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Why a Focus on Science?

Over three decades ago, the American Association for the Advancement of Science began Project 2061, a three-phase project to develop and promote science literacy. The project was established with the understanding that *more* is not *effective* (1989, 4). Shortly thereafter, in 1993, the Association developed benchmarks for science literacy. Since every state has its own science standards, these benchmarks were prepared as a tool to assist in the revision of the states' science, mathematics, and technology curricula (1993, XV).

Values, Attitudes, and Skills

Scientists work under a distinct set of values. Therefore, according to the American Association for the Advancement of Science, science education should do the same (1989, 133). Students whose learning includes data, a testable hypothesis, and predictability in science will share in the values of the scientists they study. Additionally, "science education is in a particularly strong position to foster three [human] attitudes and values: curiosity, openness to new ideas, and skepticism" (1989, 134). The *Science Readers* series addresses each of these recommendations by engaging students in thought-provoking, open-ended discussions and projects. Throughout their study, students continuously reflect on the contributions of important scientists and the advancements they have brought to society.

Within the recommendations of skills needed for scientific literacy, the American Association for the Advancement of Science suggests attention to computation, manipulation and observation, communication, and critical response. These skills are best learned through the process of learning, rather than in the knowledge itself (1989, 135). This is exactly what happens when students engage in lesson labs in the *Science Readers* program. Students follow formulas and calculations to compute numbers; they use calculators to apply computation skills quickly and accurately; they manipulate common materials and tools to make scientific discoveries; they express findings and opinions both orally and in writing; they read tables, charts, and graphs to interpret data; they respond critically to data and conclusions; and they use information to organize their own data and draw their own conclusions.

Inquiry-based Learning

Project 2061 recommends pedagogical practices in which the learning of science is as much about the process as the result or outcome (1989, 147). Following the nature of scientific inquiry, students ask questions and are actively engaged in the learning process. They collect data and are encouraged to work within teams of their peers to investigate the unknown. This method of process learning refocuses students' learning from knowledge and comprehension to application and analysis. Students may also formulate opinions (synthesis and evaluation) and determine whether their processes were effective or needed revision (evaluation). The National Academy of Science views inquiry as "central to science learning" (p. 2 of Overview). In this way, students may develop their understanding of science concepts by combining knowledge with reasoning and thinking skills. Krueger and Sutton (2001, 52) also report an increase in students' comprehension of text when knowledge learning is coupled with hands-on science activities.

The 5 Es

The 5 Es Lesson Planning

The 5 Es instructional model describes five phases of learning that follow the constructivist learning theory. In this theory, new knowledge is built on existing knowledge and experiences. The 5 Es include *engage, explore, explain, elaborate,* and *evaluate*. Each of these phases of learning helps to focus students on learning objectives while connecting these objectives to prior knowledge and alternate applications of new knowledge.

Engage

During the *engage* phase of the lesson, students are exposed to the concepts and learning objectives for the first time. Engaging students should focus them on learning outcomes and concepts while hooking their attention and interest. The teacher should also connect the learning objectives and concepts to students' prior knowledge.

Explore

The *explore* phase is student centered but teacher facilitated. Students should explore their environment, manipulate materials, and discover concepts pertaining to the learning objectives. Student exploration should be inquiry driven in this phase. They should make predictions, note questions, and explore to discover and formulate answers. The teacher should not provide answers but ask guiding questions if a group or student is stuck.

Explain

The *explain* phase is discussion driven. Students share their discoveries and explain their understanding of the explored concepts. The teacher can introduce any key terms, definitions, or explanations of concepts during this phase. The main goal, however, is for students to verbalize their understanding.

Elaborate

During the *elaborate* phase, students are able to extend their understanding. Students should practice and refine the new skills they have acquired while developing a deeper understanding of the lesson's key concepts and learning objectives. Cross-curricular connections should be made between the lesson objectives and similar concepts, allowing students to use their gained knowledge in another way.

Evaluate

The last phase, *evaluate*, is the assessment stage. Students assess their own understanding and abilities. Teachers evaluate student understanding and development pertaining to the key concepts and skills. Teachers should use this phase to help plan future lessons.

The 5 Es *(cont.)*

The 5 Es and This Book

The 5 Es are embedded in the different sections of each lesson. As you become familiar with the flow of each lesson and the suggested timeline, you will find that you can rearrange the activities to fit your 5-E needs.

Engage

Students need to be engaged during the "Introductory Activity" sections in this book. It is worthwhile to use the instructions in this section in conjunction with visuals, such as illustrations and objects. The "Before the Lab" and "Introduce the Lab" sections can also be used to engage students.

Explore

The "Introductory Activity" in each lesson provides a student-centered activity that allows students to explore what they know, as well as what they think they know, about the learning objective. Students are also able to explore while completing the lab.

Explain

Students are able to share their understanding of the learning objectives in class discussions during the "Using the Readers" section, particularly before and during the reading. The reading and discussion also allow the teacher to clarify key concepts. During the "After the Lab" activity, students can share their findings and understanding, which also applies to this step.

Elaborate

Students are able to elaborate their information on the student activity sheets found in the "Before Reading," "During Reading," and "After Reading" sections. Activities found in the "Concluding Activity" section also allow students to refine and practice their newly acquired knowledge.

Evaluate

To evaluate student progress at the end of each lesson and unit, the culmination of student work, the "Prueba de la lectura" (Reader Quiz), and teacher observations can be used. Students are also able to check their own understanding by reviewing their corrected work.

Resource Video Clips

The Teacher Resource CD includes video clips for each reader in this kit. These short video clips are included to make science learning engaging and to enhance the background knowledge of all students. All of the videos included correlate to the concepts presented in each unit of this book.

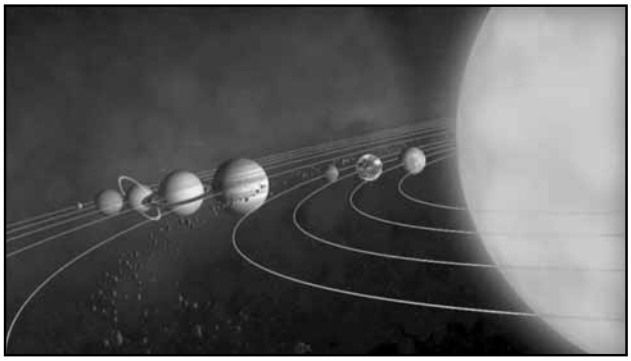
Unit 1 Video Clips:

La Tierra

- earthzoomout.mpg
- earthfromspace.mpg

Los planetas

- solarsystem.mpg
- solarsystemtour.mpg



matthiashaas/iStockphoto

Unit 2 Video Clips:

Las lunas

- fullmoon.mpg
- lunarlander.mpg

Los asteroides y los cometas

- shootingstars.mpg
- comet.mpg

wangday/iStockphoto

Unit 3 Video Clips:

Las estrellas

- galaxystars.mpg
- starnebula.mpg

El sol

- sunrise.mpg
- sunsurface.mpg

Forrestbro/iStockphoto

Video Credits: earthzoomout.mpg, tomabobu/iStockphoto; earthfromspace.mpg, NASA; solarsystem.mpg, matthiashaas/iStockphoto; solarsystemtour.mpg, kelmedia/iStockphoto; fullmoon.mpg, octopuz/iStockphoto; lunarlander.mpg, NASA; shootingstars.mpg, wangday/iStockphoto; comet.mpg, Seti/iStockphoto; galaxystars.mpg, kelmedia/Shutterstock; starnebula.mpg, NASA; sunrise.mpg, Forrestbro/iStockphoto; sunsurface.mpg, NASA

Unit 1: *Planets*

Timeline for the Unit

	La Tierra Reader	*Los planetas* Reader
Day 1	Complete the **Introductory Activity** (page 24) as a class.	
	Before Reading (pages 29–30) in reading groups	**Before Reading** (page 37–38) in reading groups Use: *Los planetas: verdadera o falsa* activity sheet (page 40; page40.pdf)
Day 2	**During Reading** (pages 30–31) in reading groups Use: *Un imán gigante* PDF file (iman.pdf)	**During Reading** (page 38) in reading groups
Day 3	**After Reading** (page 31) in reading groups Use: *Las causas y los efectos sobre la Tierra* activity sheet (page 32; page32.pdf) *El movimiento de la Tierra* activity sheet (page 33; page33.pdf) *El día y la noche* activity sheet (page 34; page34.pdf) *Prueba de la lectura* (page 35, page35.pdf)	**After Reading** (page 39) in reading groups *Use: Compara los planetas* PDF file (compara.pdf) *Los planetas: verdadera o falsa* activity sheet (page 40; page40.pdf) *Más largo y más corto* activity sheet (page 41; page41.pdf) *Ordena los planetas* activity sheet (page 42; page42.pdf) *Prueba de la lectura* (page 43; page43.pdf)
Day 4	Complete the **Lab** activity (pages 27–28; diaynoche.ppt) as a class.	
Day 5	Complete the **Concluding Activity** (page 25) as a class.	

Unit Learning Objectives

- Students use reading skills and strategies to understand and interpret nonfiction. (Reading Objective)
- Students understand the main idea and supporting details of simple expository information. (Reading Objective)
- Students know that night and day are caused by Earth's rotation on its axis. (Science Objective)
- Students know that Earth is one of several planets that orbit the sun and that the moon orbits Earth. (Science Objective)
- Students know that astronomical objects in space are massive in size and are separated from one another by vast distances. (Science Objective)
- Students understand and apply basic and advanced properties of the concepts of numbers. (Math Objective)

Before Reading *(cont.)*

3. Introduce the vocabulary words students will encounter in the text. Write the words on the board. Have students work in pairs to discuss what they think the words mean. Discuss the meanings as a class. Have students fold a piece of drawing paper into four sections. Instruct students to write one word and its definition in each section, as well as an illustration for each word. Use the glossary in the back of the reader as needed.

Vocabulary

inclinada mil millones órbita sistema solar

4. Display a globe. Have students predict how much of Earth is covered by water. Is it none, less than half, half, more than half, or all? Spin the globe. Discuss the color that most of Earth appears to be. The students can find out just how much of Earth is water on pages 12–13 of the reader. Have students read these pages to a partner. Discuss the meaning of *70 por ciento*. Explain that this is more than half.

During Reading

5. Decide whether this reader will be read as a group, in pairs, or independently.

6. Have students read pages 4–5 in the reader. Discuss and clarify the definition of a *sistema solar*. Based on the information on these pages, ask students what all eight planets have in common.

7. Have students read pages 6–17 in the reader. Have students compare the information from the reader with the information they thought they would find (listed on the chart from Step 2 in the Before Reading section on page 29). Circle information that students read about in this chapter. Point out and discuss information they did not find in this chapter. Using a different color marker, add any additional information that students think is important from the chapter. Students may already know place value up to the thousands; explain to them the concept of one billion. Briefly show them the difference in place value between one thousand, one million, and one billion to help them gain perspective on how old Earth is (about 5,000,000,000 years old).

8. Have students reread pages 14–15 in the reader. Ask students where iron is found inside Earth. Display the PDF file, *Un gran imán* (iman.pdf). Read the information and discuss what it means. Explain that students will have a chance to experience Earth's magnetic fields after their reading.

9. Have students read pages 18–25 in the reader. Have them compare the information from the reader with the information they thought they would find (listed on the chart from Step 2 on page 29). Circle information that students read about in this chapter. Draw a line through information they did not find in this chapter. Using a different color marker, add any additional information that students think is important from the chapter.

During Reading *(cont.)*

10. Have students read pages 26–27 in the reader. Discuss what the author means when he says, "Si cuidamos la Tierra, ¡la Tierra nos cuidará a nosotros!"

After Reading

11. Have students reread pages 10–15 in the reader. Discuss the different characteristics of Earth. Then have students complete the *Las causas y los efectos sobre la Tierra* activity sheet (page 32).

12. Have students reread pages 18–25 in the reader. Have students talk with a partner about the relationships of Earth's orbit, spinning motion, seasons, years, and days. Distribute copies of the *El movimiento de la Tierra* activity sheet (page 33) to students. Make sure that students understand that one full turn around the sun is the same as a day, and one orbit is the same as a year. Next, distribute copies of the *El día y la noche* activity sheet (page 34) to students. Allow students to discuss what they do during the day and what they do at night. Have students complete both activities with a partner or by themselves.

13. Use the *Prueba de la lectura* (page 35) to further assess student learning.

14. Gather students together as a class to complete the lab (pages 27–28).

15. As a class, complete the Concluding Activity (page 25).

Extension Ideas

- Have students read *Un científico actual* on page 32 of the reader. Students should use the glossary to find out what a *planetario* is. Use online resources to find a planetarium near you. If a real field trip is not possible, take a virtual field trip. Before you "go," have students discuss what they think they will learn there. After the trip (real or virtual), have students write a letter to a friend to tell about three things they learned at the planetarium. **Note:** The videos listed (page 19) for the *La Tierra* and *Los planetas* readers can be used for this activity as well.
- Give each pair of students a compass, one bar magnet, and string. Working in pairs, have students tie and knot the string around the center of the magnet so that it is level when they hold onto the string. Take students outside. Have them manipulate the compass to determine north. Then, let them hold their magnets by the string and wait patiently. Eventually, the north pole of the magnet will point north. Discuss the time it took for the magnet in the compass and the bar magnet to find their ways. According to the information students learned from the *Un gran imán* PDF page (iman.pdf), ask students where this action might take less time and where it would likely take the longest time.

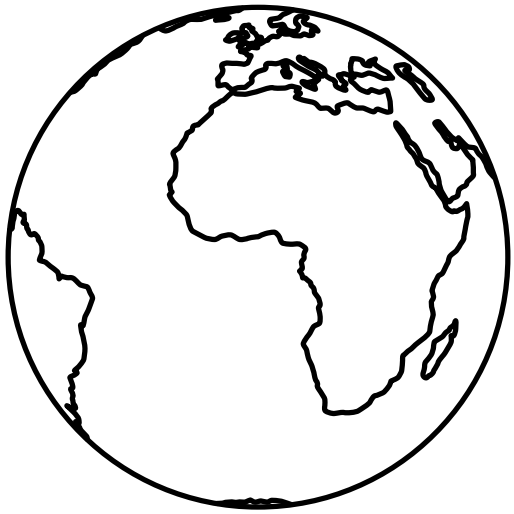
Note: Additional extension ideas may be found in the Differentiation Strategies section (page 26) of this unit.

Nombre _____

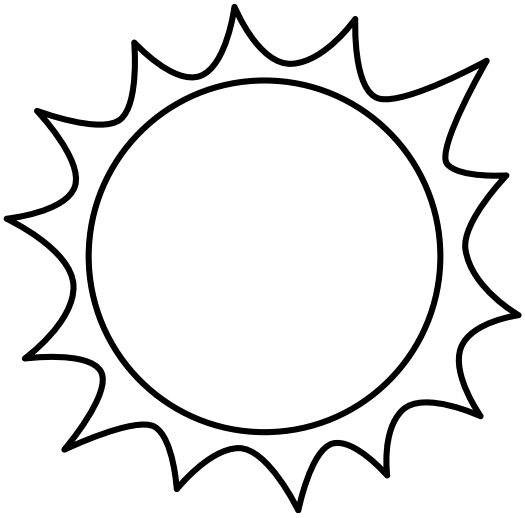
El movimiento de la Tierra

Instrucciones: Llena los espacios en blanco para completar las oraciones. Luego, dibuja flechas que muestren cómo la Tierra se mueve en cada ejemplo.

1. La Tierra tarda _____ día(s) en dar una vuelta completa.



2. La Tierra tarda _____ día(s) en viajar completamente alrededor del sol.



Nombre _____

Prueba de la lectura

Instrucciones: Encierra en un círculo la mejor respuesta.

1. ¿Qué es la Tierra?
   a. un planeta
   b. una estrella
   c. un sol
   d. una luna

2. ¿Qué causa que cambie de estación?
   a. El giro y la órbita de la Tierra
   b. La inclinación y la órbita de la Tierra.
   c. El sol se calienta.
   d. La Tierra se mueve más cerca del sol en el verano.

3. Sam se despierta. Todavía está de noche donde vive. ¿Dónde está el sol?
   a. El sol está al Polo Sur.
   b. El sol está al Polo Norte.
   c. La Tierra ha dado una vuelta para que Sam esté de espaldas al sol.
   d. El sol se ha movido al otro lado de la Tierra.

4. ¿Aproximadamente cuántos años tiene la Tierra?
   a. más años que el sol
   b. 2 mil millones
   c. 4.5 millones
   d. 5 mil millones

Instrucciones: Responde a la pregunta. Haz un dibujo con tu respuesta.

5. ¿Por qué alguna gente llama a la Tierra "Madre Tierra"?

_____

_____

_____

_____

Unit 1: *La Tierra*

Un gran imán

El núcleo exterior de la Tierra es un río de hierro. Éste hace que la tierra sea como un gran imán. Puedes ver éste magnetismo cuando llevas una brújula por afuera.. El imán dentro de la brújula señalará al Polo Norte. ¿Por qué piensas que es así?