Spanish Science Literacy


# READING THE WORLD: THE POWER OF SCIENCE TEXTS

## CONTENTS:



SANTILLANA USA
Language Education Experts

www.santillanausa.com/spanishscience

# READING THE WORLD:
# THE POWER OF SCIENCE TEXTS

## THE IMPORTANCE OF INTEGRATED INSTRUCTION

The task of teaching has become increasingly complex. Students are asked to perform at high levels in all content areas, demonstrating close reading, problem solving, and mastering both content and process standards (National Governors Association Center for Best Practices, 2010; NGSS Lead States, 2013; National Council for the Social Studies, n.d.; U.S. Department of Education). Additionally, bilingual and dual language classrooms face the challenge of developing biliterate and bicultural students (Howard, E. R., Lindholm-Leary, K. J., Rogers, D., Olague, N., Medina, J., Kennedy, D., Sugarman, J., & Christian, D., 2018). Unfortunately, while the curriculum has increased in both breadth and depth, the amount of time that teachers have with their students has not (Bang-Jensen & Lubkowitz, 2017). A powerful way to make the most of every instructional minute and create a coherent context for learning is through well-designed, standards-based integrated units (Beeman & Urow, 2017). By focusing on big ideas in science or social studies, students are able to engage with content as they develop the language and literacy skills they need for college and careers. This approach helps teachers make the most of every instructional minute and increases student engagement and academic success.

There is no question that broad reading increases vocabulary and builds background knowledge (Marzano, 2004). A key component of integrated instruction is the careful selection high-quality, authentic texts, both literary and informational. The rich vocabulary of a text such as *Las señales del cuerpo*, with lines such as *"Nuestros cuerpos son maravillosas máquinas que dan señales, como las luces de los semáforos cuando vamos a cruzar las calles y avenidas."* not only provides students with important content vocabulary, but also exposes them to Tier Two words, which, according to Beck, McKeown, and Kucan (2013) are "words that are of high utility for mature language users and are found across a variety of domains." (Chapter 1, p. 27 electronic version). When students learn words such as *maravillosas* and *señales* in the context of reading about the human body, it will increase comprehension of texts related to electronics, communication, and space travel, not to mention literary texts.

"EN EL PENSAMIENTO CIENTÍFICO SIEMPRE ESTÁN PRESENTES ELEMENTOS DE POESÍA. LA CIENCIA Y LA MÚSICA ACTUAL EXIGEN DE UN PROCESO DE PENSAMIENTO HOMOGÉNEO".

ALBERT EINSTEIN (1879–1955) CIENTÍFICO ALEMÁN NACIONALIZADO ESTADOUNIDENSE

Finding rich texts and identifying Tier Two words is an excellent first step, but making those words stick in students' minds requires a coherent instructional plan. An effective approach to vocabulary instruction involves presenting descriptions, explanations, or examples of the new words, having students relate them to familiar concepts, and finally, using them in multiple contexts, including classification, writing sentences, or providing examples and nonexamples (Beck, McKeown & Lucan, 2013; Santillana USA, 2018). When teachers incorporate rigorous, focused vocabulary instruction, students will remember the target vocabulary and connect it to other, related words. A word like *virus*, for example, will help students learn words such as *antivirus, viral, viruela, virulento* and *virulencia* and can be found in contexts as varied as health, science, literature, and social media, and will increase student comprehension of other complex texts. Integrating content and literacy provides the ideal framework for vocabulary development and, while any content area can serve as the basis for student learning, science creates a powerful context for developing content knowledge, a solid academic vocabulary, and strong readers and writers.

"CIENCIA ES TODO AQUELLO SOBRE LO CUAL SIEMPRE CABE DISCUSIÓN".

—JOSÉ ORTEGA Y GASSET (1883–1955)
FILÓSOFO Y ENSAYISTA ESPAÑOL

## SCIENCE AND INTEGRATED INSTRUCTION

There are many reasons to choose science as the cornerstone of integrated instruction. First of all, science is everywhere. As adults we take the wonders of science for granted, but every day we employ scientific principles when we select food and cook a meal, start our cars, or ask "what if" questions. At the same time, we hear about scientific breakthroughs on an almost daily basis (El País, retrieved 2/7/2018; Houston Chronicle, retrieved 2/7/2018). Clearly, science is of great interest around the world.

Children are innately curious about the world around them, and science allows them to discover how and why natural phenomena occur. While we can't give students hands-on experience with every phenomenon, we can provide them with engaging, well-written texts that will satisfy children's natural curiosity and increase their knowledge and understanding of the world around them. (Santillana USA, 2018). Those texts can be a valuable complement to hands-on laboratory experiences as well as powerful tools for increasing students' reading and writing skills.

A third and very important reason to base integrated thematic instruction in science is the rise of the STEM/STEAM (Science, Technology, Engineering and Mathematics / Science, Technology, Engineering, the Arts and Mathematics) movement, beginning in 2011. As of 2017, approximately 6 million Americans are employed in the fields of science and engineering, and that number is expected to grow to more than 9 million by 2022 (Gunn, J.L.M., 2018). Clearly, there is a need to increase student interest in and knowledge of science to meet those future demands.

"EN EL PUNTO DONDE SE DETIENE LA CIENCIA, EMPIEZA LA IMAGINACIÓN".

JULES DE GAULTIER (1858–1942)
FILÓSOFO FRANCÉS


▶ *Mi investigación, pages 20–21*

## CONNECTING SCIENCE AND LITERACY INSTRUCTION

The centrality of science in our students' daily lives and their future success is apparent. What is less obvious is how powerful connecting science and literacy instruction can be. At the most basic level, reading informational texts about science introduces students to the vocabulary associated with a given topic and will provide them with either background knowledge or additional information. For example, with a text such as *Mi investigación* (So Bo-Hyun, 2007), students are introduced to vocabulary related to biomes such as *taiga, pradera (prairie),* and *océanos glaciales (glacial biome),* and facts about the climate, flora and fauna of each region. When students are exposed to engaging, well-written texts, they will build background knowledge that enhances their learning (Marzano, 2004) and motivates them to investigate further.

At first glance, one would assume little similarity between the disciplines of science and the language arts. However, a comparison of both at the conceptual level reveals many key similarities. The National Science Teachers

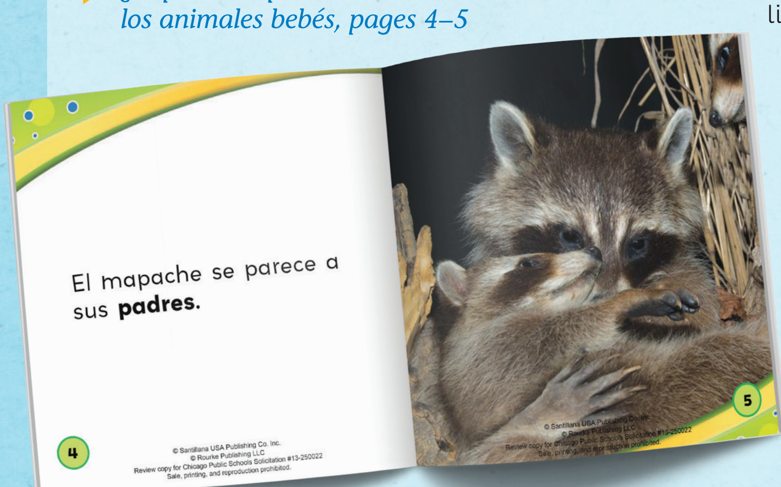
**TABLE 1. COMPARING SCIENCE CROSS-CUTTING CONCEPTS AND KEY READING SKILLS AND STRATEGIES**

| SCIENCE CROSS-CUTTING CONCEPT (NSTA, 2014) | READING SKILLS AND STRATEGIES (AFTER BANG-JENSEN & LUBKOWITZ, 2017) |
|---|---|
| patterns | classifying, comparing and contrasting, making predictions, decoding skills, word work, genre structures |
| cause and effect | cause and effect |
| scale, proportion and quantity | figurative language (metaphor, analogy), folk and fairy tales (i.e., *Ricitos de oro, Los tres cerditos,* etc.), analyzing illustrations |
| systems and system models | setting, classifying, questioning, predicting |
| energy and matter | cause and effect, sequence of events |
| structure and function | unusual book formats, narrative or poetic structure, specific science and engineering topics |
| stability and change | character development, sequence of events, cycles, figurative language (idioms) |

Association has identified seven cross-cutting concepts that are at the core of all science content: patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change (NSTA, 2014). One can see obvious relationships between the science concept of patterns and the foundational skills related to decoding and identifying rhymes. However, the concept of pattern also involves classifying, comparing and contrasting, and making predictions, which are identified as key reading goals (New York State Education Department, 2012; Texas Education Agency, 2008). Table 1 offers a comparison of the science cross-cutting concepts and key reading skills and strategies.

There are many informational texts that embody the concept of pattern. For example, in the text *¿A quién me parezco? Un libro sobre los animales bebés* (Lundgren, 2012), students can identify the pattern of how animal babies resemble their parents as well as the sentence patterns.

*¿A quién me parezco? Un libro sobre los animales bebés, pages 4–5*





*Mira cómo he crecido*

Students can recognize patterns in other genres. For example, *Mira cómo he crecido* (Vallejo-Nágera, 2003) is written in verse. After listening to lines such as, *"Me gusta jugar en la orilla del mar. Pero, mamá, ¿por qué tengo que aprender a nadar?"* students can identify rhyming words and find other golden lines within the text. A powerful tool for recognizing and describing patterns is to look for patterns across texts and genres. By comparing the animals in *¿A quién me parezco? Un libro sobre los animales bebés* (Lundgren, 2012) with Lola in *Mira cómo he crecido* (Vallejo-Nágera, 2003), students can relate science concepts to literature and their own experiences.

Cause and effect relationships exist in literature as well as in nature. Kindergarten students can develop their understanding of the concept through a literary text such as *El hombrecillo de la lluvia* (Rodari, 2014), in which students are presented with a fanciful account of what causes rain. In addition to identifying the fictitious presentation of what causes weather, students are presented with the real effects of too much or too little rainfall. Older students can explore cause and effect relationships in texts such as *Más* enormous numbers in ways that are related to students' daily experiences. Using a text such as this one will help them make sense of the many abstract facts that students are expected to remember as they advance through the elementary science curriculum.

Using a text such as *El sueño de una alubia* (Carrera, 2013) provides teachers with a wealth of opportunities to explore systems with their students as they read about the life cycle of a bean. Written in verse, this text uses rich metaphorical language and personification to describe the interaction between soil, water, and sunlight that causes the bean seed to sprout, grow and begin the cycle again. After students have read the text to understand systems, they will want to re-read the text to explore the beauty of the language. With verses such as *"Al tocar la tierra todo es maravilla, porque se ha encontrado con una semilla,"* students will be drawn into close reading and discussion about poetic devices as well as conversations about how the illustrations contribute to the mood of the text.


*¿Y sí...? Una increíble forma de percibir la realidad, pages 8–9*

*allá de los dinosaurios* (Chimal, 2003) as they read about possible causes for their extinction and the survival of their descendants.

Scale, proportion, and quantity are difficult concepts for children to understand, especially with extremely large units of measure. The book *¿Y sí...? Una increíble forma de percibir la realidad* (Adams, 2015) presents concepts such as the size of the planets, the age of the earth, distribution of resources, and others that are represented by

**GOLDEN LINES**

Use a brief excerpt from the reading selection that captures students' interest and motivates them to read the story. For example:

- *"La que fue semilla, harto dormilona, ya se ha convertido, en planta glotona". (p. 27)*
- *"La semilla nueva, de cuerpo pequeño, que entre las lombrices, reiniciará el sueño". (p. 41)*

*From the Teacher Notes for El sueño de una alubia*

A text such as *El paraguas del mago* (Montes, 2016) provides a framework for developing the concept of matter and energy with young students as they follow the sequence of events as a magician uses his magic umbrella to create matter and energy to solve a problem. Older students can read texts such as Mi-Gyeong Kim's *Contacto: La electricidad* (2006) to develop vocabulary and background knowledge to support their understanding of the concept.

As children explore the world around them, they are likely to ask questions about why animals look the way they do. Teachers can take advantage of this curiosity by having students read about plant and animal (including human) adaptations and focusing on those structures that serve particular functions. Cynthia Pratt Nicolson's *Totalmente humano* (2016) contains a series of essays answering questions about structures within the human body, explaining how they are closely related to the functions they serve. After reading the text, students can analyze the structure of the text and how the author's choice of a question-answer format increases interest and understanding.

Books about life cycles offer students opportunities to explore the final cross-cutting concept, stability and change. Georgina Lazaro Leon's *¡Viva la Tortuga!* (2004) tells the story of the life cycle of the hawksbill sea turtle in verse, using rich language to emphasize the changes that individual turtles experience as the cycle repeats across generations. The author includes a factual account of the life cycle of the hawksbill sea turtle, which allows students to compare informational texts in verse and prose.

Integrating science into literacy instruction is much more than an effective way to manage the curriculum. It allows students to make connections across content areas, develop critical thinking skills and gain an understanding of how the world works. The simple act of putting great books in the hands of our children can create the next generation of scientists. It all begins with one book . . .

"SI NO CONOZCO UNA COSA, LA INVESTIGARÉ".

LOUIS PASTEUR (1822–1895)
QUÍMICO Y MICROBIÓLOGO FRANCÉS

## REFERENCES


Adams, S. (2015). *¿Y si...? Una increíble forma de percibir la realidad.* México DF: Loqueleo/Editorial Santillana.

Bang-Jensen, V. & Lubkowitz, M. (2017). *Sharing Books, Talkling Science: Exploring Scientific Concepts with Children's Literature.* Portsmouth, NH: Heinemann Books.

Beck, I.L., McKeown, M.G. & Kucan, L. (2013). *Bringing Words to Life: Robust Vocabulary Instruction*, 2nd ed. New York: The Guilford Press.

Beeman, K. and Urow, C. (2017). *Teaching for Biliteracy.* http://www.teachingforbiliteracy.com/tips-on-writing-bufs/

Carrera, E. (2013). *El sueño de una alubia.* México DF: Loqueleo/Editorial Santillana.

Chimal, C. (2003). *Más allá de los dinosaurios.* México DF: Editorial Santillana. Grupo Prisa (retrieved 2/7/2018). El País: Ciencia. https://elpais.com/elpais/ciencia.html

Gunn, J.L.M. (2018). *The Evolution of STEM and STEAM in the U.S.* https://education.cu-portland.edu/blog/classroom-resources/evolution-of-stem-and-steam-in-the-united-states/ Portland, OR: Concordia University – Portland.

Howard, E. R., Lindholm-Leary, K. J., Rogers, D., Olague, N., Medina, J., Kennedy, D., Sugarman, J., & Christian, D. (2018). *Guiding Principles for Dual Language Education* (3rd ed.). Washington, DC: Center for Applied Linguistics.

Houston Chronicle (retrieved 2/7/2018). *Search results*: science. https://www.chron.com/search/?action=search&firstRequest=1&searchindex=solr&query=science.

Lázaro León, G. (2004). *¡Viva la Tortuga!* Doral, FL: Loqueleo/Santillana USA.

Lundgren, J. (2012). *¿A quién me parezco? Un libro sobre los animales bebés.* Vero Beach, FL: Rourke Educational Media.

Marzano, R.J. (2004). *Building Background Knowledge for Academic Achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Mi-Gyeong Kim (2006). *Contacto: La electricidad.* México DF: Penguin Random House.

Montes, G. (2016). *El paraguas del mago.* México DF: Loqueleo/Editorial Santillana.

N.A. (2017). *Proverbia: 9.793 frases célebres, 142 proverbios, 312 refranes.* http://www.proverbia.net

National Governors Association Center for Best Practices, Council of Chief State School Officers (2010). *Common Core State Standards.* Washington, D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.

National Council for the Social Studies (n.d.). *National Curriculum Standards for Social Studies: Introduction.* https://www.socialstudies.org/standards/introduction.

New York State Education Department (2012). *New York State P-12 Common Core Learning Standards for English Language Arts and Literacy.* https://www.engageny.org/resource/new-york-state-p-12-common-core-learning-standards-for-english-language-arts-and-literacy

NGSS Lead States (2013). *Next Generation Science Standards: For States, By States.* https://www.nextgenscience.org/search-standards.

Nicolson, C.P (2016). *Totalmente humano.* México DF: Loqueleo/Editorial Santillana.

NSTA (2014). *Cross-Cutting Concepts.* http://ngss.nsta.org/CrosscuttingConceptsFull.aspx.

Rodari, G. (2014). *El hombrecillo de la lluvia.* Madrid: Loqueleo/Editorial Santillana.

Santillana USA (2018). *A+ Science Literacy Kits.* Doral, Florida: Santillana USA.

So Bo-Hyun (2007). *Mi investigación.* México DF: Penguin Random House.

Texas Education Agency (2008). *Capítulo 128. Conocimientos y destrezas esenciales de Texas para Artes de la lengua y lectura en español Subcapítulo A. Primaria* https://tea.texas.gov/Academics/Curriculum_Standards/TEKS_Texas_Essential_Knowledge _and_Skills_(TEKS)/Texas_Essential_Knowledge_and_Skills_in_Spanish/

U.S. Department of Education (n.d.). College and Career Readiness Standards. https://www.ed.gov/k-12reforms/standards.

Vallejo-Nágera, A. (2003). *Mira cómo he crecido.* Doral, FL: Loqueleo/Santillana USA.

Yun-Jeong Hong (2018). *Las señales del cuerpo.* Doral, FL: Loqueleo/Santillana USA


### ABOUT SANTILLANA USA

As part of Grupo Prisa, the largest educational publisher in the Spanish-speaking world, with over forty-five years working in the U.S., Santillana USA remains committed to language education exclusively. Our goal is to make teaching and learning Spanish an enriching experience through engaging and intellectually challenging materials, with a strong focus on new educational technologies that help you meet national and state standards.


SANTILLANA USA
Language Education Experts
www.santillanausa.com
1-800-245-8584

ISBN 978-1-64101-373-4
9 781641 013734