The Effectiveness of "Just in Time" Vocabulary Instruction in Science Education

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Focus Questions

1. Are students able to learn and apply science vocabulary if the vocabulary is back-loaded, meaning students build conceptual understanding and then learn the relevant vocabulary word, instead of pre-taught?
2. Is this method of vocabulary instruction equally effective for English Language Learners (ELL) and non-ELL students?

Background

- Vocabulary is often pre-taught in a separate activity, meaning students learn the definition before they encounter the words in the context of a lesson or activity[1]
- This strategy is often emphasized as necessary for ELL students, since they are learning language and content at the same time [2]
- Because science contains so much specialized vocabulary, all students are in some capacity language learners in science class
- In an inquiry approach to science instruction, students are not given information in a lecture format, but instead discover concepts and make connections themselves.
- In an inquiry setting, front-loading vocabulary is often discouraged, as it tends to give away what students are expected to figure out for themselves. [2]
- In inquiry instruction, it is recommended that vocabulary instruction come at the end, after students have built an understanding of concepts, and the vocabulary serves as simply a word to attach to the new concept. [2]

Data Collection

Vocabulary terms were introduced in the middle or end of lessons, and were not introduced until students had already been exposed to the related concepts. Data was collected in the following ways:

- Vocabulary pre-test and post-test for units on nuclear chemistry and chemical bonding
- Self-assessment of confidence in knowledge of terms on a 0-3 scale
- Vocabulary Post Unit Survey
- Vocabulary Interview

References

[1]Nelson-Herber, J. (1986). Expanding and refining vocabulary in content areas. *Journal of Reading*, 29(7), 626-633.

[2]Weinburgh, M., Silva, C., Smith, K. H., Groulx, J., & Nettles, J. (2014). The intersection of inquiry-based science and language: preparing teachers for ELL classrooms. Journal of Science Teacher Education, 25(5), 519–541.

Both ELL and non-ELL students performed significantly better on vocabulary post-tests than pre-tests when vocabulary was taught after students had learned the related concepts. All students scored higher on vocabulary recall than on applying vocabulary in constructed response questions, and non-ELL students scored higher than ELL students on constructed response questions.

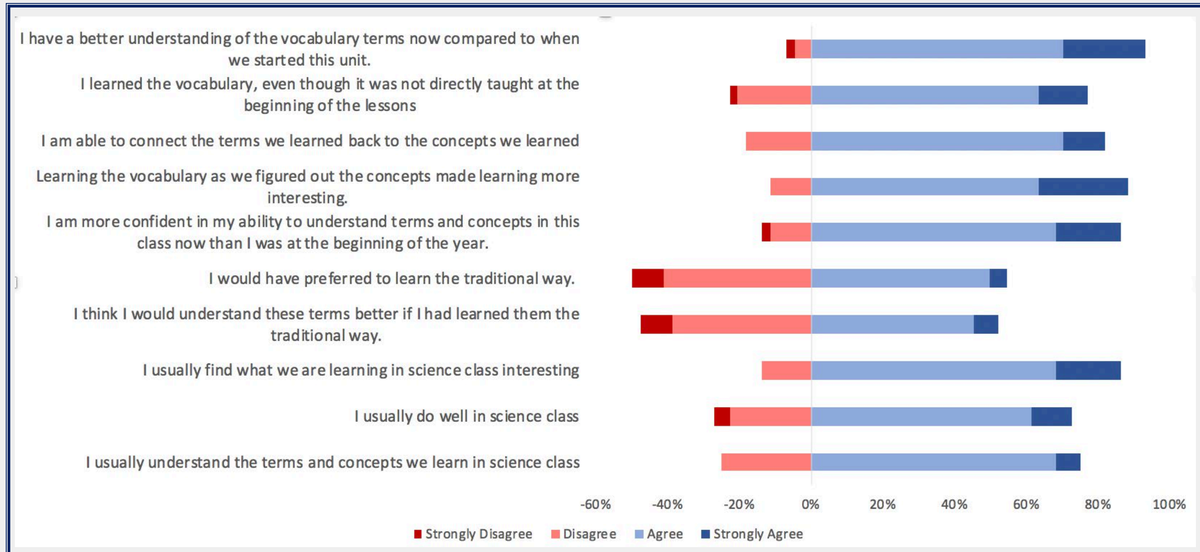

Figure 1. Vocabulary survey responses, (n = 44).

Student Quotes

"It helps that you introduce the word when we need it and not beforehand where we'd probably have forgotten by the time we got to it."

"You let us tell you what we thing the definitions are…that gives us a chance to tell you what we think."

"It helps me when you use the word and connect it to the concept we're learning.

Results

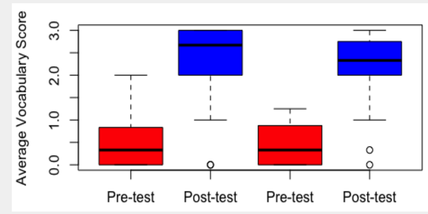

Figure 2. Pre- and post-test scores for nuclear chemistry vocabulary, (n = 71) and chemical bonding vocabulary, (n = 68).

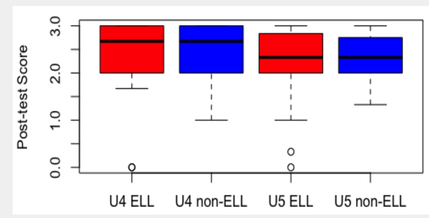

Figure 3. Post-test scores of ELL and non-ELL for nuclear chemistry and chemical bonding units, (n = 27), (n = 44), (n = 23), (n = 45).

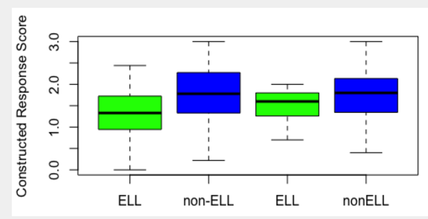

Figure 4. Recall and application scores for nuclear chemistry and chemical bonding units, (n = 71), (n = 68).