Put Your Walls to Work

Planning and using interactive word walls to support science and reading instruction

By Julie Jackson and Annie Durham

Many classrooms have word walls displaying vocabulary that students have learned in class. Word walls serve as visual scaffolds to support instruction. To support vocabulary development in science, we replaced traditional word walls, which are generally lists of words or word banks, with interactive word walls. Interactive word walls may resemble graphic organizers or data tables. They highlight connections between concepts and artifacts (realia) from inquiry-based science activities while connecting scientific concepts and academic vocabulary. They strategically target vocabulary and include visual aids that illustrate word meanings to deepen understanding. Interactive word walls usually include a visual representation of specific vocabulary words and labels. Definitions are optional (Jackson and Narvaez 2013). In this article, we describe how we select vocabulary for interactive word walls and our efforts to use interactive word walls as scaffolds that help students effectively communicate scientific ideas and structure writing.

Vocabulary and Reading

Vocabulary development is one of the five essential components of reading (National Reading Panel 2000). When science teachers explicitly address vocabulary development, they support reading instruction. Research has found that student achievement improves when academic vocabulary, student-generated materials, and visual supports are arranged to organize learning (Jackson 2014; Jackson and Ash 2012). Interactive word walls support the *Common Core Language Arts* standards because they help students form relationships with and learn vocabulary through interactive visual literacy. Teachers plan the structure of interactive word walls and organize the sequence in which they are built. Students complete interactive word walls during the "Explain" section of a 5E lesson, when academic vocabulary is typically reinforced or explicitly taught (Bybee 2014).

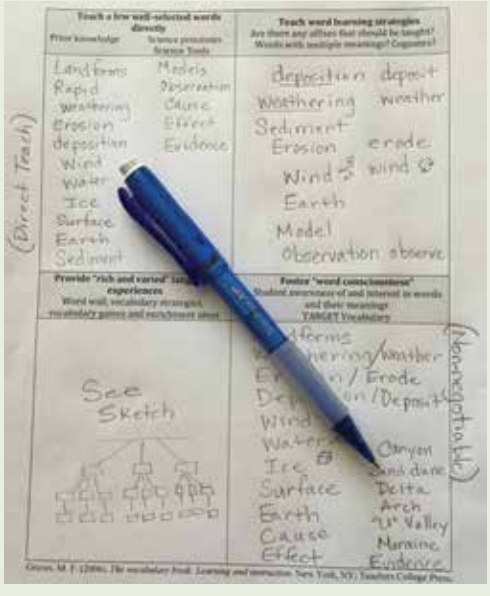
Student participation is critical. A first-grade teacher shared that "sitting down to think through these word walls helped me so much in planning instruction. Already my students are using more vocabulary correctly and frequently as we build the word walls and use them daily in our class. Their understanding seems more solid and concrete than I've seen in years' past."

Selecting Vocabulary

Selecting vocabulary to teach is a challenging and at least partially subjective task (Graves, August, and Mancilla-Martinez 2013). To ensure that the vocabulary selection is focused and systematic, we use a Vocabulary Planning Document (see Figure 1) that reflects the four

FIGURE 1.

Vocabulary planning document.



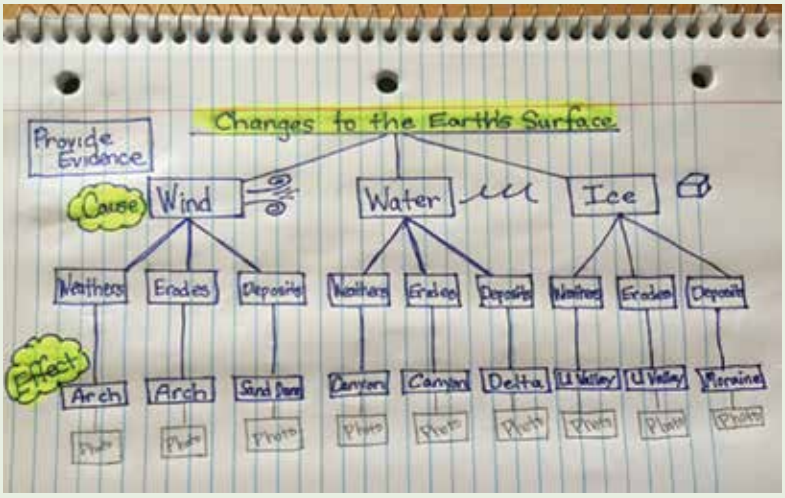
components of a comprehensive vocabulary program: teach a few well-selected words, teach word-learning strategies, foster word consciousness, and provide rich and varied language experiences (Graves 2006). The Vocabulary Planning Document is completed during team planning, and the vocabulary included on this document underpins the selection of all instructional materials.

We often refer to a completed Vocabulary Planning Document as a "shopping list." If lesson materials do not contain vocabulary included on the list, we add the vocabulary words to the lessons and locate or create materials to support teaching the concept they represent. If available lesson materials contain vocabulary not on the list, we discuss the merits of including the additional terms in our lessons. Grade-level teams decide if the additional vocabulary is fully aligned with the content articulated in the standard. If it is aligned with the grade-level standard with exactness, the word is added to the Vocabulary Planning Document and it will be included in lessons. If it is not aligned, it will not be used and lesson materials that support it will be discarded.

This vocabulary-driven process focuses team meetings and ensures that all lesson materials are aligned to standards with fidelity and it supports a robust and informed review of instructional materials. It provides a mechanism to test the merit of lesson materials included in a state–district-approved curriculum, suggested by peers, retrieved from filing cabinets, purchased from internet vendors, pinned and shared on open access sites, or available for free. Reactions from teachers using the Vocabulary Planning Document include "We have been over teaching," "No wonder we never had enough time," and "Now I know what is important."

FIGURE 2.

Interactive word wall sketch.



Using the Planning Document

Disciplinary core idea 4-ESS2.A Earth Materials and Systems states that students should be able to make observations to provide evidence of the effects of weathering or the rate of erosion by water, ice, and wind (NGSS Lead States 2013). Texas standards require that fifth-grade students recognize that landforms are the result of changes to the Earth's surface by wind, water, and, ice. The following planning example is from Texas, but it could be easily adapted to cover 4-ESS2.A by using landforms as evidence to describe the effects of weathering and erosion by water, ice, and wind.

All vocabulary decisions are driven by science standards. Teachers read the standard that they are scheduled to teach and consider the rigor, depth of knowledge of the verbs, and science-process skills associated with the concept. Teachers review the standards vertically to determine the science concepts that students need to know, what concepts they already know, and what they will learn in the future. Finally, they consider the science tools their students will use during inquiry science activities. The results of this review are included on the Vocabulary Planning Document under the heading "Teach a few well-selected words directly."

Next, we consider word-learning strategies. We review the science standard looking for any affixes that should be taught or reviewed. Using word parts to help unlock the meaning of unknown words is a widely accepted practice (Graves 2006). Understanding and using prefixes, suffixes, and roots (morphemic analysis) helps English language learners (ELLs) and students with reading disabilities unlock the meaning of academic and common vocabulary words they encounter on a daily basis. A list of common prefixes, suffixes, and Greek and Latin roots is available at *www.cdl.org/wp-content/uploads/2013/12/Common-Prefixes-Suffixes-and-Roots-8.5.13.pdf*.

We also look for words with mul-

tiple meanings. Many familiar words have different meanings in science. To *rotate*, or spin on an axis, does not describe rotating or moving stations or activities in a classroom. The more frequent the word, the more likely it is to have multiple meanings (Graves 2006). In fact, some words have over 100 meanings. Run has 179 meanings and take has 123 meanings. Science standard 4-ESS2.A uses *wind* as a noun to describe moving air. As a verb, *wind* means to have a circular or spiral direction. These two meanings are completely unrelated. Students build conceptual understanding when teachers openly address words with multiple meanings, provide authentic context for one or more of the meanings, and create opportunities to use them. A list of 10 English words with the most meanings can be found on a "English with a Twist" website (see Internet Resources).

We also consider English-Spanish cognates. Cognates are words from two different languages that have the same or similar meanings, spellings, and sometimes, similar pronunciations (Graves, August, and Mancilla-Martinez 2013). A list of Science English-Spanish cognates is available on The Science Toolkit website (see Internet Resources).

Then, we foster word consciousness. We select the target vocabulary that MUST be included on the interactive word wall and structure ways that students might become aware of and interested in these words and their meanings. Finally, we plan for ways to provide rich and varied language experiences. Teachers sketch the interactive word wall making sure that all target vocabulary is included. The sketch often resembles a graphic organizer or a data table and frequently includes verbs, science-process skills, and crosscutting concepts. To determine the best way to represent the information, we ask ourselves about the nature of the content: Does the concept have a hier-archical structure that can be divided into categories and subcategories? Is this concept a cycle? Do students need to compare and contrast topics? Explore cause and effect? Examine structure and function? Recognize scale, proportion, and quantity? Text structures, connections, and cross-cutting concepts related to the science standard help organize the word wall. For example, flow maps easily illustrate the flow of energy in a food chain, while a web concept map may be used to represent the flow of energy in food webs. Fishbone graphic organizers, arrows, or pie charts can represent cause and effect. Structure and function is easily displayed as a tree map with one column labeled structure and another column labeled function (Jackson and Narvaez 2013). Sketches do not always fit on the Rich and Varied Language section of the Vocabulary Planning Document and may be created on another sheet of paper (see Figure 2, p. 79).

Teachers also plan ways that the interactive word wall may be used to support classroom discussions and writing, vocabulary games, and other vocabulary enrichment activities. We look for ways students can speak and write about science and engineering topics with a purpose in mind and for an audience—their classmates (Graves, August, and Mancilla-Martinez 2013). Data table word walls support science and engineering practices. Students can use mathematics and computational thinking to analyze and interpret data included on the word wall. They can construct explanations and engage in arguments using evidence posted on the word wall. The word wall can also be used as a reference when students need to obtain, evaluate, and communicate information. In this example, the teacher provided four sentence stems (prompts) that students used to communicate their ideas verbally and in writing. The sentence stems or discourse patterns are arranged from simple to complex to scaffold student success and differentiate the activity (see Figure 3). This work could be used as a formative assessment during a changes to the Earth's surface unit because it contains the content and academic vocabulary included in the standard.

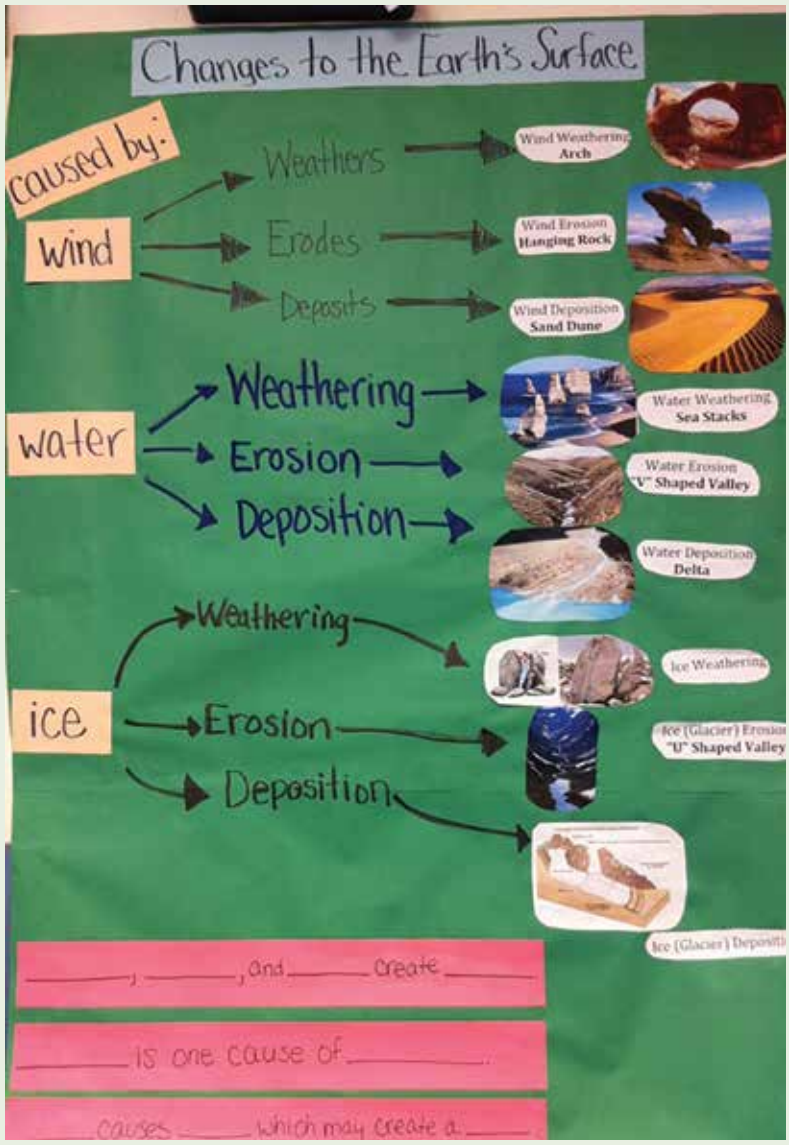
Interactive Data Tables

Some interactive word walls resemble graphic organizers. Other interactive word walls are designed to mirror data tables and contain data collected during inquiry investigations. Students develop a basic understanding of how a data table is organized when they represent data concretely and pictori-

Sentence Stems/Discourse Patterns for 4-ESS2.A
Level 1: _____, _____, and _____ create _____ .
Level 2: _____is one cause of _____.
Level 3: _____causes _____, which may create a _____.
Level 4: _____ is a result of _____ by _____.

FIGURE 3.

Completed interactive word wall with sentence stems/discourse patterns.



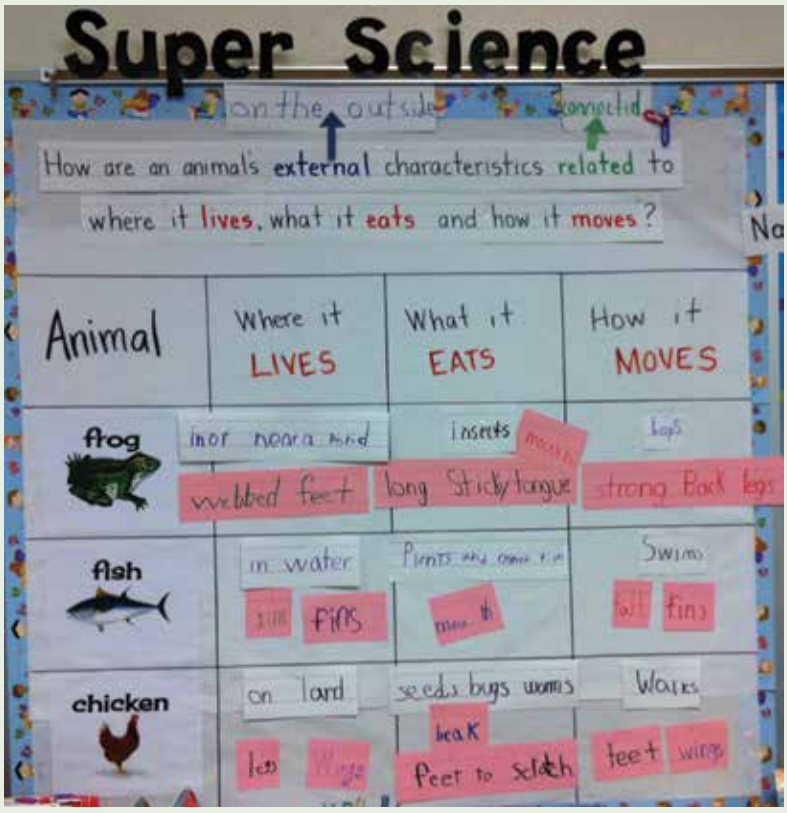
ally, sort and sequence data, describe results from data collection and display, and interpret visual representations (Sullivan and Lilburn 2005).

First-grade students conducted research to determine how the external characteristics (structures) of animals function, thereby influencing where the animal lives, what it eats, and how it moves (1-LS1.A). They presented their research findings to their classmates and then posted their results in the appropriate columns and rows (see Figure 4, p. 82). Their teacher stated that "we built our frog, fish, and chicken word wall and then we did a lot of writing using sentence stems. It was really neat to see how I could use my interactive word wall to get the students to write. I used to use word banks, but they did not work for me. Having words posted on anchor charts didn't work either. Word banks and anchor charts are words without context and they don't have meaning on their own. I realized that my students needed to experience the science concepts before they were exposed to the vocabulary. Now we make sense of the inquiry science experiences and connect them to vocabulary terms as we build our word walls together. Data from our investigations become part of the word wall. My students are using the words from our science word walls and from our discussion in their writing and in their talking. I've seen some of this in years past but not to the degree that I've seen it this year." Rich and varied language experiences in which students have multiple thoughtful encounters with words ensures that all students have opportunities to speak, read, and write about science.

Weather data can also be displayed in interactive data tables. Disciplinary core ideas that focus on weather (3-ESS2-D; 3-ESS2-1) suggest that students represent data in tables to describe typical weather conditions and patterns across time and areas so that students can make predictions about what weather might happen next. Suggested data points include average temperature, precipitation, and wind direction. Texas students collected weather information and posted their data on their classroom interactive word walls (see Figure 5, p. 83) and in their science notebooks. Then, they used the weather data to predict future weather conditions. Students used target weather vocabulary when they collected data,

FIGURE 4.

Interactive structure and function data table.



recorded data, and made weather predictions. This work could be used as a formative assessment of a weather unit because it contains the content and vocabulary included in the weather standard.

Constructing Interactive Word Walls

Teachers plan what interactive word walls look like and how data should be organized. The word wall "frame" is sketched during planning and prepared at the beginning of a unit. Figure 5 illustrates how fourth-grade teachers used blue painter's tape to "frame" weather data table walls. After planning, sketching, and framing word walls, teachers know what content is required to complete the word wall, and they use this knowledge to select inquiry activities that support essential science content and guide classroom conversations toward target academic vocabulary.

The interactive structure and function data table word wall (Figure 4) was introduced to students with a focus question: How are an animal's external characteristics related to where it lives, what it eats, and how it moves? The class discussed the focus question and worked to define *external* and *related*. The teacher wanted her students to understand that *external* means on the outside. The class talked about what *external* meant and discussed word parts. *Ex*it means to go *outside*. An *exo*skeleton is on the *outside* of an animal. The class agreed on a definition for *external* and a student wrote the definition on a sentence strip. The teacher stapled the definition to the wall. They repeated this process for *related*, but this time they added the definition and two chain links to the wall. One chain link represented a frog living in a pond; the other chain link represented webbed feet. They connected the chain links to demonstrate that *related* means being connected. Living in a pond and webbed feet are *related*. They used the same chain links when talking about making connections during reading. They "clinked" the chain links together when making text-to-self, text-to-text, and text-to-world connections.

Students construct the word walls by entering data gathered during inquiry activities, contribute illustrations, select artifacts, prepare labels or definitions negotiated during class discussions. Interactive word walls are constructed using everyday school items such as, painter's tape, chart paper, butcher paper, construction paper, sentence strips, index cards, and objects from inquiry experiments. Teachers recommend using thick, dark markers for writing words and definitions.

Students often decide how visuals

FIGURE 5.

Interactive weather word wall.

or artifacts from labs should be linked with vocabulary to clarify meaning and showcase connections. Students may make individual contributions to a class wall or they may work in small groups to collect data or create artifacts. If limited time is a factor, the teacher may ask the entire class to work together to socially negotiate what should be included on the wall. The level of teacher support varies by student ability and grade level.

Walls are built in increments. Some walls require weeks to complete and other walls are completed more quickly. The science content being covered and the district scope and sequence determine the timeline. Students often reference the walls throughout a unit. One teacher shared that "this is my science team's first year using interactive word walls and students love to see it up. It's a daily reminder of what they have learned. You will find many of them trying to answer questions without looking at the wall to test themselves." Photo albums of exemplary math and language arts interactive word walls are available on the Science Toolkit website (see Internet Resources).

Science for All

A fourth-grade teacher discovered that building interactive word walls helped her lowest-performing students. "I noticed that my lowest students understood the material. It was fun for them, and drawing pictures and writing words on sentence strips is nonthreatening. I have a student who reads at a first-grade level, and she scored 100% on our last assessment. I saw her eyes light up when she passed the quiz. Today she was sitting by me and looking at everything on the word wall, and I could see that it's nonthreatening to her. If I give her a reading passage or a reading assignment, she knows she cannot do it and automatically she is defeated. But she can do this." A third-grade teacher reported that interactive word walls "have transformed my lessons and have been so beneficial for my ELL learners." Interactive word walls are a reliable resource that students with varying academic abilities may reference in their efforts to apply academic vocabulary when participating in or listening to classroom discourse as well as when asked to read or write about science content.

Conclusion

Interactive word walls support robust science instruction that benefits all students (Jackson 2014; Jackson and Ash 2012). The Vocabulary Planning Document provides a systematic approach to selecting vocabulary and lesson materials that are aligned with standards. Explicit teaching of a few well-selected vocabulary words in context while providing multiple rich and varied exposures to target vocabulary ensures a comprehensive approach to vocabulary instruction. Students build vocabulary knowledge and make connections between vocabulary and inquiry science experiences as they participate in word wall construction and use the word wall to support scientific discourse. A teacher summarized this process "I just started having my students make our first interactive word wall this week in my fifth-grade class. They are writing the vocabulary words and they are using them—very cool!" ■

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Internet Resources

English With a Twist
http://englishwithatwist.com/2014/03/18/10-english-words-with-the-most-multiple-meanings-part-1

Science Toolkit Photo Albums
www.facebook.com/Science-Toolkit-336549323099512/photos_stream?tab=photos_albums

The Science Toolkit
www.thesciencetoolkit.com/wp-content/uploads/2015/10/04_Cognates-for-Science.pdf

NSTA Connection

Download a checklist of word wall expectations at *www.nsta.org/SC1611*.