Synthesis of Research: NGSS for English as a Second Language

Laura Beth Yarrow

Kansas State University: EDEL 412

4/10/16

With the implementation of the New Generation Science Standards (NGSS), students are being faced with cognitively demanding standards that require knowledge of more complex, science-specific language. With NGSS's focus on combining Science & Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts (the 3 dimensions of NGSS), what students do with language, as well as using scientific terms, is an integral part of how students learn. In the article "NGSS for English Language Learners," the authors write that the challenge for all students is to "use language like a scientist does, and collaborate to support growth in scientific understanding" (Miller, Lauffer, & Messina, 2014, p. 57). For English Language Learner (ELL) students, this can be especially challenging.

In order to meet these cognitively demanding standards, ELL students need explicit instruction and scaffolding to understand not only the new science vocabulary, but their science-specific structures as well. In their article "A Brick and Mortar Approach," the authors write that individual science vocabulary words are like bricks in the foundation of the students' understanding, and the language structures that connect them are the mortar. Having a solid understanding of both brick and mortar language is important because "many of the NGSS core ideas, practices, and crosscutting concepts rely on the use of scientific language structures to effectively communicate ideas" (Tretter, Ardasheva, & Bookstrom, 2014, p. 40). For example, to describe observations relating to the crosscutting concept of patterns, students must use "language to convey organization, classification, & relationships." For cause & effect, students must master "language to convey dependency of one factor on another" (p. 41).

However, these language structures should not be learned separately from the rest of the class, but rather within the context of "sense-making about core ideas in science" (Miller, Lauffer, & Messina, 2014, p. 56). ELL students need language goals as well as content goals, but

in science, language goals that are separate from the content may be inauthentic and get in the way of comprehension. In an ideal classroom, "the language goals for ELLs look almost identical to the content goal for everyone in the class because the language-intensive practice is blended with core ideas and crosscutting concepts" (p. 58). Some scaffolds suggested by the authors to promote fluency in science-specific language are to use graphic organizers with words and pictures, have students physically point to evidence before using it in argumentation, explicitly model coming to a consensus with peers, practicing oral critiques with other students, using ample wait time, paraphrasing, constantly checking for understanding, and providing sentence starters (Miller, Lauffer, & Messina, 2014). These scaffolds are known to be extremely affective for ELL students, and they're easy to incorporate into general education classes!

However, in "A Brick and Mortar Approach," the authors go even further when it comes to providing language supports. They suggest focusing on only one given language structure at a time through repeated use for three to five days. This is important, because repetition is extremely important for language development! To introduce a new language structure, the authors suggest first using nonscientific examples with visual aids or modeling to communicate the concept and aid comprehension. Students then reinforce this new language structure by writing about it in their science journals. First they write out the language structure term (e.g. "compare") and its definition. Next, they draw a picture to help them remember the meaning. Then, in the "more ideas" section, many ELL students translate the term into their native language. Lastly, students self-assess their comprehension of the language structure on a numerical scale set by the teacher. Once students have all this information in their journals, the teacher provides them with sentence frames (e.g. "[something is] as [adjective] as [something else]" for comparisons). These frames help students practice forming meaningful sentences with

the new language structure. Overtime, students build up a strong repertoire of different language structures and begin to combine them to create even more meaningful sentences and communicate more complex science ideas and relationships (Tretter, Ardasheva, & Bookstrom, 2014).

By blending this explicit language instruction with the NGSS standards, teachers are not only providing students with the science content and knowledge they need, but with the language skills students need to demonstrate their understanding as well. This "brick and mortar" approach has been found to increase student performance and decrease the spread of scores throughout the whole class. "This suggests that not only did the whole class improve their use of key mortar vocabulary, but this approach seemed to help those most in need of assistance" (p. 44). The "brick and mortar approach" is a great way to differentiate instruction to meet the special needs of ELL students! By building students' confidence in their ability to express what they have learned, students are more confident in their ability to master the cognitively demanding standards presented to them by the New Generation Science Standards.

References

Miller, E., Lauffer, H., & Messina, P. (2014). NGSS for English Language Learners. *Science and Children, 51*(5), 55-59.

Tretter, T., Ardasheva, Y., & Bookstrom, E. (2014). A Brick and Mortar Approach. *The Science Teacher, 81*(4), 39-44.