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Science-Based Literacy

by Sylvia Linan-Thompson

From the time they are born, children are fascinated by the world around them. Young children are eager to find out why and how things work, about animals and plants and the natural forces of the universe. Listening to and reading science-based books, both informational and narrative, addresses their interests and questions and can motivate students to read books that explain the natural and physical world.

When nearly 40% of school children read only what they are required to in school (Gambrell, 2011), ensuring access to science-based literacy is critical for building and maintaining their interest in and access to science content. *Panorama* combines informational and literary nonfiction texts to build students' general literacy skills; science concepts; and discipline-specific vocabulary, grammar, language and discourse structures (Cummins, 2000; McKenna & Robinson, 1990).

Informational texts describe objects and processes; provide technical vocabulary, realistic illustrations or photographs, labels and captions, and various graphical devices to teach science concepts. Children who read informational text will be familiar with these structures before they encounter them in content area textbooks.

Literary nonfiction is a type of narrative text that includes content-specific information. Reading this type of text can help students build general literacy skills as they integrate content knowledge with information provided in the story's text to draw inferences about the story events and characters' behavior in specific situations. One example is how a character might react in a weather-related emergency.

To ensure that students have several opportunities to encounter key ideas and vocabulary, several texts around the same topic are provided in each unit of *Panorama*. After reading, carefully sequenced lessons build students' language and literacy skills and content knowledge

Science Concepts

Science-based literacy helps students build background knowledge by exposing them to science-specific concepts. Concepts are mental representations that include features or attributes of an object (planet), process (water cycle) or idea (gravity) (Chi, 2008; Murphy, 2002). The early and systematic introduction to science concepts provides children the opportunity to acquire content knowledge and the language associated with it.

Learning new concepts is facilitated when they are related to students' existing vocabulary or concept networks; therefore, opportunities to learn science concepts early increases students' ability to learn more complex concepts in later grades. Systematic reintroduction of concepts across grades provides students opportunities to modify their understanding of concepts over time. For example, students who learn about the water cycle in kindergarten develop not only knowledge of the water cycle and the states of matter but also of cycles as a concept that can be expanded as they learn about other cycles. When students read and learn about a specific concept, explore associated concepts and vocabulary networks, and engage in follow-up activities, their notion of the concept can be clarified or elaborated (Graesser, Singer, & Trabasso, 1994; Kintsch, 1988; van den Broek, 2010).

From kindergarten to sixth grade, *Panorama* provides engaging texts with photographs and illustrations that exemplify critical concepts. Each unit begins with a Big Question that highlights a critical issue and creates student interest. As they move through the unit, Focus Questions support students' critical thinking, while the combination of reading and writing activities improve students' understanding of concepts (Tierney & Pearson, 1983).

Language of Science

Systematic exposure to science concepts through literacy activities is also vital for language development. According to Nagy and Scott (2000), word knowledge development is incremental and multi-dimensional. Students need multiple exposures to words in a variety of contexts. They also need to understand that words can have multiple meanings and can serve multiple functions in different sentences and texts. This is particularly true for science vocabulary.

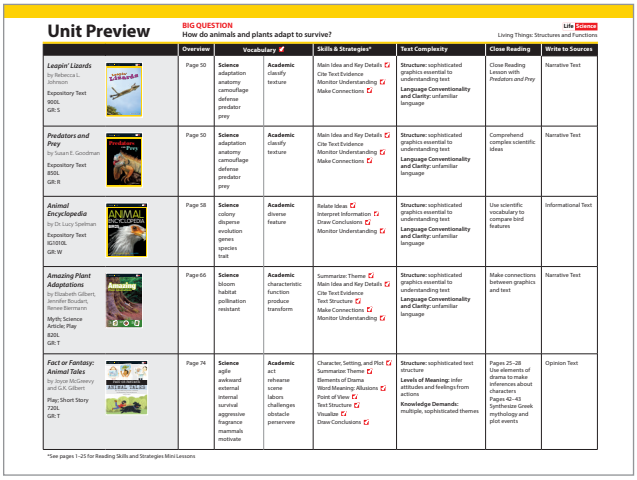
In science, everyday words have meanings unique to scientific contexts (matter, energy), technical terms that are necessary to describe concepts, and nominalization, the process of converting nouns to verbs (pollen to pollinate) to describe natural and physical processes or adjectives to nouns to describe qualities (intense to intensity) (Fang & Schleppegrell, 2010). Further, word knowledge is interrelated, that is knowledge from one word connects to knowledge of other words. Teaching content specific vocabulary in clusters of related concepts facilitates the learning of new, but related, concepts (Cervetti, Wright, & Hwang, 2016).

Panorama uses a number of evidence-based practices to ensure students learn both general academic vocabulary and science vocabulary. They include word learning in a language-rich environment; intentional and explicit teaching of words through multiple exposures; and teaching words in a generative way by using context and word parts.

Beyond specific vocabulary, engaging in science-based reading and discussions provide students the opportunity to learn the language structure of science. Science text can be inaccessible for many students, because it is dense and contains content-specific language. Dense text contains a high percentage of content words that may be unknown, if a student is not familiar with the topic. Science-based narrative texts, on the other hand, include fewer content words while keeping facts related to the concept intact. This provides a means for students to learn science concepts.

Informational text exposes students to science structures such as language to formulate and state hypotheses, draw conclusions, make inferences, and ask questions needed for science inquiry. Informational text will also help students learn process skills such as observing, describing, explaining, or predicting, (Casteel & Isom, 1994).

Panorama pairs informational text with science-based narrative texts to help students build background knowledge. In addition, throughout the unit, students analyze articles and text critically, evaluate and question ideas and methods, and make connections between the text, other sources, and their own knowledge. These activities facilitate their comprehension and science knowledge.



Unit Preview

BIG QUESTION
How do animals and plants adapt to survive?

Life Science
Living Things: Structures and Functions

	Overview	Vocabulary		Skills & Strategies*	Text Complexity	Close Reading	Write to Sources
Leapin' Lizards by Rebecca L. Johnson Expository Text 900L GR: S	Page 50	**Science** adaptation anatomy camouflage defense predator prey	**Academic** classify texture	Main Idea and Key Details Cite Text Evidence Monitor Understanding Make Connections	**Structure:** sophisticated graphics essential to understanding text **Language Conventionality and Clarity:** unfamiliar language	Close Reading Lesson with *Predators and Prey*	Narrative Text
Predators and Prey by Susan E. Goodman Expository Text 850L GR: R	Page 50	**Science** adaptation anatomy camouflage defense predator prey	**Academic** classify texture	Main Idea and Key Details Cite Text Evidence Monitor Understanding Make Connections	**Structure:** sophisticated graphics essential to understanding text **Language Conventionality and Clarity:** unfamiliar language	Comprehend complex scientific ideas	Narrative Text
Animal Encyclopedia by Dr. Lucy Spelman Expository Text 820 OOL GR: W	Page 58	**Science** colony disperse evolution genes species trait	**Academic** diverse feature	Relate Ideas Interpret Information Draw Conclusions Monitor Understanding	**Structure:** sophisticated graphics essential to understanding text **Language Conventionality and Clarity:** unfamiliar language	Use scientific vocabulary to compare bird features	Informational Text
Amazing Plant Adaptations by Elizabeth Gilbert, Jennifer Boudart, Renee Biermann Myth; Science Article; Play 820L GR: T	Page 66	**Science** bloom habitat pollination resistant	**Academic** characteristic function produce transform	Summarize: Theme Main Idea and Key Details Cite Text Evidence Text Structure Make Connections Monitor Understanding	**Structure:** sophisticated graphics essential to understanding text **Language Conventionality and Clarity:** unfamiliar language	Make connections between graphics and text	Narrative Text
Fact or Fantasy: Animal Tales by Joyce McGreevy and G.K. Gilbert Play; Short Story 720L GR: T	Page 74	**Science** agile awkward external internal survival aggressive fragrance mammals motivate	**Academic** act rehearse scene labors challenges obstacle persevere	Character, Setting, and Plot Summarize: Theme Elements of Drama Word Meaning: Allusions Point of View Text Structure Visualize Draw Conclusions	**Structure:** sophisticated text structure **Levels of Meaning:** infer attitudes and feelings from actions **Knowledge Demands:** multiple, sophisticated themes	Pages 25–28 Use elements of drama to make inferences about characters Pages 42–43 Synthesize Greek mythology and plot events	Opinion Text

*See pages 1–25 for Reading Skills and Strategies Mini Lessons

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