# *Student-led* **inquiry.**

*PhD Science* students engage with science the way scientists and engineers do—by asking questions, analyzing and synthesizing information, and applying knowledge to new contexts.

Anchor visuals that students create help them collect and display evidence of their new knowledge so they can integrate it with prior knowledge. At the end of each module, students can then apply their conceptual understanding to solve real-world problems in the Science or Engineering Challenge.




# Supporting diverse learner *needs*.

*PhD Science* incorporates the three guiding principles of the Universal Design for Learning framework to ensure that all students have access to learning. The Teacher Edition also includes just-in-time notes for differentiation, language support, and extension opportunities to support all students.

### Differentiation

To provide additional support, consider rereading portions of the text aloud to small groups or pausing and summarizing the text more frequently.

### Language Support

Important, unfamiliar words in this reading may include *detect*, *discriminate*, and *impulse*. As needed, provide students with synonyms, definitions, or example sentences.

### Extension

Have students research more about Pacinian corpuscles in humans and determine where most of these sensory receptors are.

# The Great Minds *promise*.

We know that with the proper support for educators, high-quality instructional materials can transform teaching and learning. Great Minds is the exclusive provider of professional learning created and delivered by the *PhD Science* team of teacher-writers. We offer in-person and virtual professional development and personalized coaching options, with sessions designed for both teachers and leaders, to ensure strong initial implementation and sustained success.

GREAT MINDS™

At Great Minds, we strongly believe that every child is capable of greatness, especially when they're given access to engaging, knowledge-building instructional materials.

Contact your Great Minds representative for a deeper dive into the learning design behind *PhD Science*.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