

Incorporating a Microbiology Curriculum with an Emphasis on Vocabulary by Utilizing Verbal, Reading, and Writing Skills in a Secondary Classroom

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1. Introduction

In 1990, the National Research Council marked science as a national priority and set a future goal to increase student achievement in science and math [1;2]. Since 1990, science education reforms have suggested that science teachers should focus on communication through written and oral interactions in an attempt to increase science literacy [3]. One of the specific areas that encompass both written and oral communication within the science classroom is vocabulary.

Due to extended research that has been conducted on vocabulary in the classroom, many educators are aware of the strong relationship between vocabulary knowledge and subject comprehension [4]. Despite this understanding, however, many science students do not have developed oral vocabularies [2]. Students with limited vocabulary skills are less likely to develop an integrated understanding of the science concepts since science textbooks utilize thousands of specialized and technical vocabulary words for each year of school [5; 2]. For this reason, science activities and lessons should be carefully developed for vocabulary learning and enhancement.

It was believed that if students received microbiology instruction with an emphasis on vocabulary by utilizing reading, writing, and verbal skills, their knowledge of microbiology would increase more than if they received instruction without an emphasis on vocabulary. The curriculum for this project was designed for a secondary microbiology class and consisted of oral, written, and reading activities to promote vocabulary learning in the subject area.

2. Method

A six-week curriculum for a secondary microbiology elective class was developed and used for a private high school class. The project consisted of a cumulative pretest followed by four separate microbiology units of materials. The first two units of instruction emphasized vocabulary through hands-on lab activities with vocabulary, discussion-based and written questions over vocabulary words, vocabulary review and discussion, case study readings, class discussions over various microbiology topics, and lab results. The lab activities provided the students with interactive learning and covered certain vocabulary terms. Students received one case-based investigation per week consisting of a written story that allowed class exploration in a microbiology topic and further understanding of specific vocabulary terms. Class discussions that followed labs and case studies allowed an informal assessment of each student's comprehension and gave students the opportunity to cognitively evaluate the assignment's effectiveness on their learning. During each unit, students were given a list of topics that had been covered or discussed in class as a review for their unit test. At the end of each eight-day period during the first two units, students worked in pairs to review the words that they had worked with throughout the unit. At the end of the class period, a short vocabulary quiz was administered to assess the understanding of the words. In addition, at the end of each unit, students took a unit test over the content material. The final two units of the microbiology curriculum study offered the same various classroom activities, however, vocabulary was not discussed, there were no questions over vocabulary understanding or usage, and no vocabulary review was provided for quizzes. Following each of the final two eight-day units of the microbiology study, a vocabulary quiz and unit test was administered to the students over the vocabulary words and content material that had been encountered. At the end of the study, a posttest was given. The pre and posttest, the unit test, and the vocabulary quiz results were compared for differences between units of study with an emphasis on vocabulary and without. The pre and posttest results were also compared to measure overall improvement in basic microbiology knowledge. To measure vocabulary retention over time, a final vocabulary test over all of the words covered during the study was administered two weeks after the study was completed for comparison of the first two vocabulary treatment units versus the last two control treatment units.

3. Results

Assessment results for each of the four units showed an average score that was 8.4% higher in content knowledge for the two units presented with an emphasis on vocabulary than the two units without the emphasis. Assessment results for vocabulary showed an average score that was 20.1% higher in vocabulary knowledge when vocabulary instruction was emphasized than when it wasn't. Differences in pretest and posttest scores showed that comprehensive microbiology knowledge of all four units increased by an average of 38.8%. Two weeks after the study, vocabulary retention was assessed and showed a class test average of 84.9% for the experimental unit words and an average of 71.8% for the control unit words.

4. Discussion

While the results supported the hypothesis, several factors could have played a role in the results of the study. Test treatment order could have affected the results. All assessment tests were administered in the same format, so students had the opportunity to become familiar with the test format for the last two units of study in which vocabulary was not emphasized and may have scored higher than they would have otherwise. Oppositely, student enthusiasm and effort seems to dwindle as a semester progresses, so emphasizing vocabulary for the first two units may have resulted in higher assessment achievement than if vocabulary had been emphasized later in the study. Class time could have also played an impact on the results of the study. The class was taught during the last hour of the day, which resulted in numerous absences for several students. In addition, by the end of the day many students are tired and unfocused, which would affect their overall understanding of instruction on any given day. Finally, on two of the assessment days, students were overwhelmed with other tests and large assignments that were due on the same day, which always tends to affect student focus and time spent reviewing outside of class.

5. Conclusion

Overall, the test treatment of emphasizing vocabulary was effective for students in learning both vocabulary and content information. Vocabulary retention scores showed that the test treatment also seemed to be effective in long-term memory of vocabulary words. The major contributing factors to these results were using activities appropriate for the secondary level, using activities that would enhance an understanding of the vocabulary, the amount of participation by the students in each activity, and the students' knowledge of the concepts prior to the study. Teachers must incorporate activities that integrate vocabulary as a regular part of all subject matters. For science teachers specifically, emphasis should be placed on technical and specialty vocabulary that occurs in the classroom to improve national benchmarks, science literacy, and enjoyment for more students.

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7. References

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