Vocabulary Instruction in a Secondary Science Course

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Introduction

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I studied the effect of two different types of vocabulary learning activities in my Biology I classroom (N = 30) at Killian Hill Chritian School, an independent religious school in the Atlanta area with a diverse but academical focused student population.

A recent study[1] of science textbooks for secondary school indicates that these texts place a very large burden on students to learn specialized vocabulary, equivalent to a second language course. Understanding the method by which learners grow their vocabulary skills can inform decisions about teacher behavior and the design of student activities. Wise choices seem to provide the probability of positive learning outcomes. I want to investigate the effectiveness of learning activities that are typical for my classroom with new activities that are informed by theory and previous studies. I also want to know if success at learning vocabulary gives better general science performance.

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KILLIAN HILL CHRISTIAN SCHOOL

Theoretical Framework

Four models informed the innovative vocabulary methods for this investigation. They are each described briefly below.[2]

Social Constructivism/Sociocultural Theories: Emphasize the need for connection with others during learning.

- learning set in social interactions; learners help one another construct knowledge.

Schema and Psycholinguistic Theories: Describe the mental filing cabinets and hierarchical organization of knowledge.

- Connect words to synonyms/antonyms; consciously connect terms by using concept maps; analyze prefixes, roots, suffixes, predict possible meanings for new terms.

Dual Coding Theory: There are two major codes, verbal and nonverbal; best learning will connect knowledge in both codes.

- Use multiple modalities, focus on concrete and imageable examples, intentionally elicit mental images.

Motivation Theory: Students recognize the alignment between their own goals and the learning task.

- Word-learning games, and technology-based activities, word consciousness to enhance student interest

Focus Questions

Overall focus question: What effect will the innovative vocabulary learning activities produce on the academic growth of students in my classroom?

	Sub Questions		
Data Collection Instruments	How does vocabulary acquisition differ when using intervention vs established instructional methods?	How do students respond subjectively to intervention and established instructional methods for learning vocabulary?	How is vocabulary acquisition related to general science performance in my classroom?
Vocabulary Pre- and Posttests	X	X	X
Likert Scale Student Surveys	X	X	X
Open Ended Student Surveys		X	
Unit test	X		X

Experimental Design and Data Collection

Students from a 9th grade biology class were separated into two groups, A and B, each approximately equal in academic performance. Over the course of two units of study (approximately three week each unit) students participated in different vocabulary learning activities, the Control and Intervention activities.
The Experimental Design diagram shows the treatment for each group

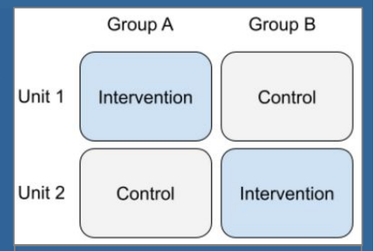

Figure 1. Experimental Design

Students progress was measured using a vocabulary pretest and posttest for each unit, and the normalized gain for the intervention and control group was compared. Normalized gain was compared to performance on unit tests. Qualitative data was collected using two surveys: a Likert-scale survey and an open ended survey.

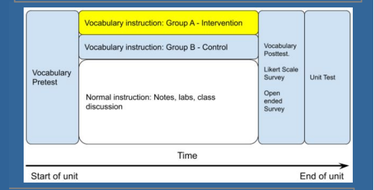

Figure 2. Data Collection Cycle for Unit 1

The Data Collection Cycle for Unit 1 diagram shows the timing and type of data collected. For Unit 2, the cycle repeats, but has the treatment switched between Group A and Group B.

Discussion

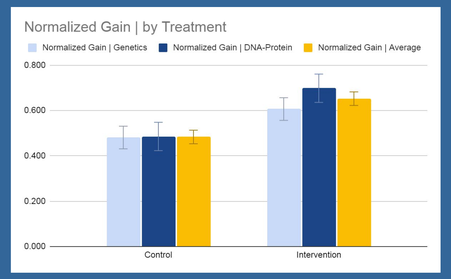

Figure 3 - Normalized gain <g>. This figure groups results by treatment.

Figure 5. Word clouds generated from responses to open-ended survey by the control group (left) and intervention group (right)..

Results

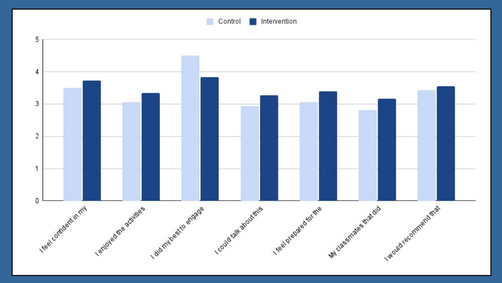

Figure 4. Mean of student responses for each Likert survey item for Control (n = 15) and Intervention (n = 15) groups.

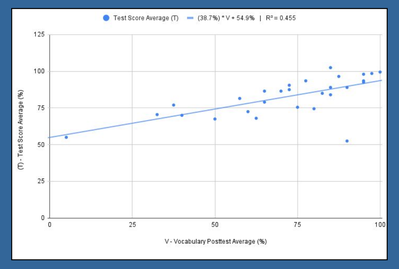

Figure 6. Average unit test score vs average posttest score.

Claims from the Study

Claim 1: Intervention Learning Activities Increase Vocabulary Learning More Than Control Activities.

Claim 2: Students had slightly more positive subjective responses to intervention activities than they did to control activities.

Claim 3: Vocabulary learning is strongly associated with general science performance in my classroom.

References

1. Groves, F. H. (2016). A longitudinal study of middle and secondary level science textbook vocabulary loads. School Science and Mathematics, 116(6), 320-325. doi:10.1111/ssm.12183
2. Moody, S., Hu, X., Kuo, L., Jouhar, M., Xu, Z., & Lee, S. (2018). Vocabulary instruction: A critical analysis of theories, research, and practice. Education Sciences, 8(4), 180. doi:10.3390/educsci8040180