When my sixth-grade students first observe single-celled organisms like paramecia careening across their microscope stages, they are often at a loss for words. Excitedly pulling on the sleeves of their classmates, they urge each other again and again to “Look at this!” This is often followed by a chorus of “that’s so cool” or the all-encompassing “awesome.”

Yet when I ask students to describe what they see, to use vivid verbs to compare the ways in which the different organisms move, my sixth graders struggle. Table to table, the answers are much the same. After looking through the microscope, students invariably answer my question about movement by saying, “They’re movin’ like crazy!”

I think students fumble for movement words in part because they are in a state of wonder, seeing for the first time a miniscule world that feels a bit like stepping into the land of Oz or into Wonka’s chocolate factory, with foreign-looking creatures zipping all around at breakneck speed. But I also think it’s important to acknowledge that students often grasp for words because they struggle with the vocabulary they need (and want) to express what they are seeing. In any subject area, teachers have opportunities like this one to help their students develop a more “robust vocabulary” (Beck, McKeown, & Kucan, 2002). These opportunities are critically important. A more robust vocabulary can enhance students’ abilities to make more detailed observations, to appreciate and articulate more complex concepts and relationships, and to go deeper with content understanding. The words students know affect what they see, how they think, and what they understand.

Fisher and Frey (2008) write that many content area teachers “know relatively little about effective instructional practices for vocabulary development” (p. 3). Teaching words through definitions in isolation remains a common approach, even though research strongly indicates that this strategy doesn’t lead to enduring learning. According to Beck, McKeown, and Kucan (2002), Fisher and Frey (2008), and Marzano (2004), students need several conditions for lasting word learning; they need to:

- encounter and use new words in a variety of settings through speech, reading, and writing;
- characterize words through linguistic and non-linguistic representations;
- understand words in relationship to other words;
- connect words to students’ own contexts; and
- interact with peers as they process new words.

Though creating these conditions requires time, I have found that focusing on rich vocabulary
learning has actually enhanced, rather than compromised, my ability to cover content. In this article, I describe three examples of opportunities for vocabulary learning in my middle school science classroom and the conditions that support word acquisition in each case. I also explain how and why more robust vocabularies can enrich the ways students observe, think, and understand content.

Prime the Descriptive Pump

In Gallagher's (2006) book *Teaching Adolescent Writers*, he describes an activity in which students watch him saunter from one end of the room to the other and then write one sentence describing what they have seen. Students' first attempts are lackluster: "Mr. Gallagher walked across the room." Gallagher pushes his students to be more specific, to consider different variations in how people walk. For example, people can *swagger, limp, and wobble*, and each of these variations on *walk* captures something more precise and nuanced than *walk* itself. These word choices force Gallagher's students to carefully consider exactly what they saw. This strategy of *priming the descriptive pump* can be used in any subject area to activate and develop vocabulary and strengthen student observations.

In my science classroom, for example, after my students' initial attempts to describe what they see through their microscopes, I ask them to think of different words that describe how macro-animals move. Because I have a number of English language learners and students with language disabilities on my team, I share starting examples (such as *dart, flutter, twirl, spiral, paddle, and creep*) if they are struggling. This often prompts students to add more words to the list. We model what each kind of movement looks like, creating visual and tactile representations of each word to distinguish one from the other, defining them in relationship to each other. Though my students are new to the microscopic world of one-celled organisms, most have noticed important differences in the way macro-organisms move; activating and clarifying this background knowledge can help to equip them for sharper observations through their microscope eyepieces.

With descriptive language activated, I notice that students observe their slides for longer periods of time, frequently asking for clarification on movement words as they consider what they are actually seeing. They check the class word list, then look through their eyepieces, then return to the word list. I notice that the words are helping students to look more closely and that the distinctions among the words are motivating them to observe more keenly. Burke (2008) describes a similar sharpening effect on student writing in his English classroom when he primes the descriptive pump by generating verbs, nouns, and adjectives before students put pen to paper.

Keener observations through the microscope have a significant impact on my teaching of content. Different one-celled organisms use different structures to move. Once students observe and describe the different ways in which one-celled organisms move, I challenge them to figure out how they move the way they do. The relationship between structure and function is an essential idea in science; it is easier and more meaningful to inquire into structure if students are more deeply aware of differences in function. Activating a more robust descriptive vocabulary has helped students clearly articulate these differences in function.

Go beyond the Words in Bold

In any text about single-celled organisms, students will find a fair number of highly specialized, boldfaced words, such as *paramecium* and *heterotroph*. Though these terms are surely challenging, many of the surrounding terms in plain print are difficult as well. Instead of using the phrase *get food*, for example, these readings de-
scribe paramecia obtaining nutrients. When reading about heterotrophs (organisms that eat other organisms), students often get hung up on the word consume. In many subject areas, academic language in plain text can cause just as much if not more trouble than highly specialized words in bold (Zwiers, 2008). This problem presents a second opportunity for developing robust vocabulary: go beyond the words in bold.

Terms like consume and nutrients are terrific examples of what Beck, McKeown, and Kucan (2002) call “tier 2 words.” They define tier 2 words as high-utility academic words that offer students more sophisticated ways of thinking and talking about familiar ideas. In their 3-tier model, tier 1 consists of basic words that students easily pick up through oral exchanges as young children (such as eat). In contrast, tier 3 consists of specialized, low-frequency words that occur in a specific domain (such as heterotroph); these are typically the words bolded in a text.

There are several important reasons for content area teachers to incorporate tier 2 words into target vocabulary lists. First, these words are frequently used to define domain-specific, specialized words (tier 3 words); if students do not fully comprehend these high-utility words, they will not be able to understand descriptions of domain-specific terms, either. Also, tier 2 words appear in a wide array of reading materials across disciplines, especially because many of these words have multiple, nuanced meanings. Thus, knowledge of these terms enhances students’ science content understanding and may potentially enhance students’ general reading comprehension skills as well.

In class, I focus on giving students multiple and varied opportunities to interact with target tier 2 words. For example, students begin by drawing pictures of words like “consume” and link these terms to visuals they see in the text, through their microscopes, and on live-action videos of microscopic organisms. In small groups, students work with peers to articulate the
relationships among high-utility terms and specialized terms; we frequently use concept circles (Allen, 1999) to make these connections. The concept circle shown in Figure 1 includes tier 3 words (*heterotroph* and *autotroph*) and tier 2 words (*synthesize* and *consume*). Students work together in groups of 2 to 4 to write sentences that show how the words relate to one another. I also ask students to identify another word that would fit into this concept circle and to then state why. This challenge often yields more connections to words from a range of tiers, such as *eat*, *nutrients*, and *photosynthesis*. Understanding words in relationship in this way is a key element of enduring vocabulary learning. Immediate feedback is critical here as well. I confer with each group as they are working, and the class gives further feedback when we share in a large discussion group.

As my students shift from building to consolidating word understanding (Fisher & Frey, 2008), they have additional opportunities to use new terms through individualized assignments that ask them to manipulate and compose. For example, students create a concept map to organize their word knowledge and understanding of one-celled life, allowing them to determine which words “belong together” and how. They create original song lyrics about one-celled organisms using a required list of vocabulary words and their choice of musical tunes. Students also answer open-ended questions such as the state assessment item in Figure 2. Because of our work with domain-specific and high-utility terms, students can successfully access the vocabulary in the question. Even though I do not require students to use any specific words for this assignment, I find that students often independently choose to use higher-level terms in their answers by this point in the unit.

All these opportunities to work with words combine to nurture and reflect the simultaneous development of language and content under-

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**Figure 1.** Concept circle for sixth-grade study of how unicellular organisms obtain nutrients. The circle challenges students to make connections among tier 2 and tier 3 words.
2006 Spring Release, Science and Technology/Engineering - Grade 8
Question 37: Open-Response
Reporting Category: Life Science
Standard: 2 - Recognize that all organisms are composed of cells, and that many organisms are single-celled (unicellular), e.g., bacteria, yeast. In these single-celled organisms, one cell must carry out all of the basic functions of life.

The diagrams below show an Amoeba and a Chlamydomonas.

<table>
<thead>
<tr>
<th>Diagram A</th>
<th>Diagram B</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram A" /></td>
<td><img src="image2" alt="Diagram B" /></td>
</tr>
<tr>
<td>Food vacuole</td>
<td>Flagella</td>
</tr>
<tr>
<td>Pseudopod</td>
<td>Cell wall</td>
</tr>
<tr>
<td>Food particle</td>
<td>Mitochondrion</td>
</tr>
<tr>
<td>Nucleus</td>
<td>Nucleus</td>
</tr>
<tr>
<td><img src="image3" alt="Amoeba" /></td>
<td>Chloroplast</td>
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<td>0 100 μm</td>
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</tbody>
</table>

Both organisms can be seen only with a microscope. Since these are one-celled organisms, each cell must be able to carry out all important life functions, such as moving from place to place and getting food.

a. Compare the ways these two organisms move. Be sure to include information from the diagrams in your answer.

b. Compare the ways these two organisms obtain nutrients. Be sure to include information from the diagrams in your answer.

Figure 2. Released open-response test item from the 2006 Massachusetts Comprehensive Assessment System. To answer this question, students need to know specialized words such as “pseudopods” and “flagella” in addition to high-utility academic terms such as “obtain nutrients.”

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Make Connections with Connectors

A third opportunity for building robust vocabulary is to focus on transitional words or phrases—what I call connectors. These phrases or terms—such as however, in contrast, and as a result—show relationships among ideas. When my sixth-grade students read, they often miss the meaning cues that connectors provide. When they read the phrase in contrast, for example, they don’t necessarily understand that the author is about to highlight a difference between two ideas, observations, or events. When students miss these cues, meaning making suffers. In his book Building Academic Vocabulary, Zwiers (2008) advises that connectors—what he calls “terms for building academic sentences”—should be on any target vocabulary list. There are opportunities, and reasons, to explicitly teach such terms in all subject areas.

In my classroom, our work with single-celled organisms presents natural opportunities to focus on connectors that compare and contrast different methods and structures of movement. However, before students can use these connectors in the context of content, it’s important to help them understand the nature and function of connectors in the context of their own lives. I do this early in the year by dividing students into groups and assigning each group a connector. I then share a familiar statement, such as “The New England Patriots lost in the playoffs.” I challenge each group to write a second related sentence that starts with their connector term. For example, the however group might write, “However, the Boston Celtics are doing well and could win the championship.” The as a result group might write, “As a result, many students are in bad moods today.” This activity is often slow going at first as students grapple with what their connector actually means. As they get more practice under their belts, students start to see clearly the different roles that various connectors play. Working with peers on examples from their own lives, students see that different connectors show different relationships between ideas.

When we later tackle single-celled organisms, students already have the idea that specific connectors fit specific situations. I can ask students what connectors would best help us compare two single-celled organisms that move and feed differently. We brainstorm possibilities: however, in contrast, whereas, in comparison. I then require students to use these connectors in their writing, and I challenge them to find these signal phrases in their text reading as well. The comparative thought process is central to science, so focusing explicitly on the language that is tied to this process furthers my content teaching. These transitional phrases are more than just linking words that create a smooth path for readers. They are terms that, when understood, can cue students to think, write, and read more analytically.

The Value of a Robust Vocabulary

In my science classroom, the words students know—especially descriptive terms, high-utility words, and connector phrases—are just as powerful a tool for understanding as the microscopes.

WORD WALLS WITH TWO TIERS

On the word wall in my room, I code words with two colors. Orange words are terms that students will most likely see only in science class or in a science reading. White words are high-utility terms that students will most likely see in other classes and readings in addition to science. These distinctions help students see that words have different “lives.” Some are specialists that are typically used in very specific situations. Others find more general use in a great variety of situations.
they peer into. Like microscopes, words also magnify, enhancing what and how students see and think. Cultivating robust vocabularies in any content area can help students observe in more detail, express more complex concepts and relationships, and plunge more deeply into content.

References

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