The Effects of Computer Animations on High School Students Performance and Engagement in Biology

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Abstract. Technology and computers today play a huge part of how society and education function. The learner has been shaped by digital media such as computers, internet, iPods, and Xbox. Research has shown that learning in biological science is enhanced with the use of computer animations. This study involved 79 biology students from an urban high school participating in a three-week study. In this study a pretest, post-test and retention test was given for assessment. The study focused on the use of computer animations to increase the performance and engagement of cell transport and movement. This research shows that computer animations accompanied with traditional teaching increases the performance of high school biology students and should be recommended to aid the teaching of biological concepts.

1. Introduction

Why is it that Microsoft has sold over 10 million Xbox 360s in the U.S. and over 19 million worldwide with over 12 million Xbox Live registered users (Terdiman, 2008)? Why is that kids are more likely to stay at home in front of the TV and play Madden football than to actually go out and physically play football with their friends down the street? Why is it that a majority of the country is tagged as obese? Why is that we all have cell phones, text messaging, computers and face books? The reason is that we are a three-dimensional visually stimulated technology driven society. Diana and James Oblinger (2005) of Educating the Net Generation, found that 13 to 17 year-olds spend 3.5 hours a day using digital media which include computers, games and internet. Technology is continually changing, but is our instruction changing with it? In order to truly leave “no child behind” classrooms and instructional methods must stay up to speed with technology and our learners. Since over 60% of learners are visual and many stimulated on a daily basis by computer animation such as Xbox then our instruction needs to contain computers and animation (Martindale, 2007). There are still teachers that use the old Socratic methods of teaching supplemented with note taking and worksheets. What changes in instruction can lead to better engagement and performance in the biology classroom?

2. Research Questions

Research Question from the literature review, one can surmise that computer animation would be more engaging and could thus increase student performance. The research questions for this project are as follows:

1. Will computer animations added to traditional lecture provide higher engagement in the learning process than traditional lecture alone?
2. Will computer animations added to traditional lecture provide a better understanding and long-term retention of biological concepts than traditional lecture alone?

The purpose of this study is to research the effectiveness of adding computer animations to traditional lecture for understanding and retention of cell biology concepts. The concepts being studied are cellular transport and movement. The study involves 79 Biology 2 students in three different classes of 25 to 28 students each. The ages of the students were from an urban school in south central Kansas with approximately 1600 total students.

3. Methods and Procedure

Class A was given traditional lecture and notes accompanied by two dimensional textbook illustrations, textbook worksheets and questions. Class B was given traditional lecture and notes accompanied by non-illustrated worksheets. Class C was given traditional lecture and notes accompanied by computer animations of cellular transport and movement. The traditional lecture, notes and lab activities are the variables held constant. The variables changing were non-illustrated worksheets and questions, illustrated worksheets, and computer animations. The ages of the students were from 15 to 17 years old.
4. Assessments

A pretest was given on the concepts at the beginning of the three-week period. After the three-week period or seven 90-minute block classes, a post-test was given. During the three-week study field notes and informative assessments to study engagement were monitored. Included in the twenty multiple choice post-test are ten level-one questions and ten level-two questions. In order to also test for retention and understanding of the concepts, the post-test was given again after two weeks of not studying the concepts.

5. Results

Class A had 28 students present during the pre and post-test exams. Class A had an average standard deviation for all three tests of 13.0%. All three class averages of the three tests are shown below on the left. Class A as shown below on the right had an average gain of 26% on pre and post-test scores. Class B with a total of 25 students in the class period directly after lunch had an average standard deviation of 13.1%. Class B had a 22% average gain between pre and post-test scores. Class C had a total of 26 students that took the pre and post-test. Class C was held right after Class B and the period just before lunch. Class C had an average standard deviation of 12.6%. Class C had an average gain of 43% between the pre and post-test scores. As shown below in the chart, Class C (computer animations) had the largest percent of gain per student by 17% over Class A and almost doubles that of Class B. The retention test showed that all three classes had dropped or had a loss of retention. However, Class C had a smaller percentage at 4.8% of decreased scores than that of Class A with 8.4% and Class B with 5.8%. The results below show that when computer animations are shown the last 15-minutes of class after lecture, notes and activities that students understand and retain more of the biological concepts presented in the high school biology classroom.

6. Conclusions

There are many factors that can play a role in the classroom and on student performance. The results of the post-test as a whole, meaning all three classes, were a little discouraging in that the overall percent gain was not enormous. Some of the factors that could have inhibited the ability to understand the concepts are sleep, food, absences, school activities, behavioral disruptions, class passes, hour of the day, and difficulty of the content. However, the results do show that computer animations when shown after concepts are introduced provide increased performance, engagement, and retention of biological concepts with high school students. Therefore, computer animations should be continually developed and used to teach these concepts in the high school science classroom.