Improving students' comprehension of Biology Labs with Audio-Visual Materials.

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INTRODUCTION

The learning process is complex and cannot be simply described as a linear flow of new written knowledge. Human beings elaborate external information through the five senses of the nervous system. The external inputs are processed to build models and patterns of new knowledge in a way that is different for each individual. Audio-visual (AV) materials are very useful to improve general comprehension for the majority of students, especially when delivered before a Biology Lab class. It is well accepted that the same information should be presented to students in a variety of ways to improve comprehension and learning. This three principles of Universal Design for Learning (UDL) 1,2 illustrates the importance of presenting class materials in multiple ways to promote students' engagement at different levels of comprehension and stimulate students' interest toward self-learning. Furthermore, the learning process in UDL may be more effective when the new concepts retrieve previous background knowledge and/or life experience in each subject. 3,4

Because of the technological advancements, today's teachers can select interesting AV materials from reliable websites. In this pilot study, educational videos supplemented with relevant reading materials were selected for undergraduate biology students to belong to different level courses. Educational videos last approximately 3 to 15 minutes and could be viewed at any time and location. Students responded to these promising AV Learning 5,6 approaches were evaluated through anonymous online survey (http://www.surveymonkey.com/). The data revealed that approximately 99% (BIOD 2298: 93.4% and BIOD 1111: 98.2%) of the students found Extremely/Very helpful the use of educational videos as a method to improve comprehension on a specific subject. The results of this pilot study suggest that AV materials are very useful teaching tools, which should be introduced in Biology Lab class and; perhaps, in all other undergraduate and graduate courses as support to the written material available to students.

METHODS

In this pilot study an anonymous survey (http://www.surveymonkey.com/.) has been freely delivered to undergraduate Biology Lab students (individuals are not identifiable). Specifically, the survey that can be completed in approximately 1 to 2 minutes was sent to two BIOD 2298 genetics class (sample size n=250) and three BIOD 1111 General-Biology (sample size n=465) students at the end of the semester after the final exams. Students were asked to evaluate the usefulness of selected educational videos toward their comprehension of biological concepts and practical Lab activities. They received a Matrix of Choice questions (One Answer Allowed) and they were asked to rate each item's based on the following five-point scale: Extremely important, Very important, Moderately important, Slightly or Not important.

Furthermore, a comment box was also provided to allow students to express their opinion on the selected educational videos. The AV materials were selected from various reliable online sources including the DNA learning Center, NASA, YouTube and other CourseUniverse websites, and could be easily watched by students in 3 to 15 minutes. Moreover, AV material has always been on a regular basis before classes that allowed students to familiarize with the new biological topics and use as a studying and reviewing tool before exams.

Survey analysis

<table>
<thead>
<tr>
<th>Likert (Extensive Example) Scale</th>
<th>Confidence Level</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>1 (Very Slightly)</td>
<td>8.5%</td>
<td></td>
</tr>
<tr>
<td>2 (Slightly)</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>3 (Moderate)</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>4 (Very)</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>5 (Extremely)</td>
<td>20%</td>
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</tbody>
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Survey Question: Did you find the videos helpful for your understanding of the Lab material?

Yes | No

The sample size (n = 15) and confidence interval (also called margin of error) has been calculated using the sample size calculator from http://www.surveysystem.com//. In order to estimate the number of students needed in each sample that is drawn from a population of few hundred (e.g. n=250) who usually enrol in those Biology courses. The estimated data are used to evaluate the accuracy of this study. Furthermore, as previously reported, the test is valid even if the percentage of the students responding is to the survey is approximately 5% of the total student population, see table below from Dr. Van Bennekum, Great Brook, 2010-2011:

http://www.greatbrook.com/statistical_confidence.htm

As the statistical confidence can be estimated using the accuracy chart shown below, the confidence level of this student survey is certain to be of 85% with a 20% accuracy.

RESULTS AND DISCUSSION - I

Anonymous survey, which can be completed in not more than 1 or 2 minutes, can be very valuable tools to gather useful feedback from students. A survey response rate of 10-20% is considered very common (http://www.surveymonkey.com/about/sample-size/) and 30-35% it would be highly successful (http://www.surveymonkey.com/about/sample-size/). Obviously, responses can vary depending on several factors, which also influence the degree of importance given by the students to each specific topic. The response rate (expressed as % of responding students) of this pilot study for both groups (i.e. Genetics and Intro to Biology) is estimated to be successfully as the response rate was about 20%.

The results of the survey for BIOD 2298 students are shown in Fig. 1 and 2, and 83.4% rated the AV materials as Extremely/Very helpful. Furthermore, I received some very positive comments from the students: 1) "I really thought they helped and every "TA should post them" 2) "More videos like these before lab would be a great tool to further conceptualize what we will be doing in the next check" 3) "The videos help me to remember the concepts of the labs. It is also a good introduction to the lab before i start reading about it.

Similar results for BIOD 1111 students are presented in Fig. 2 with a rate of 66.3%. Regrettting, the BIOD 1111 group, I also included in the survey a few extra-questions, asking if students would be interested in making their own videos and how useful were other educational tools used in the course (Joulzies and other Lab Assignments). I used those extra questions for comparison on how new students rated the usefulness of the AV materials. As shown in Fig. 3, students were not particularly interested in making their own videos, only 39% were Extremely/Very interested. Furthermore, Fig. 4 shows that 64% of the students rated Quizzez and Lab Assignments, respectively, with a percentage of 30% (80% like them) and 23.10%. Of note, none of the students (0%) ever used the Slightly/Not at all useful features when rating the questions on AV materials, see Fig. 1 and Fig. 3.

In Conclussion, AV materials may become very useful tools to support student written descriptions needed to apply in Biology Lab classes. This pilot study supports the importance of AV Learning in improving students' comprehension of the topics presented in class. In consolidating information that is processed through the brain, it also supports the principles of UDL 1,2 underlying the incorporation of multiple ways to promote engagement at different levels of comprehension. Furthermore, a teaching tool that can improve comprehension of the many working college students could bring great benefits in their academic performance. We often learn how we were thought but we can always find new strategies to promote better learning. Introducing new educational tools is also part of informal teaching, which is done by example. Informal teaching can be extremely important in higher education because it could open new doors in the life and career of each student as a valuable member of our society.

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