Interactive word walls: Visual scaffolds that transform vocabulary instruction

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Research shows a strong relationship between vocabulary and academic achievement. Vocabulary knowledge is a critical factor in school success for English language learners (ELLs) and students with learning challenges. This article describes how middle school teachers can use interactive word walls to increase their students' ability to learn and effectively use the language of science.

Interactive word walls

Traditional word walls are organized collections of vocabulary words displayed in a classroom. To support vocabulary development in science, we replaced *traditional word walls*, which are generally lists of words or word banks, with *interactive word walls,* which resemble graphic organizers or data tables and highlight connections between concepts and artifacts from inquiry-based science activities. Interactive word walls strategically target and connect scientific concepts and academic vocabulary. Interactive word walls usually include vocabulary words and visual representations that illustrate word meanings. Definitions are optional (Jackson and Narvaez 2013).

Starting an interactive word wall is simple and the benefits to student learning make it well worth the time. Interactive word walls are planned by teachers but constructed by students. As students create interactive word walls, the process enables them to build on prior knowledge, have multiple encounters with new academic vocabulary, and connect learning to inquiry activities and the real world. We recommend teachers follow a simple five-step instructional sequence to plan and use interactive word walls.

Step 1: Planning

Analyze a science standard, select vocabulary, and sketch the word wall

Purposeful planning moves teachers from "day-to-day survival" planning to unit planning. It provides opportunities to evaluate and select instructional activities that focus on disciplinary core ideas, performance expectations, and vocabulary—all while heeding state standards and district guidelines with fidelity. Only the vocabulary included in the *Next Generation Science Standards* (NGSS) or state standards (or specified in a district instructional guide) is taught. It also provides time to vertically review content while answering the questions: What has been taught? What needs to be taught? What will be taught in future grades? Selecting vocabulary to teach is a challenging and, at least partly, 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 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 in this document underpins the selection of

all instructional materials and word wall organization.

Teach a few well-selected words directly

We draw all vocabulary from our states' science standards because "the words found in the science content standards are the *de facto* vocabulary curriculum" (Fazio and Gallagher 2014, p. 1410). We look closely at grade-level disciplinary core ideas and verbs in order to understand the depth of knowledge, rigor, and intent of the standard, and to identify supporting vocabulary.

First, we distinguish between familiar (prior knowledge) and new academic vocabulary. We determine familiar vocabulary by looking at the previous grade-level science standards. Vocabulary words that students learned in prior grades and may have forgotten are considered familiar vocabulary, and they will be directly taught. New vocabulary is experienced during inquiry "explore" activities and explicitly taught during the "explain" phase of a 5-E lesson. The 5-E lesson plan model (Bybee 2014) is designed to structure and support scientific inquiry. Lesson plan components include: Engage, Explore, Explain, Elaborate, and Evaluate.

Teach word-learning strategies

We identify multiple-meaning words, affixes, and root words related to disciplinary core ideas. This is an important step because many ELLs and students with learning disabilities often lack

FIGURE 1: Vocabulary planning document

Standard:

Teach a few well-selected words directly Prior knowledge	Teach word learning strategies Are there any affixes that should be taught? Words with multiple meanings? Cognates?
Provide "rich and varied" language experiences Word wall, vocabulary strategies, vocabulary games and enrichment ideas	Foster "word consciousness" Student awareness of and interest in words and their meanings TARGET Vocabulary

Graves, M. F. (2006). *The vocabulary book: Learning and instruction*. New York, NY: Teachers College Press.

Jackson, J., & Durham, A. (2016). Put your walls to work: Planning and using interactive word walls to support science and reading instruction. *Science and Children, 54*(3), 78-84.

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CONTENT AREA

Physical science

GRADE LEVEL

6

BIG IDEA/UNIT

The student knows that force and motion are related to potential and kinetic energy

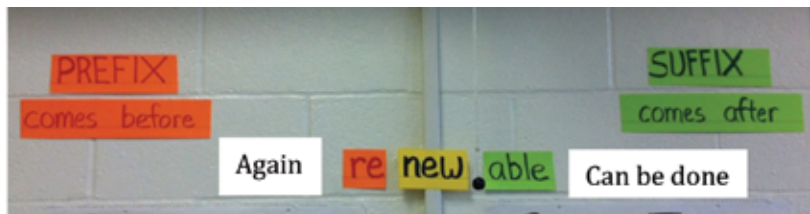**ESSENTIAL PRE-EXISTING KNOWLEDGE**

Mechanical energy is energy of motion

TIME REQUIRED

Five 45-minute class periods

COST

Free, if school has materials for kinetic and potential energy lab activities

FIGURE 2: Teach word-learning strategies

Prefix	Meaning	Root	Meaning
a	without	act, ag	to do, to act
ad	toward	aqua	water
ab	away from	astro	star
bi	two	bio	life
circum, cir	around	cred	to believe
com, con, co	together	dic, dict	to say or speak
de	down, opposite of	duc, duct	to lead
dis, dif, di	apart	equ	even
epi	on top of, upon	fer, ferr	to carry, bring
equ	equil	geo	earth
ex, e, ef	out, from	graph	write
hemi	half	hab	to live
inter	between, among	hydro	water
mono	one, alone, single	mit, mis	to send
non	not, the reverse of	par	equal
poly	many	scrib, script	to write
post	after		
pre	before		
re	again		
un	not		

knowledge of multiple meanings of words and may have limited grammatical knowledge of prefixes, suffixes, and roots, which interferes with vocabulary comprehension. ELLs and students with reading disabilities had improved vocabulary acquisition, knowledge of word structure, and reading comprehension when they were explicitly taught the process of analyzing prefixes, suffixes, and roots (Harris, Schumaker, and Deshler 2011). Learning a set of 20 prefixes and 14 roots, and knowing how to use them, un-

locks the meaning of over 100,000 words (Gruber 2011; also see the Online Supplemental Materials). Figure 2 contains an example of an interactive word wall that is teaching word-learning strategies. See Resources for a list of common prefixes, suffixes, and Greek and Latin roots.

Because many science terms have Greek or Latin origins, we also look for Spanish–English cognates. *Cognates* are words from two different languages that have the same or similar meanings and spellings, and sometimes, similar

pronunciations. See Resources for a list of science English–Spanish cognates.

Foster word consciousness

We determine target vocabulary related to the disciplinary core idea and plan ways to support these words during instruction. We use visuals (photos, color pictures, sketches) that illustrate new vocabulary words or vocabulary words that have multiple meanings. We typically begin with two to three key vocabulary words listed in the standard and on our district unit plan documents. These words are linked to the big idea for the concept. As the construction continues, five to 10 words are added, depending on the content. Then we think about words that are common, but might be unfamiliar to our students. During class activities, labs, or student discovery, other words are added to the interactive word wall to help students with real-world connections. Vocabulary choices are flexible and allow for additional words that emerge during instruction. We pair selected words with pictures, illustrations, or real objects. We like to use real objects (*realia*) when possible. For example, we add samples of sedimentary, metamorphic, and igneous rocks directly to the wall when we study the rock cycle. If the real objects are not available, we use pictures, ask students to draw illustrations, or use images found on the internet. These do not need to be elaborate.

Their purpose is to help students (especially those who are ELLs or learning disabled) make quick and easy visual connections to vocabulary (see Figure 3).

Rich and varied language experiences

Once target vocabulary and phrases are identified and matched with pictures or realia, we sketch a concept map or data table to organize content and connect the vocabulary. To determine the best way to represent the information, we ask ourselves about the nature of the disciplinary core ideas and related crosscutting concepts: Can the concepts be divided into categories and subcategories? Is it a cycle? Do the crosscutting con-

cepts explore cause and effect? Examine structure and function? Recognize scale, proportion, and quantity? This process ensures that interactive word walls visually illustrate the patterns and connections related to the disciplinary core idea and crosscutting concepts.

For example, flow concept maps illustrate the flow of energy in a food chain or biological succession, while a web concept map may be used to represent the flow of energy in food webs or the characteristics of objects in our solar system. Some disciplinary core ideas lend themselves to circle maps, continuum/time lines, tree maps, Venn diagrams, or T-charts. See Resources for photos of interactive science word walls. Completed concept map/

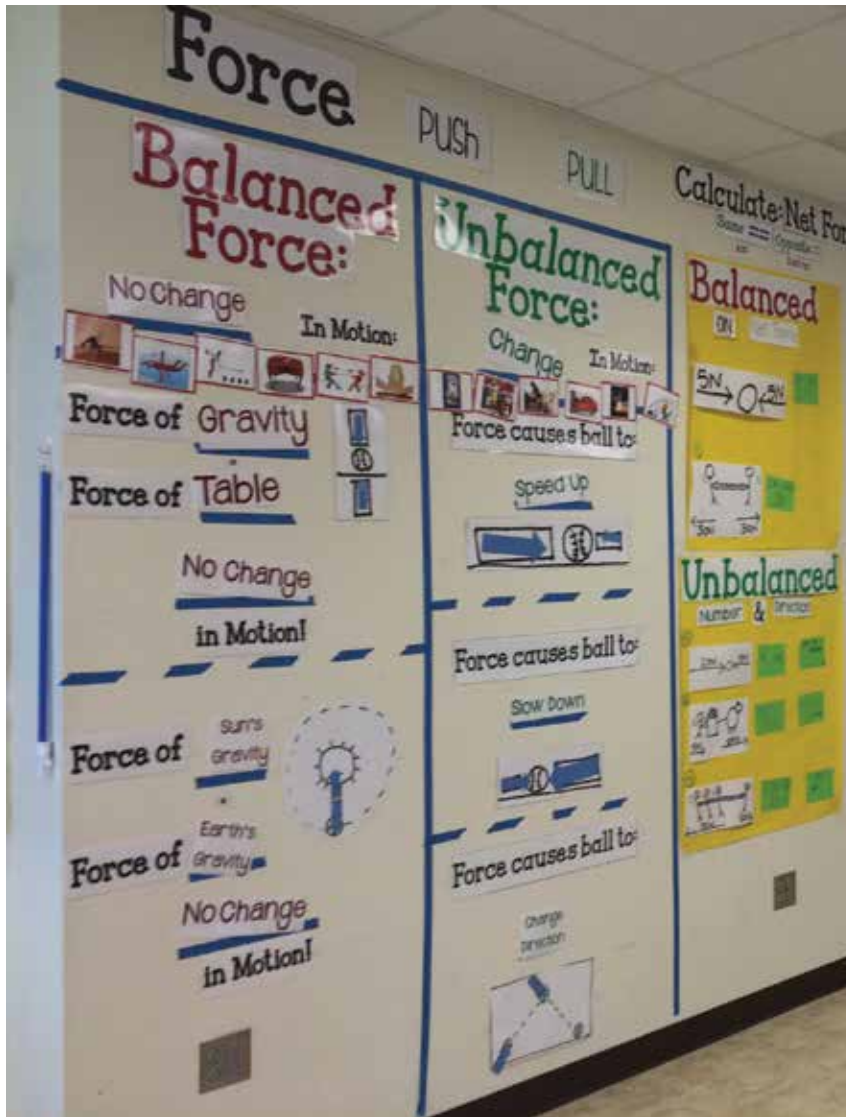data table sketches become blueprints for interactive word walls.

Interactive word walls function as unit organizers that students can easily reference to help them connect content and support vocabulary development as the unit progresses. Many teachers leave important word walls such as foundational scientific principles and safety in their classroom as long as possible so students can reference them and use them as reflection tools. Figure 3 illustrates how a sixth-grade teacher in Texas used different color backgrounds and distinctive labels to differentiate science content and units.

Figure 4 illustrates how blue painter's tape and columns may be used to differentiate science content and units (the science

FIGURE 3: Interactive word walls can differentiate units by color and labels

Step 3: Build the word wall frame

Once we have selected vocabulary, formed an idea of how specific concepts are linked, sketched the word wall, and prepared the student organizer, we are ready to place the word wall frame or outline on a classroom wall. Wall space and room arrangements often determine the configuration and placement of interactive word walls. They may be arranged on cupboard or classroom doors, on classroom walls, on windows, or hung from the ceiling with wire. Word walls are built across many days and are finished as a unit nears completion.

Step 4: Students construct the word wall

We plan and structure instruction around word wall construction. We strategically introduce target vocabulary and highlight connections to prior knowledge or concepts during instruction. To support classroom management, students are permitted to add items as directed by their teachers during whole-class discussions and explanations. Word wall creation is led by students but teacher facilitated. Students are always engaged in the word wall building process. Allowing specific students to add to the wall at specific times is a management strategy that teachers are familiar with because they use it during group work/collaboration all the time. Teach these

content in Figures 3 and 4 is not fully aligned with the *NGSS* because Texas has not adopted the *NGSS*).

Step 2: Create a student organizer

After we identify target vocabulary and sketch the interactive word wall, we prepare a student organizer (worksheet) that mirrors the word wall sketch (Fig-

ure 5). Students are given copies of the unit organizer and they complete it during the unit. If the district allows it, fill in a copy and provide copies to students with accommodations. Figure 5 contains an example of a completed forces and interactions student organizer. The "forces and interactions" word wall shown in Figure 4 mirrors the forces and interactions student organizer in Figure 5.

same group management skills when facilitating the creation of word walls. We rarely have issues with management on word wall construction days because students are focused and excited to participate. The forces and interactions word wall (see Figure 4) was planned and framed by the teacher. Students completed it as they socially negotiated understanding during the Explain portion of a 5-E lesson. Word strips are removable. Key vocabulary terms that address learning targets are premade, by the teacher, before class. Blank sentence strips are usually available and used to clarify words or add real-world examples. Students add the premade terms during class and they also make word strips as the need arises. When they are not posted, the wall looks like a fill-in-the-blank worksheet. Students placed the appropriate word strips in the blank spaces (horizontal lines of blue tape) during whole-group discussions and explanations that followed lab (Explore) experiences. We typically have a student help us remove words at the end of each class. Because students have the opportunity to create the word walls (or replace things that the teacher premade), they have ownership. We also interact with the word wall throughout the unit: We use it to review previously taught content, to support students who have missed one or more classes, and to play vocabulary games. Occasionally, we allow every class to add real-world

FIGURE 5: Completed forces and interactions student organizers
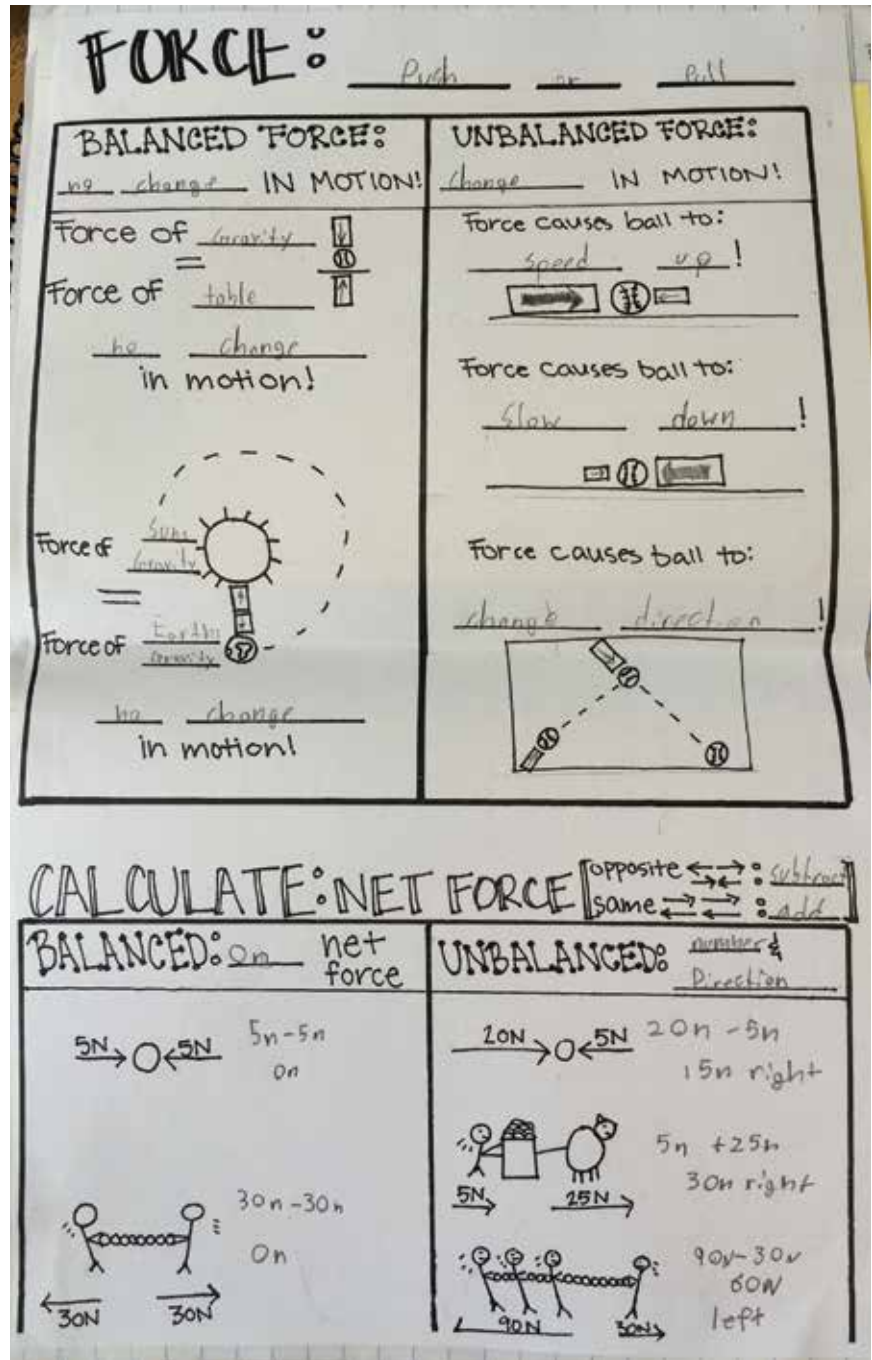
examples to the word wall, and these stay posted. Class discussions are often ignited when students observe an example provided from a student in another class. This provides unity among

the science classes and students often discuss examples used outside the classroom.

Step 5: Complete the student organizer and word wall together

Student organizers mirror the interactive word wall. As the word wall sections are completed during the Explain phase, students fill in corresponding sections of their organizer. As a result, students have a copy of the word wall in their possession. These sheets track instruction and may be used as formative assessments. Teachers may need to adjust instruction after looking at student organizers and noticing that students have not recorded information correctly, have confused concepts, or included inappropriate examples. Students also use the interactive word wall and their organizer to develop responses to an exit ticket or reflection question provided by the teacher. This helps the teacher assess if the students understand the concept covered in class that day. Typically, one organizer per unit is adequate.

Students usually glue the incomplete unit organizers into their science notebooks at the beginning of a unit. They complete the unit organizer section by section as content is covered in class. We like to take photographs of completed word walls and give copies of the photos to students to glue into their notebooks at the end of their unit notes. This creates visual bookends of the learning experience. Additionally, a photo helps us remember how we organized the walls and eases the planning burden year to year. Figure 5 contains a completed student organizer that accompanies the forces and interactions interactive word wall (see Figure 4).

Valued by students

Interactive word walls might appear cluttered or messy to visitors but not to students who were present as each section was built. Interactive word walls are visual displays that connect content and vocabulary. Student quotes confirm that interactive word walls are a valued classroom resource because they help students remember and recall information. One student stated, "I like the walls because we see the info that we need to know every day and it makes its way to our brain!!!" Another student shared, "I like it because it is just like a 2-D model that is labeled. Unlike a regular word wall, there is also a large picture that represents the word and it is easy to see." Finally, "I like it because it helps me. It helps me because I can memorize the things and when the test comes I've memorized what was on the wall so I can use it as a cheat sheet in my brain." (Note: Interactive word walls are covered for tests and exams.)

Students rely on interactive word walls for support. A sixth-grade teacher reported, "Last year, during our force and motion unit, the students did well on speed, graphing motion, and balanced/unbalanced forces, but they bombed pulleys and inclined planes. I talked with my classes the day after the test to find out why they struggled and every class said, 'Well, it wasn't even on the wall!' This year, we created a specific interactive word wall for inclined planes and pulleys, and the students excelled on our campus test and the district benchmark." Another teacher was displaced during testing and taught science in a different room for several days so she streamlined word wall construction. "We covered the physical properties of the Sun, planets, Galilean moons, meteors, asteroids, and comets, but many things were missing from the wall. My kids got mad that the Galilean moons were not anywhere to be found on Jupiter. Every class mentioned it."

Broad range of students

Most science classes include students with a broad range of abilities. The constant need for differentiation and varied needs of students can make planning and teaching difficult. One teacher noted, "Interactive word walls allow me to accommodate and expand the thinking of all of my students. In my PreAdvanced Placement and Gifted/Talented (PreAP/GT) classes, my students add a level of depth that other classes do not yet grasp and expand their thinking on a subject. My in-class support students are able to vary the content and expand it or keep it basic depending on their needs.

My English as a second language (ESL) class adds many labels to the wall, which we use to support their language learning. The interactive word wall allows me to differentiate without lots of extra work. My students are able to make it their own throughout the day and add what they find to be important."

Word walls can vary in size, depending on the classroom. Large poster board could be used for smaller classrooms or even science fair tri-fold boards. Many walls are made using butcher paper so they may be reused from year to year. Some teachers use classroom windows and white boards. Windows and white boards are not limitations. Rather, they are extra wall space. After a word wall is completed, it can also be displayed in other parts of the school, such as in the hallway by the classroom, in the cafeteria, or other high-traffic areas.

Start small, start now

The key to undertaking interactive word walls is to be flexible and patient. Planning is vital and it becomes easier with practice. One teacher reported that her first interactive word wall was a large piece of paper divided in half with the words "Physical Change" on one side and "Chemical Change" on the other. The wall began to take on a life of its own as students added their own examples throughout the unit. Students called the interactive word wall their "Graffiti Wall" and they were anxious to add to it each day. As students reflect and contribute, it is important to allow time for collaboration. Meaningful classroom discussions and teachable moments are often fostered when students share their knowledge with others. Interactive word walls provide opportunities for students to internalize key concepts and connect them to past, current, and future learning. Students also use interactive word walls as a connection to current events, scientist discoveries, science lab investigations, and other inquiry-based activities. Some students bring items from home to add to the wall and other students add fun facts that they discover independently. Interactive word walls are an instructional strategy that teachers can use to help all students learn and use the language of science. Start small, start now. ●

REFERENCES

Bybee, R.W. 2014. The BSCS 5E instructional model: Personal reflections and contemporary implications. *Science and Children* 51 (8): 10–13.
Fazio, X., and T. Gallagher. 2014. Morphological development levels of science content vocabulary: Implications for science-based texts in elementary classrooms. *International Journal of Science and Mathematics Education* 12 (6): 1407–23.
Graves, M.F. 2006. *The vocabulary book: Learning and instruction.* New York: Teachers College Press.
Graves, M., D. August, and J. Mancilla-Martinez. 2013. *Teaching vocabulary to English language learners.* New York: Teachers College Press.
Harris, M., J. Schumaker, and D. Deshler. 2011. The effects of strategic morphological analysis instruction of the vocabulary performance of secondary students with and without disabilities. *Learning Disability Quarterly* 34 (1): 17–33.
Jackson, J., and R. Narvaez. 2013. Interactive word walls: Create a tool to increase science vocabulary in five easy steps. *Science and Children* 51 (1): 42–49.

RESOURCES
Common prefixes, suffixes, and root words—*http://bit.ly/2piRwsi*
Graphic organizer templates—*www.achievementstrategies.org/graphicOrganizers.html*
Gruber, G. 2011. *Gruber's SAT 2400: Strategies for top scoring students.* 2nd ed. Naperville, IL: Sourcebooks.
Photos of interactive word walls—*www.thesciencetoolkit.com*
Science English/Spanish cognates—*http://bit.ly/2pj43vx*

ONLINE SUPPLEMENTAL MATERIALS
Prefixes and suffixes—*www.nsta.org/scope1707*

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