Research Into Practice SCIENCE

Vocabulary Instruction in Science

Vocabulary knowledge, arguably one of the most important hallmarks of an educated person, is essential for comprehending science texts at all levels. It plays a vital role in every aspect of reading from understanding the gist of a simple text to interpreting and appreciating the most complex texts (Beck, McKeown and Kucan, 2002; Brassell and Flood, 2004; Lapp, Flood, Brock and Fisher, 2005; Nagy and Anderson, 1988).

The Most Frequently Asked Questions About Vocabulary Instruction

How many words can I teach in a year?

While estimates vary, Beck et al. (2002) concluded that 400 words per year was a reasonable estimate of the number of words that could be taught and learned in one school year.

How many words can I teach in one lesson?

There is an easy answer: five (5) new, unfamiliar words per lesson. When we try to extend this number by preteaching difficult words that children will encounter in a new text (and the list grows to 10–20 words), we are courting disaster. For each new word introduced beyond five, we can count on memory overload, which negatively affects the learning of the five target words.

However, not all children know the same words, so some of the words you designate as new will not be new for every child. Moreover, new words may be introduced through known words.

How many encounters/exposures to words are needed?

Some researchers (Lapp, Flood, Brock and Fisher, 2005; Scott, 1988) have suggested that at least 8 to 10 exposures are needed before a new word begins to become part of a child's lexicon. The real answer to this question depends on the child's background as well as the word itself. Some words clearly take time "to own." As Brassell and Flood (2004) note: Vocabulary development is incremental. We never really own most words; we just grow in our understanding of the concepts they represent.

What words should I teach?

Anyone who has stopped to ponder this question has been immediately overwhelmed by the myriad of choices: 1) content-area words like *matter, force, gravity, energy;* 2) grade-level high-frequency words; 3) high-utility (but less frequent) words like *imaginative, design, adjustable, creative*. Although the list of possibilities seems endless, as teachers we must make sensible choices that are based on sound criteria.

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Criteria for Selecting Vocabulary Words to be Taught

In an attempt to sort out the words that should be taught, Graves (2000) advises teachers to distinguish between teaching new concepts and teaching new labels for familiar concepts. Words may be divided into four very useful categories:

1) high-frequency words (car, driver);

2) domain-specific technical vocabulary (raceway);

3) low-frequency words (carburetor); and

4) high-utility words (gasoline).

Beck and her colleagues (2002) provide another framework for organizing words into three general categories: Tier I words include words that are almost universally known *(tree, leaf);* Tier II words include almost all of the words we need to teach students; and Tier III words are infrequent and technical *(photosynthesis)* that are best learned at their point of need.

A sensible set of criteria for selecting Tier II words includes the following:

1. Choose words that have high utility in the child's life.

2. Choose words that will lead students to other words.

3. Choose words that are needed in a particular content area.

How can I proactively teach vocabulary?

There is no one best way to teach vocabulary to every child. Children learn word meanings in multiple ways ranging from learning words incidentally, e.g. from Read Alouds, to robust, explicit, effective, teacher-led instruction.

Instructional Strategies

Well-researched instructional strategies can help teachers instruct their students in the vocabulary they will need to comprehend science books. While there are many excellent strategies that teachers can use effectively (for a review, see Brassell and Flood, 2004), we will include one—perhaps the most effective—strategy for helping children learn science words.

Semantic Mapping

Semantic maps are particularly useful for visually representing new word meanings and the relationship between the new word and other known words (Blachowicz & Fisher, 2002; Brassell and Flood, 2004). **Semantic Mapping,** which is also known as "semantic webbing" and "semantic networking," often uses a graphic organizer resembling a spider web to connect information.

In the classroom example that we present below, the teacher presents the word *dinosaur,* which is a Tier I word for most children; it is not a new concept, therefore, it does not count as one of our 400 words for the year: it may be a new written word for many children, but it is probably not an unknown word. In this lesson, *dinosaur* is the topic word that leads to three new words that the teacher wants to teach—extinct, survival, and fossil. The words linking *dinosaur* with the target words are all Tier I words (lived, earth, water, land) which are the 'glue' that keeps the network operating. The linking words *lived* and *became* are critical for understanding the relationships among the words that

are included in the semantic map; they become review words that help children place the new words in a functioning network.

Classroom Example:

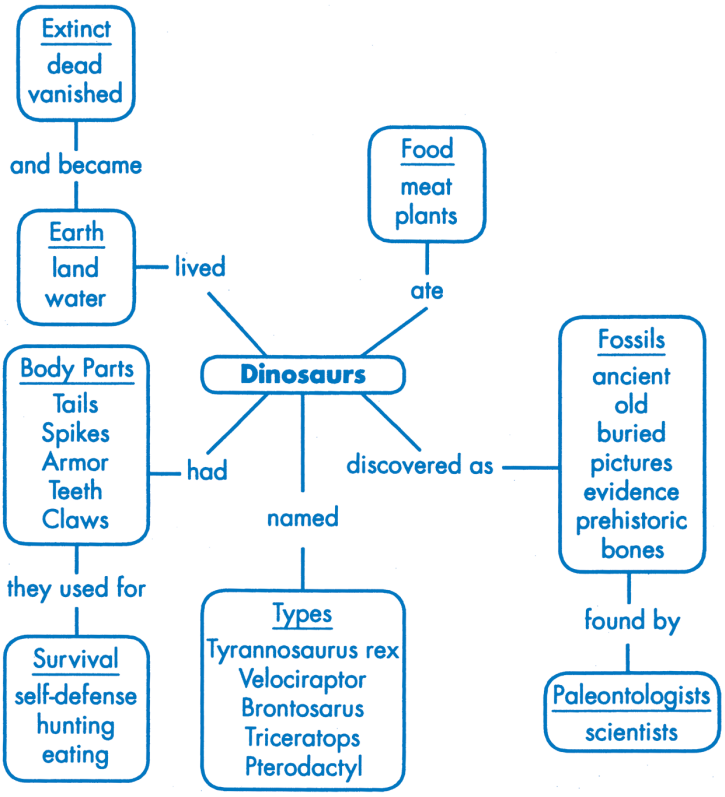
Rogelio Martinez's second graders were beginning a unit on dinosaurs. He wanted his students to understand how scientists could prove dinosaurs' existence and why the dinosaurs became extinct. Mr. Martinez wrote the word "dinosaurs" on the chalkboard and asked students to organize into groups of three or four. Next, he asked each group to brainstorm all of the words that they could think of associated with dinosaurs. He told the groups to pay attention to characteristics words shared so that they could categorize them under subheadings. After about five minutes, Mr. Martinez asked the groups to dictate their words, which he then wrote on the chalkboard. He encouraged students to place words under categories. For example, when students shared the words "ancient" and "old," Mr. Martinez explained that dinosaur remains were also known as "fossils" and placed the terms under that category. Later, when students said that dinosaurs had lived on "land" and in "water," a student suggested that Mr. Martinez categorize those terms under "Earth." After further discussion, students asked Mr. Martinez to connect categories with the key word "dinosaur" by writing relationship words on the connecting lines. For example, one student asked Mr. Martinez to connect "dinosaurs" with "food" with the word "ate." Finally, Mr. Martinez told students to add words and categories to the semantic map as they learned more about dinosaurs.

While there are many excellent strategies that teachers can use effectively, perhaps the most effective is semantic mapping.

Semantic Map

Concept/Key Word: Dinosaurs

The following standards were met as this lesson was presented:



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The following standards were met as this lesson was presented:

Grade Two Science Goals

After the unit lesson, students will be able to:

1. say that fossils provide evidence about the plants and animals that lived long ago on Earth;
2. list characteristics of dinosaurs;
3. describe conditions that may cause a species to become extinct; and
4. explain how scientists learn about the past history of the Earth.

Notes

Academic Professional Development (APD Press) has granted permission to reprint the classroom example that is presented in this paper. The example appears in Brassell, D. and Flood, J. (2004) *Vocabulary Strategies Every Teacher Needs to Know.* San Diego, CA: APD Press.