Lesson 1.2
Introducing Systems
Lesson Overview

To begin to tackle the problem of designing improvements to the Ergstown electrical system, students first set out to understand what a system is. They observe a simple system—a cherry pitter—and identify its parts and their functions. To broaden students’ understanding of systems, the teacher introduces the *Systems* book and the reading strategy of synthesizing. Students work in pairs to synthesize their prior knowledge, what they learned from the cherry pitter system demonstration, and what they are reading in the text in order to strengthen their understanding of what a system is. The purpose of this lesson is to introduce students to the concept of systems and to prepare them to investigate the electrical system, its parts, and their functions.

**Anchor Phenomenon:** Ergstown has frequent blackouts.

**Investigative Phenomenon:** The way a bicycle works and the way a home works

**Students learn:**

- Synthesizing can help readers understand informational text.
- There are many kinds of systems in the world around us.
- Scientists and engineers gather information from books.
Introduction to Synthesizing

Students are introduced to the *Systems* text. The teacher models the reading strategy of synthesizing.

**Instructional Guide**

1. **Hold up a copy of *Systems* and introduce the book.** Let students know that they are going to read a book that will help them answer the question *What is a system?*

2. **Designate partners for reading.** Distribute one copy of *Systems* to each pair of students. Have students briefly look through the book and describe to their partners what they notice.

3. **Introduce the synthesizing strategy.**

   When reading an informational text such as this one, readers often make connections between what they are reading, their prior knowledge, and their experiences. This helps them to better understand the information that they are reading.

   You will read about different types of systems today. See if you can connect what you read with your observations of the cherry pitter system to help you think about the question *What is a system?*

4. **Read pages 5 and 6 as a class.** Instruct students to turn to page 5 in their books. Have student volunteers take turns reading aloud through page 6. Review each part of the bicycle pictured on pages 6 and 7 with students.

5. **Model synthesizing.**

   A bicycle is made of many parts. When we observed the cherry pitter system, we saw that it was made of parts too. When I connect what I read about bicycles with what I observed about the cherry pitter I can build a deeper understanding. I can conclude that some things are made of many parts and that each part has a different function.

6. **Discuss the table on page 7.** Point out the “Part” and “Function” headings on the table.
This table provides me with more detailed information about the bicycle. It includes a list of bicycle parts and the function of each part.

Read the information in the table.

Can anyone connect the information in this table to anything else we’ve seen today?

[The table we filled out together for the cherry pitter system. It showed parts and functions too.]

7. Read page 8. Have a student read the first paragraph and stop after “A bicycle with all its parts connected is a system.”

8. Connect to the reading strategy.

Now we know from our reading that a bicycle is a system. We also know that a cherry pitter is a system.

As we read the book to better understand systems, I am connecting what we are reading about bicycles with what I observed about the cherry pitter system and its parts. When I connect these ideas together, I come up with a new understanding. This type of thinking is called synthesizing.

9. Post the word synthesize on the wall.

To synthesize means to put together multiple pieces of information in order to understand something, like I just did when I read about the bicycle and its parts.

Teacher Support

Rationale

Literacy Note: Synthesizing
In this unit, students will use the cognitive strategy of synthesizing to help them understand important science ideas about energy and systems. Scientists, engineers, and readers often connect information from different sources to come to a new or deeper understanding. Being able to connect information from investigations, readings, and other sources is an important way that students can make sense of their investigations and reading. Embedded throughout the unit are multiple opportunities for you to model this strategy and then facilitate students’ independent practice.

Background

Literacy Note: The Word “Source”
This may be the first time that students are hearing the word source. The word source will be used throughout this unit in various ways. Here, source is used to refer to a place that information comes from, such as a book or an experience. In Chapter 3, students are introduced to the concept of a source of energy. In both instances, source refers to the place that something comes from. Students will have many opportunities to hear and use the word source in the context of using information and evidence to support ideas before they are introduced to the term as a science concept.
Background

About the Book: *Systems*

*Systems* introduces students to a concept that is essential to the unit: what makes a system. The book’s introduction defines *structure* and *function* and uses the example of a bicycle to illustrate how parts have a structure that allows them to perform specific functions. Once all the parts are connected, that makes a system. The next example presented is a home, which is a system made of systems—plumbing, heating, electrical, etc. Each system is made up of parts that work together, and all the smaller systems work together to make the whole system of the home. In turn, the home is part of larger municipal systems, such as the public water system and the electrical energy system. The final pages of the book discuss system failure and encourage students to think further about why systems are an important concept and what systems they see in their daily lives. This book sets the context for the unit and introduces vocabulary and concepts that will be used extensively throughout the unit.

Rationale

Literacy Note: Why Modeling Before Reading?

Synthesizing is a complex cognitive strategy that involves drawing together multiple pieces of information, usually from more than one source, to better understand something. In this lesson, the teacher models how to synthesize ideas from *Systems* to understand the practices of engineers and apply this to what students have been doing in their investigations of parts and functions of systems. The teacher demonstrates that when synthesizing, readers consider how different information from the book relates to one’s personal experience.

Instructional Suggestion

Providing More Experience: Informational Text

A major goal of this program is to deepen students’ awareness of and experience with the genres of science text that they are likely to encounter in school and in their lives outside of school. The student books and related investigations in this program are designed to provide supportive instruction around informational text. Depending on the level of experience your students have with different genres of text, you may wish to spend more time or less time discussing the differences between fictional and informational text as you introduce *Systems*. You may need to show students examples of fictional texts and various informational texts to help them identify and discuss the differences between the two types of writing.

Instructional Suggestion

Supporting English Learners: Additional Time with Synthesizing

After you have introduced the synthesizing strategy, you may wish to spend a bit more time on this idea with English language learners. Check for understanding by inviting students to summarize the class discussion. Invite students to use both the cherry pitter and the book to refer to as they summarize. If necessary, you may wish to clarify the part to whole relationship of the bicycle system in the book and invite students to describe orally how this is similar to the cherry pitter system. Then, refer back to the definition of *synthesizing* and inform students they will continue to connect ideas in this way as they read *Systems*. To further support students in using the synthesizing strategy, you might also want to meet with a small group of students and discuss the text together as you read, while the rest of the class reads more independently.
Reading: Systems

Student pairs read *Systems*, applying the synthesizing strategy as they read, then reflect on their new ideas as a class.

Instructional Guide

1. **Introduce the Partner Reading Guidelines.** Let students know that they will read the book *Systems* with a partner. Refer to the poster on the wall and read through the guidelines with the class. Let students know that they can refer to the guidelines as they read.

2. **Have pairs read and synthesize.** Remind students to connect what they read to other sources of information and to discuss their new ideas about systems with their partners.

3. **Circulate and provide support.** As pairs read, circulate to monitor students’ progress and provide assistance as necessary. When most pairs are about halfway through the book, remind students to share any new ideas with their partners. Let them know that after the reading they will discuss the information they have synthesized with the whole class.

4. **On-the-Fly Assessment: Synthesizing Information.** As you circulate, listen to make note of what information students are connecting as they read and of any new ideas they generate that might help them answer the Investigation Question.

5. **Invite students to discuss their ideas.**

   You have just observed a cherry pitter system and read about systems. What new understandings do you have about systems?

Call on student pairs to share ideas. Ask them to explain, if possible, how they arrived at their new understanding. Prompt students to refer to specific pages in the text as they share.

6. **Refer to the following lesson’s activities.** Let students know that in the following lesson, they will get to build their own simple electrical systems and gather more information to help them answer the question *What is a system?*
Embedded Formative Assessment

On-the-Fly Assessment 1: Synthesizing Information

Look for: This lesson provides students’ first opportunity to learn about and discuss how to synthesize information as a reading strategy. They will continue to develop facility with this strategy throughout the unit through repeated practice. As you circulate, make note of what students are connecting to the reading and what deeper understanding they come to as a result. Are they connecting together relevant pieces of information from different sources? Are they using these connections to help them better understand systems?

Now what? If students are having trouble getting started with synthesizing, or if they are connecting the reading to unrelated information, provide some additional models. You may wish to provide examples that combine information from the first section of Systems with information from other sources. Depending on how many students need this support, you could either coach a few students individually during the reading or you could work with a small group or the whole class. Be sure to remind students to keep in mind the goal of connecting pieces of information in order to come to a deeper understanding of the concept of systems.

Teacher Support

Instructional Suggestion

Supporting English Learners: Reading with a Purpose
Throughout this unit, there are additional resources that support English learners. Providing English learners with a focus for reading can help them concentrate their comprehension efforts on the most important ideas in a text. Before having students read Systems, use the section titles to preview the main ideas. Explain that reading section titles and headings can help students identify the most important ideas in a section of a book. Read aloud each of the titles and have students discuss the photos on each page in reference to the title for that section. For example, on pages 6–7, “Bicycle Parts,” ask students to point out and name each bicycle part shown in the photos. On page 12, “Systems Made of Systems,” ask students to point out the smaller system within the larger system of the bicycle. After previewing the book, let students know that when they read the whole book, they will learn more details about these main ideas.

Rationale

Literacy Note: Partner Reading
Throughout this unit, we suggest that students read the books with a partner. This allows students time to apply and practice the reading strategies they’re learning, keeps them focused on the task at hand, and provides opportunities for them to assist each other with reading. Of course, you can use any effective reading procedures you’ve already established with your class. Before reading this first book in the unit, you may need to provide instruction on how to read with a partner by using the Partner Reading Guidelines provided or your own guidelines. Establishing procedures takes time at first, but will pay off in terms of student learning and management of the lessons. Over time, students gain practice working together and will need fewer reminders about reading together effectively.
Background

Literacy Note: Teaching Vocabulary in the Context of Reading
To know a word is to know more than just its definition. Sophisticated word knowledge involves an understanding of how words relate to other words and how words are used in context. In this unit, students are introduced to a small number of conceptually important words, and students are exposed to these words many times in many ways to help them develop flexible word knowledge. In this lesson, students describe the function of the parts of a system as well as the function of system. You may wish to discuss this in more detail after students have had a chance to read the words system, part, and function used in context.

Instructional Suggestion

Providing More Experience: Home Investigation
This optional activity invites students to interview two friends or family members about their experiences in a blackout. Home Investigations can encourage interaction and discussion between students and their families around science concepts, which has been found to be beneficial for student learning. See the Optional: Chapter 1 Home Investigation: Blackout Interview copymaster (in Digital Resources). Make one copy for each student and review the instructions with the class.
Students are introduced to the *Systems* text. The teacher models the reading strategy of synthesizing.

**Instructional Guide**

1. **Hold up a copy of *Systems* and introduce the book.** Let students know that they are going to read a book that will help them answer the question *What is a system?*

2. **Designate partners for reading.** Distribute one copy of *Systems* to each pair of students. Have students briefly look through the book and describe to their partners what they notice.

3. **Introduce the synthesizing strategy.**

   Cuando leen un texto informativo como este, los lectores a menudo hacen conexiones entre lo que están leyendo, su conocimiento previo y sus experiencias. Esto les ayuda a entender mejor la información que están leyendo.

   Hoy leerán sobre diferentes tipos de sistemas. Vean si pueden conectar lo que leen con sus observaciones del sistema para despepitar las cerezas para ayudarles a pensar en la pregunta *¿Qué es un sistema?*

4. **Read pages 5 and 6 as a class.** Instruct students to turn to page 5 in their books. Have student volunteers take turns reading aloud through page 6. Review each part of the bicycle pictured on pages 6 and 7 with students.

5. **Model synthesizing.**

   Una bicicleta está hecha de muchas partes. Cuando observamos el sistema para despepitar las cerezas, vimos que también estaba hecho de partes. Cuando conecto lo que leí sobre las bicicletas con lo que observé sobre el despepitador de cerezas puedo desarrollar una comprensión más profunda. Puedo concluir que algunas cosas están hechas de muchas partes y que cada parte tiene una función diferente.

6. **Discuss the table on page 7.** Point out the “Part” and “Function” headings on the table.
Esta tabla proporciona información más detallada sobre la bicicleta. Contiene una lista de partes de bicicleta y la función de cada parte.

Read the information in the table.

¿Alguien puede conectar la información en esta tabla con algo más que hayamos visto hoy?

[La tabla que llenamos juntos para el sistema para despepitar las cerezas. También mostraba partes y funciones].

7. Read page 8. Have a student read the first paragraph and stop after “A bicycle with all its parts connected is a system.”

8. Connect to the reading strategy.

Ahora sabemos de la lectura que una bicicleta es un sistema. También sabemos que un despepitador de cerezas es un sistema.

Mientras leemos el libro para entender mejor los sistemas, estoy conectando lo que estamos leyendo sobre las bicicletas con lo que observé sobre el sistema para despepitar las cerezas y sus partes. Cuando conecto estas ideas, se me ocurre una nueva comprensión. Este tipo de pensamiento se llama sintetizar.

9. Post the word synthesize on the wall.

Sintetizar significa juntar varias piezas de información con el fin de entender algo, como acabo de hacer al leer sobre la bicicleta y sus partes.

Teacher Support

Rationale

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4. **On-the-Fly Assessment: Synthesizing Information.** As you circulate, listen to make note of what information students are connecting as they read and of any new ideas they generate that might help them answer the Investigation Question.

5. **Invite students to discuss their ideas.**

   Acaban de leer sobre sistemas y observar un sistema para despejar las cenizas. ¿Qué nuevas comprensiones tienen sobre los sistemas?

   Call on student pairs to share ideas. Ask them to explain, if possible, how they arrived at their new understanding. Prompt students to refer to specific pages in the text as they share.

6. **Refer to the following lesson’s activities.** Let students know that in the following lesson, they will get to build their own simple electrical systems and gather more information to help them answer the question *What is a system?*
Embedded Formative Assessment

On-the-Fly Assessment 1: Synthesizing Information

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