Vocabulary Development and Nonlinguistic Representations: How Can Science Help?

Vocabulary instruction is a complex, well-researched, and well-debated topic in all levels of education. Is direct vocabulary instruction effective? How many words should be taught at once? How can educators bridge the gap between students with rich vocabulary knowledge and those with poor? What are best practices in vocabulary instruction? All are important questions that deserve careful consideration.

While some researchers have claimed that direct instruction is not sufficient to cope with the thousands of words that students encounter every year in their reading, others strongly support a systematic approach to teaching vocabulary. However, this approach does not simply mean reciting dictionary definitions or even writing sentences for a prescribed list of vocabulary words. Instead, extensive research tells us that students must encounter words multiple times and in multiple contexts.

In their book, *Classroom Instruction That Works*, Marzano, Pickering, and Pollock (2001) review the research on vocabulary instruction. In Chapter 11, “Teaching Specific Types of Knowledge,” they make five research-based generalizations about vocabulary instruction:

1. Students must encounter words in context more than once to learn them.
2. Instruction in new words enhances learning those words in context.
3. One of the best ways to learn a new word is to associate an image with it.
4. Direct vocabulary instruction works.
5. Direct instruction on words that are critical to new content produces the most powerful learning.

In the same chapter, the authors also present a five-step process for teaching new terms and phrases:

1. Present students with a brief explanation or description of the new term or phrase.
2. Present students with a nonlinguistic representation of the new term or phrase.
3. Ask students to generate their own explanations or descriptions of the term or phrase.
4. Ask students to create their own nonlinguistic representation of the term or phrase.
5. Periodically ask students to review the accuracy of their explanations and representations.

What is a nonlinguistic representation? As explained by the authors, researchers believe that knowledge is stored in two forms: linguistic and imagery. While the linguistic form involves the written and spoken word, the imagery form includes mental pictures and physical sensations. Including this second form of knowledge in vocabulary development can have a powerful effect on student achievement.

Nonlinguistic representations include graphic organizers, physical models, mental images, pictures and pictographs, and kinesthetic activity. These representations are particularly suited to the types of activity typically included in hands-on, inquiry-based science. While engaged in a science lesson, lab, or activity, students are constructing contextual, nonlinguistic “ definitions” of key terms and concepts. Depending on the content and terms being addressed, this could take many forms – modeling the process of erosion, building a weather instrument such as a wind vane, or investigating which objects sink or float to learn about the concepts of density and buoyancy. In all of these examples, students are developing informal definitions of scientific vocabulary through their investigations. Of course, kinesthetic activity can also include creative movement, dance, charades, and drama – but it is important to note that even the simple act of completing a lab activity counts!

When should this contextual, nonlinguistic development take place? Many researchers advocate that experience of a word in context should occur prior to encountering the word in written text as students can use this network of knowledge to bolster their comprehension. In Marzano, Pickering, and Pollock’s five-step instructional sequence, exploration and contextual experience through labs and hands-on activity would follow steps 1 and 2 (in which the teacher provides a description and nonlinguistic representation). Students would use their direct experiences to then create their own explanations and nonlinguistic representations – in and of themselves formative assessment of the activities.

In addition to creating nonlinguistic representations through kinesthetic, inquiry-based activity, constructivist pedagogy emphasizes that students have the opportunity to create representations and definitions within a social context. Small group work and discussion allow students to compare results and discuss findings, leading to rich definitions and deep understanding of vocabulary from multiple perspectives.

Use the books and web sites below to learn more about nonlinguistic representations and their role in vocabulary development. While we’ve mainly discussed the kinesthetic activity of hands-on science as a
means of creating these representations, it is important to remember that graphic organizers, models, mental imagery, and pictures are also helpful.

**BOOKS**

*Classroom Instruction That Works: Research-Based Strategies for Increasing Student Achievement*. Robert Marzano, Debra Pickering, and Jane Pollock. 2001. McREL.

This book presents nine research-based strategies for improving student achievement. Nonlinguistic representations, one of those strategies, is discussed in detail in Chapter 6. In addition, teachers will want to refer to Chapter 11, “Teaching Specific Types of Knowledge,” for the section on vocabulary.


This handbook is designed to accompany *Classroom Instruction That Works* and is a self-study guide in the nine research-based strategies. For each strategy, you’ll find an introduction, opportunities for self-reflection, recommendations for classroom practice, rubrics, and questions to help you implement the strategies into your current practice.

**WEB SITES**

*TeacherTube: Kinesthetic Activities in Science*

This video from TeacherTube (3:56) demonstrates an example of a kinesthetic activity that can help students develop a nonlinguistic representation of the terms “predator” and “prey.”

*Creative Movement: A Physical Language for Learning*

This article discusses the use of kinesthetic activity in a variety of content areas.

*Increasing Academic Language Knowledge for English Language Learner Success*

While this article’s intended audience is educators of ELL students, the suggestions and strategies are valuable for all students. In the article, the author explores ways to make academic language (content-area vocabulary) meaningful for students primarily through nonlinguistic representations.

*Vocabulary Notebook Sample*

This Word document provides several examples of graphic organizers that can be used for vocabulary development, including, a vocabulary map, vocabulary model, and vocabulary word box. Each of these involves drawing a symbol, picture, or other nonlinguistic representation of the vocabulary term.

*Reading Rockets: Vocabulary*

This site lists 17 articles that provide information about effective vocabulary instruction, the relationship between vocabulary and comprehension, and practical ways that parents can introduce new, exciting words to their children. Particularly relevant are *Improving Reading Skills in the Science Classroom*, *Teaching Vocabulary*, and *Multisensory Vocabulary Instruction: Guidelines and Activities*.

**National Council of Teachers of English and International Reading Association: Standards for the English Language Arts**

http://www.ncte.org/standards

This site lists the 12 English Language Arts Standards for K-12 students. Standard 3, which states that “students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts,” and Standard 7, which states that “students gather, evaluate, and synthesize data from a variety of sources,” are addressed in lessons and activities that require students to create and use nonlinguistic representations in building vocabulary.

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