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Molly C. Theus

Southern Adventist University, mollytheus@southern.edu

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Comparative analysis of comprehension of non-content specific collegiate vocabulary in
Southern Adventist University students

Molly Theus

Southern Adventist University

Abstract

In the HAPS community there is a documented phenomenon appearing to show a lack of mastery in non-content specific collegiate vocabulary in Anatomy and Physiology students. This research seeks to investigate possible causation and propose a solution using the microcosm of Southern Adventist University students. A knowledge-based questionnaire was distributed to six subpopulations composed of lower and upper division Biology, nursing and non-science major students. The questionnaire is comprised of two parts: a section on background and reading habits, and a section with twenty multiple choice vocabulary questions. The results were compiled into a comparative analysis.

Comparative Analysis of Comprehension of Non-Content Specific Collegiate Vocabulary

Vocabulary comprehension is a crucial component of any student's education. Research has been done about how to best teach content-specific vocabulary (Stinnett, 2012), and competent instructors is certainly a key component. Non-content-specific vocabulary instruction requires specific skills. In fact, teachers need to have "specialized linguistic knowledge" (Phelps & Schilling, 2004) to effectively teach reading at the elementary level. Reading comprehension is assessed primarily with standardized testing assessing Common Core standards (Fisher & Frey, 2014). These Common Core standards mean that "teaching to the test" will no longer work, and there is hope that a reading improvement could be on the way (Hirsh, 2010). Content-specific subject tests, such as science and math tests, are also useful in assessing reading and vocabulary comprehension.

There is growing concern in the education community about an apparent lack of vocabulary mastery. A strong emphasis was placed on reading under the 2001 No Child Left Behind Law (Hirsh, 2010), which aimed at improving test scores across all subject areas. The National Assessment of Educational Progress (NAEP) reports that the nation's average reading scores in 2009 for grades 4 and 8 are not statistically different from those in either 2007 or 2001. While there has been no marked improvement in reading scores, math scores "have seen an upward trend after the instatement of the law in 2001" (Hirsh, 2010). A study conducted in 1983 showed students having a difficult time comprehending assigned tests, seemingly due to issues with vocabulary comprehension, not content complexity (Moore, Readence & Rickelman). Content-specific comprehension could also be linked to reading strategies, as passive readers

appear have a more difficult time comprehending science texts than active readers (Croner, 2003).

Vocabulary comprehension is not only important for success on individual scholastic tasks, such as exams, but also for a student's overall outlook for success. In an article written for the publication *Principal*, E.D. Hirsch Jr. states that "Verbal scores are highly correlated with student's life chances and contributions to society" (2010). It is crucial that students who appear to be lagging in vocabulary comprehension are identified and given supplemental assistance, as "Vocabulary growth rate differences accumulated over time such that the effect on vocabulary size was large" (Duff, Tomblin & Catts, 2015). This means that the gap between high achieving students and underperforming students continues to widen over time.

Several instructional methods have been shown to be particularly effective in improving vocabulary comprehension in lower grades. One such technique is scaffolding. Scaffolding, or using complex texts above a student's grade level to build on each other, rather than staying below or at grade level can "build confidence and competency decoding unfamiliar words" (Fisher & Fray, 2014). Encouraging teachers to read aloud to students can help students understand "text structure, word solving and comprehension strategies so that skills are built and habits are formed" (Regan & Berkeley, 2012). Teachers should also emphasize that their students "read widely from texts they want to read, building their background knowledge and vocabulary while developing morally, emotionally, and intellectually (Ivey & Johnston, 2013). Patrick Croner investigated active versus passive readers comprehending science texts. Active readers demonstrate more metacognition and utilize pre-reading and during-reading strategies to improve comprehension. Passive readers tend to be much less engaged in the text. Croner

recommends using these varied reading strategies to turn passive readers into active readers to improve their textual comprehension (2003).

Outside of the classroom, reading for pleasure is an indicator for vocabulary success. Students reading on their own are more likely to encounter low-frequency words and improve their vocabulary than their minimally-reading counterparts (Duff, Tomblin & Catts, 2015). It has also been demonstrated that reading aloud with preschoolers, and asking the children questions while being read stories, improves vocabulary acquisition (Senechal, 1997).

Steps need to be taken in preschool-age students at home, up through elementary and high school to give students the tools they need to be successful in college and beyond. Basic vocabulary comprehension is an issue best solved before students reach the colligate level. However, new developments such as novel methods of teaching content and reading comprehension to college students using adaptive computer software (Ray & Belden, 2007) could be promising for struggling students.

Method

Participants

Six classes, General Biology II, Principles of Biology, Anatomy and Physiology II, Cell and Molecular Biology, Studies in Daniel, and Pathophysiology, were identified as candidates for investigation. These classes were chosen as to include one lower and one upper division biology-major class, one lower and one upper division nursing class, and one lower and one upper division general education class. The major-specific classes were matched as closely as possible for similar numbers of students for class comparison. There were a total of 195 participants, broken down with 42 in GB, 31 in Cell, 27 in Principles, 20 in Daniel, 43 in A&P, and 32 in Pathophysiology.

Materials

To assess personal reading habits and history a student information questionnaire (see Appendix 1) was distributed to all six selected classes. To assess vocabulary comprehension a twenty question multiple choice vocabulary quiz was also distributed to the six classes. The vocabulary words were selected from an aggregate list of commonly missed non-content specific words made available through the Human Anatomy and Physiology Society online community forums. Informed consent was obtained from each participant with an IRB-approved consent form. In order to assure anonymity, the informed consent and the student information forms were assigned a unique three number code corresponding to each questionnaire.

Procedure

Questionnaires consisting of the informed consent, student information and vocabulary quiz were distributed in all six of the afore mentioned classes over a two week period. When the

questionnaire packets were collected, the informed consent containing student names was separated from the rest of the forms. This kept identifying student information separate from their quiz scores. The names were used to compile GPA and class standing information for each participant, and the responses to both the information form and vocabulary quiz were compiled. GPA and class standing was matched to quiz scores using the unique numerical codes.

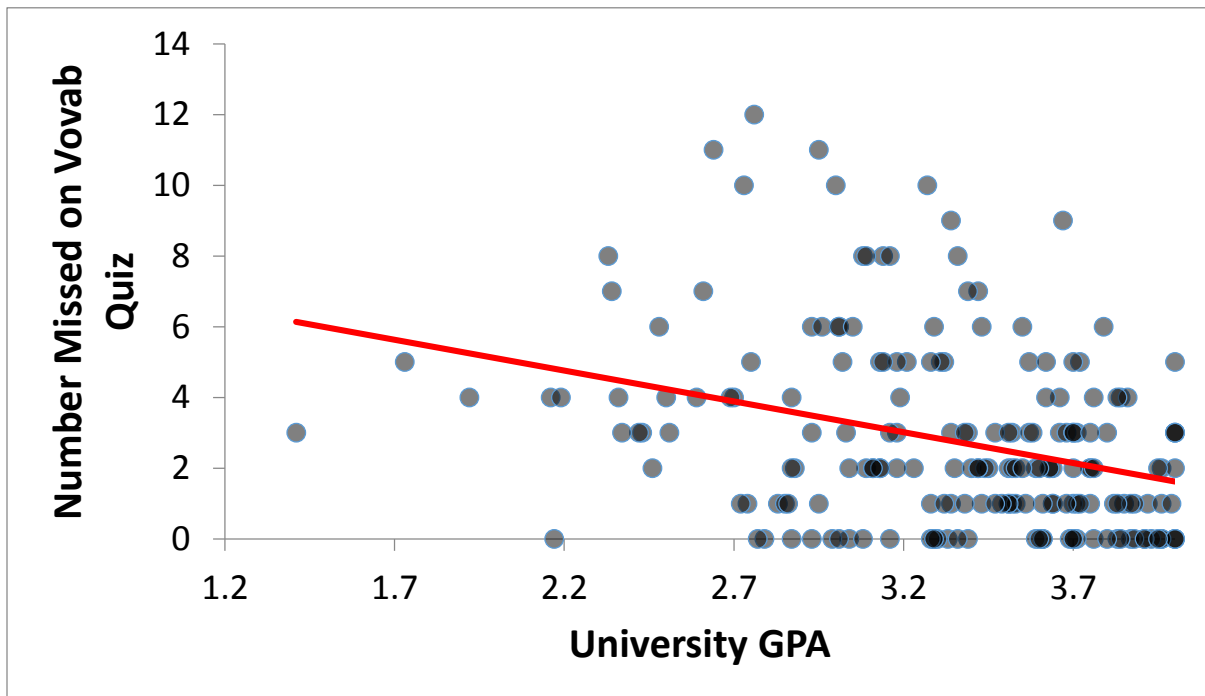
Results

Numerical values were assigned to each of the responses for the childhood reading history for ease of analysis. Frequently translated to 3, some became 2, rarely was 1 and never was zero. There were 183 useable data points, with some questionnaires being thrown out due to the student being under 18, or various missing pieces of information. An Analysis of Covariance (ANCOVA) linear model was used to assess correlation between variables. The dependent variable was number of questions missed, and the independent variables were cumulative college GPA, amount parents read to their child, upper vs. lower division classes, how much the student reads for pleasure, and type of class being profiled. The ANCOVA model generated p-values that measured statistical significance between the dependent variable and each independent variable (Table 1). Based on a p-value of less than 0.05, this model showed that cumulative college GPA has a statistically significant relationship to the number of questions missed on the vocabulary quiz. Additionally, time parents spent reading to their child has a statistically significant relationship with the number of questions missed. This variable was statistically significant even when controlled for university GPA. This would predict that out of two students who had the same GPA, the one who was read to more as a child would score better on the vocabulary quiz.

Table 1. Independent variables and their associated p-value

Independent Variable	P-Value
Cumulative College GPA	<0.001
Parents Reading to Child	0.003
Upper vs. Lower Division	0.081
Reading for Pleasure	0.400
Type of Class	0.900

In order to generate a linear model for university GPA and the number missed on the vocabulary quiz, the data was rank transformed to make the data normal. This rank transformation showed an inverse relationship between higher GPA and the number of questions missed (Figure 1).

**Figure 1.** Graph illustrating the inverse relationship between the number of questions missed and cumulative GPA.

Discussion

Of the five independent variables being investigated, only parents reading to their children and cumulative university GPA appeared to be significant. Upper vs. lower division classes was approaching statistical significance with a p-value of 0.08. This seems logical as more time spent in college would naturally improve vocabulary. Most interestingly, the ANCOVA model showed that reading for pleasure is not statistically significant in predicting student quiz scores. There are several possible interpretations for this finding, but perhaps the most important one is that students naturally choose to read material at or below their reading level. They are not challenging themselves or encountering low-frequency words enough to make any significant improvement to their vocabulary. Additionally, self-reporting is not a precise tool, and students could have said they read more than they actually do.

Early intervention seems to be key to the issue of vocabulary comprehension. Families should be encouraged to read frequently and actively with their children from their earliest years. This vocabulary comprehension problem is not only a family issue, however, but also a scholastic issue. Collegiate students identified as struggling with non-content specific vocabulary need interventions as well. Assigning challenging books both inside and outside of class to encourage discovery of foreign words, as well as mentor and peer support could all be potentially implemented to assist students. Vocabulary comprehension is an interdisciplinary issue that needs to be addressed in every department, not just in the sciences.

There are many opportunities for further research with this project. The questionnaires could be repeated and include a question about what primary language is spoken at home, as this could be a confounding factor affecting non-native English speakers. The project could be

repeated with a larger sample size, pulling from a wider variety of disciplines and departments. The research question could be narrowed and the number of independent variables limited to focus the study on what types of books students are reading in their free time. These are only some of the possibilities for continued work on this subject.

Acknowledgements

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Appendix 1

Student Information

Survey Code: _____

Age _____

Major _____

On average, how many hours per week do you read for pleasure (not for school)? (Circle one)

- a) 0-1 b) 1-2 c) 2-4 d) 4 or more

How much did your parents read to you as a child? (Circle one)

- Frequently Some Rarely Never

Appendix 2

Vocab Quiz

Instructions: Circle the best definition for each vocabulary word below.

1. contour

- a) to be or become absorbed or incorporated.
- b) to have the experience of; receive; endure.
- c) not subject to change; unchanging or unchangeable.
- d) the outline of a figure or surface; shape.**

2. void

- a) not containing anything; empty.**
- b) to be or become absorbed or incorporated.
- c) to bring to a climax or conclusion.
- d) not permitting passage or penetration.

3. onset

- a) any feature that serves to distinguish something.
- b) the early stage; beginning.**
- c) not subject to change; unchanging or unchangeable.
- d) habitually inactive physically.

4. immutable

- a) the frequency with which something happens or the range over which it occurs.
- b) to bring to a climax or conclusion.
- c) not subject to change; unchanging or unchangeable.**
- d) not containing anything; empty.

5. undergo

- a) having no order; without aim or purpose.
- b) to have the experience of; receive; endure.**
- c) to invent or think out.
- d) to make greater in size or amount; increase.

6. threshold

- a) to bring together or combine (separate elements) to form a whole.
- b) the point when something starts to happen.**
- c) the outline of a figure or surface; shape.
- d) habitually inactive physically.

7. depict

- a) a bar that forms the step of a ladder, or the piece between the legs of a chair.
- b) to show, describe, or portray in a painting, sculpture, or written work.**
- c) to make greater in size or amount; increase.
- d) the early stage; beginning.

8. sedentary

- a) to show, describe, or portray in a painting, sculpture, or written work.
- b) to bring together and mix into a whole.
- c) not containing anything; empty.
- d) habitually inactive physically.**

9. synthesize

- a) the point when something starts to happen.
- b) any feature that serves to distinguish something.
- c) to bring together or combine (separate elements) to form a whole.**
- d) to have the experience of; receive; endure.

10. impermeable

- a) to bring together or combine (separate elements) to form a whole.
- b) to bring together and mix into a whole.
- c) to have the experience of; receive; endure.
- d) not permitting passage or penetration.**

11. devise

- a) the point when something starts to happen.
- b) to show, describe, or portray in a painting, sculpture, or written work.
- c) the frequency with which something happens or the range over which it occurs.
- d) to invent or think out.**

12. culminate

- a) the early stage; beginning.
- b) to bring to a climax or conclusion.**
- c) the frequency with which something happens or the range over which it occurs.
- d) to bring together and mix into a whole.

13. hallmark

- a) not containing anything; empty.
- b) to make greater in size or amount; increase.
- c) any feature that serves to distinguish something.**
- d) to have the experience of; receive; endure.

14. augment

- a) to be or become absorbed or incorporated.
- b) not subject to change; unchanging or unchangeable.
- c) having no order; without aim or purpose.
- d) to make greater in size or amount; increase.**

15. interfere

- a) having no order; without aim or purpose.
- b) to be or get in the way**
- c) to be or become absorbed or incorporated.
- d) to have the experience of; receive; endure.

16. integrate

- a) having no order; without aim or purpose.
- b) to bring together and mix into a whole.**
- c) the point when something starts to happen.
- d) a bar that forms the step of a ladder, or the piece between the legs of a chair.

17. incidence

- a) not permitting passage or penetration.
- b) any feature that serves to distinguish something.
- c) the frequency with which something happens or the range over which it occurs.**
- d) not subject to change; unchanging or unchangeable.

18. haphazard

- a) habitually inactive physically.
- b) not containing anything; empty.
- c) having no order; without aim or purpose.**
- d) not subject to change; unchanging or unchangeable.

19. rung

- a) a bar that forms the step of a ladder, or the piece between the legs of a chair.**
- b) to have the experience of; receive; endure.
- c) having no order; without aim or purpose.
- d) not subject to change; unchanging or unchangeable.

20. assimilate

- a) to bring together and mix into a whole.
- b) habitually inactive physically.
- c) to be or become absorbed or incorporated.**
- d) to have the experience of; receive; endure.