Science Vocabulary Module – Transcript

Introduction and Slide 1
Hello, I'm Kevin Anderson, the Science Education Consultant at the Wisconsin Department of Public Instruction. As my students sometimes told me, science can be like learning a new language. In order for students to be able to effectively share their ideas and investigate interesting phenomena, they need the language to describe their growing understanding of the world around them. Thersea Burzynski, now at CESA 10, but also a former science teacher and reading specialist, prepared these slides to support teacher professional development in effective vocabulary instruction in science. I'll be the narrator, but this is her great work. Throughout the presentation I'll ask questions that could be used for discussion starters if you're using this resource with a professional learning community, or as guides for reflection if you're going through it on your own. On this website the transcript of this presentation is provided, as are these discussion questions, along with other links to resources to support your work.

2
Briefly, here is an outline of this presentation.
First, I'll briefly share an Overview of research related to vocabulary instruction and learning.
Second, I'll discuss some strategies matched to that research
Then, I'll spend a significant amount of time sharing Marzano's Six Step process for Vocabulary Instruction. Some of these ideas come from a new book he released on connecting vocabulary instruction to the Next Generation Science Standards.
Finally, I'll share some an activity for staff on vocabulary instruction and some concluding comments.

3
In essays and lectures Neils Bohr continually emphasized the role played by language in the field of science and in our basic understanding of nature.
He said, "Scientific investigations are not exclusively formal, mathematical affairs for they also involve informal discussions in which key concepts are explored and understood."

4
In a framework by Deck, McKeown, and Kucan, there are three tiers of vocabulary.
Tier I is basic, general words, such as take, eat, basketball
Tier II is high frequency words with multiple meanings, words such as analyze or construction.
Tier III is domain specific, where technical science vocabulary largely resides (though tier II also includes important language for framing student work).

5
Importantly, research indicates that direct or explicit instruction in vocabulary can increase vocabulary learning and comprehension. John Hattie's meta-analysis of education studies, **Visible Learning,** showed this instruction has a significant effect size on assessment outcomes.

6
Research reviewed in Marzanos new book on vocabulary in science instruction indicates that direct vocabulary instruction should include these elements:

First – present individual terms and their descriptions in rich contexts.
Second – use multiple media methods to introduce and practice terms
Third – Ask students to relate new terms to words they already know
Fourth – provide multiple exposures to new terms and opportunities to use them

**Take a minute and discuss or reflect on how you use these strategies in your classroom.

7
Marzano used the research on vocabulary instruction to develop a process for building academic vocabulary. It's a six step process.

8
First, the teacher provides a description, explanation, or example, w/ a visual representation (not a dictionary definition). Note, students can't just copy a definition out the glossary or dictionary, it must be rooted in visuals and accessible descriptions. That could often include something tangible in science.

9
Second, you have students put the term into their own words and construct their own visual.

10
This is a sample of a page that can guide steps 1-3 using student notebooks or as a stand alone vocabulary glossary which is student developed. Note, access to the reproducible page can be found on the Marzano research link in the resources section of this science vocabulary website. As I'll mention again, I think connecting the vocabulary to scientific modeling is even better than just a picture, particularly one just copied from a book. Notably, in scientific modeling, students are not copying a diagram out of a book. They're making sense of a phenomenon. They're predicting what will happen. They're actively building a conceptual understanding. So, diagraming how they think something works and rediagramming their ideas as they learn more would be modeling. Using correct vocabulary to annotate those models is a great strategy.

**Take a minute and share or reflect on strategies you've found useful for having students notebook vocabulary. Or, what notebooking strategies might you use in the future?

11
Fourth, students in science should authentically experience scientific language. Engaging students in science and engineering practices allows for engagement and experiencing the words. It is important to maintain the expectation of understanding and using science terminology once it's introduced. At times front loading vocabulary prior to the experience may be determined as the most appropriate learning sequence. Or, an introductory experience might provide a scaffold on which to build the language. Students should be using scientific vocabulary as the explain phenomena, though initial explanations as they explore might start with less formal language. Students should be using proper vocabulary as they're modeling, conducting inquiry-based investigations, discussing videos or demonstrations, conducting research, and reflecting on their learning.

12
Fifth, students should use and speak the words often.
It is important to match authentic contexts, i.e. purpose and audience, to the classroom practice. For students learning English consider the language goals as well as allowing for Total Physical Response (TPR) or scaffolded choral practice. Another option is to consider dialogues such as those created by Bisbee, Westrich, and Berg, which is linked in the reference section of this website.

13
If you haven't reviewed materials from the TERC Inquiry Project on Science Talk, they're definitely worth checking out. They're designed for upper elementary, but they can be adapted below and above that level.

**Take a minute to discuss or reflect on how you structure student talk in your classroom. How do you ensure they're using science language in those conversations?

14
Based on observations of many classrooms, teachers talk too much. I'm sure I did too. I encourage you to video your teaching and observe how much you're talking. If it's over 30% of classtime, start thinking about ways to stop.
One strategy is to pause and chunk, also referred to as Chunk and Chew…
Pause every 5 minutes in elementary or every 8 minutes in middle school or high school. When you pause have students 'chunk' or process the information through strategies such as summarization, think-pair-share, or compare and contrast.
CRISS is a framework that allows for the practices of Pause and Chunk within content literacy. CRISS stands for CReating Independence through Student owned **Strategies.** There will be a link in the references to this CRISS framework and the work of Eric Jensen.
The benefits of this chunking approach are:
1) increased processing time and retention
2) Vocabulary practice
3) And student engagement (which follows a socio-cognitive theory of learning)

15
Students should be communicating often through multiple formats. Some examples of authentic informational and persuasive writing in science could include: research proposals, Editorials, Article reviews, Letters to the Editor, Commentary Forums, Research Articles, Letters to government or community members, lab resports, and blogs.

**Pause and discuss or reflect on what types of authentic writing your students do, and what other projects you might consider.

16
Sixth in Marzano's steps, involve students occasionally in games that allow them to play with vocabulary. Some examples are provided within this list of websites, also listed in the references section.

17
Looking at further research into learning, George Miller found that when we process information, we do so spatially. The brain puts things into categories.
So, students learning should include opportunities to:
Categorize terms
Label authentic objects or visuals
Use and develop graphic organizers and concept maps
Classify missing pieces to a group
Create lists
Again, scientific modeling can provide these types of structures.

18
Building on this research, in primary grades, students could place pictures or actual objects into categories based on some identified characteristic or quality while verbally using the words represented.

19
Concept circles are another tool for spatially mapping ideas.
Here we're moving towards students seeing that
Average Speed = Distance Traveled/time of Travel, and Average Velocity= Change in position/time or displacement/time
This builds on work by Janet Allen.

20
In CLOZE activities, certain words are removed. This table and CLOZE activity from a NASA (linked on the site). Students would complete the table with the word bank provided – categorizing ideas and terms. It would also make sense to have a class or group discussion afterward where students explain why they put words where they did.

*Considering these past few examples of research-based strategies, discuss or reflect on how you have students organize their learning of concepts. What structures do you provide?

21
Here is a secondary staff vocabulary activity that shows connections across disciplines. The references section will describe this middle or high school whole staff activity in more depth. Basically, staff sit together by discipline and brainstorm words related to their disciplines with a chosen stem or affix. They then share the words and consider how well they're able to understand unfamiliar words because of the common word parts. Finally, they discuss implications for classroom practice.

22
These links provide references and resources related to root words and word origins. They relate to the previous activity. The full links are in the resources.

23

Here are a few further reflections questions for a science department.

- How do you have students learn science vocabulary (tier III words)?
- How important is it to explicitly teach tier II or process words?
- Do you have specific discourse structures or protocols in place?

24

Edgar Dale was one of the first to look at degrees of knowing word meanings. We have multiple researchers who are using these foundations in their strategies of helping students be aware of their own word knowledge. Too often students feel they KNOW a word if they can quickly access it's meaning, but in reality they only know it receptively when it can be understood when others use the word in context; it is understood productively when the individual can use it accurately and in the correct context. All english learners understand words receptively before productively, occuring between stages 3&4. That includes native and non-native speakers.
The samples of rating scales linked here can serve as tools for students of many ages to be aware of their stage of word knowledge with the important vocabulary to your content. There are samples to be used a varying grade-levels.

25

Students should be engaged in science practice in order to effectively develop vocabulary. Engaging Tasks allow for a deep building of concept development and vocabulary use. Multiple encounters with vocabulary in a variety of contexts – such as investigations, reading, class discussions, small group discussions, individual tasks, etc. - allow words to go from the receptive level of understanding to the productive level.

26

If it's relevant for your work, Marzano's book has a listing of vocabulary by grade in the Next Generation Science Standards.

27

The pressure of word knowledge for success on the ACT and SAT use to place outside pressure on teachers more towards ambiguous terms and the mastery of isolated terms. Please note the emphasis shifts within these assessments to reflect a more moderate approach to vocabulary and the assessment of science knowledge.

28

Also, as part of the SAT redesign there will be less of an emphasis on vocabulary terms with little context such as the sentence completion questions and there will be a greater emphasis on the meaning of words in extended contexts and on how word choice shapes meaning, tone, and impact.

29

Finally, although some might question whether the time spent on vocabulary instruction is worthwhile, Judith Scott, Dianne Jamieson-Noel, and Marlene Asselin (2003) explained that "when conceptual understanding is central, the time devoted to understanding the vocabulary is well worth the effort…."

30

In this presentation, I have:

- reviewed some of the research related to vocabulary learning and instruction.
- Shared strategies aligned to that research
- Discussed Marzano's six step process for vocabulary instruction
- And provided some activities and discussion questions for staff

Please, send an email to me, Kevin Anderson or Thersea Burzynski if you have any questions or comments on this work!