

Problem:

Students are disengaged during lecture and come to laboratory unprepared. Either they have not reviewed the laboratory procedure before coming to class or have read it but do not understand the procedure. Students have verbally expressed frustration to the Primary Investigator their difficulty with reading laboratory procedures and visualizing exactly what they are expected to do in lab. Students have also expressed their desire for additional practice problems that correlate lecture material to laboratory exercises. However, there is limited class time to devote to additional case studies and practice problems.

Hypothesis:

A flipped classroom model of instruction will allow students to view screencasts of lectures (utilizing Tegrity) and videos of laboratory procedures at home. They will practice what they have learned in class by analyzing case studies and patient vignettes before going to the laboratory. This instructional model will increase the level of student engagement in class and increase their understanding of laboratory concepts and procedures. For the purpose of this study "flipped learning" is defined as a form of blended learning where "instructor-led lecture and student note taking is done prior to class and assigned problems (what used to be homework) is done [during] the scheduled class time." (Fox & Pierce, 2012)

Objectives:

1. Implement a flipped classroom model of instruction in CLS 100-Introduction to Clinical Laboratory Science.
 - a. Students will view screencasts in the form of Tegrity lectures introducing students to the various disciplines within clinical laboratory science (chemistry, cytology, hematology, immunohematology, microbiology, phlebotomy, safety, and urinalysis.)
 - b. Students will view laboratory videos demonstrating laboratory techniques prior to attending the associated laboratory.
 - c. Using the Tegrity lectures as a foundation, class time will be spent investigating case studies and patient vignettes to help students develop critical thinking and problem solving skills as they relate to the clinical laboratory.
 - d. Students will then use this information (Tegrity lectures, videos and case study assignments) to complete a laboratory exercise. The laboratory exercise will reflect the objectives stated in the Tegrity lectures, videos and case studies.
2. Assess the impact of the flipped classroom model on student performance in lecture, laboratory and student attitudes using the following data:
 - a. Comparison of student performance on assessments and laboratory activities from previously taught CLS 100 courses to student performance on assessments and laboratory activities in CLS 100 courses taught using the flipped model of instruction.
 - b. Comparison of time the students spent viewing the Tegrity lectures and the number of times they viewed the Tegrity videos and Lectures to their performance on assessments and laboratory activities.
 - c. Survey to assess students' perception of the flipped model of instruction
3. Use the above information to assess the implementation of the flipped classroom model in higher-level CLS lecture and laboratory courses.

Results:

Student Survey: Perceptions About the Use of the Pre-Recorded videos and a Flipped Classroom Model

N = 43	STRONGLY AGREE/ AGREE	STRONGLY DISAGREE/DISAGREE
1. Viewing the Tegrity lecture before class prepared me for the in class activity.	97.5%	
2. I did not view the Tegrity lecture before class even though I knew it was required.		77.5%
3. Viewing the pre-recorded Tegrity lecture was essential to successfully completing the in class activity.	78.4%	
4. The instructors made meaningful connections between the topics in the pre-recorded lecture and the in class activities.	100%	
5. I enjoyed being able to view the Tegrity lecture prior to the scheduled class as opposed to live class lecture.	76.9%	
6. The instructor required student participation in the in-class activity	97.3%	
7. Viewing the pre-laboratory video before lab prepared me for the laboratory activity	97.6%	
8. I did not view the pre-laboratory video before lab even though I knew it was required.		84.6%
9. Viewing the pre-recorded pre-laboratory video was essential to successfully completing the in class activity.	84.2%	
10. The instructors made meaningful connections between the topics in the pre-recorded laboratory videos and the in class activities.	100%	
11. I enjoyed being able to view the laboratory procedure(s) prior to the scheduled lab as opposed to only reading the procedure.	92.5%	
12. The pre-recorded laboratory videos helped me to prepare for the laboratory activities.	100%	
13. I now have a basic understanding of the various CLS disciplines	100%	

*NOTE: These values were obtained by subtracting the percentage of students who neither agreed nor disagreed with the above statements

Overall the majority of the students found both the Tegrity Lectures and the Pre Laboratory Videos helpful in their learning of the course material and in their understanding of laboratory procedures. This is supported by the results of the student survey (above). Once the responses were adjusted to discount the students that answered, "neither agree nor disagree," there was a >75% positive response for each of the questions asked. The statements with the lowest scores were #2 "I did not view the Tegrity lecture before class even though I knew it was required" where 77.5% said they strongly disagreed/disagreed. This means that 77.5% of the students *did* watch the Tegrity lectures. In the overall course evaluation some students expressed they felt the Tegrity lectures were "too long" and that is was easy to "zone out" and "[not] watch the full thing and skip points]. According to the statistics tracking offered via the Tegrity software it was never a week where 100% of the students watched the Tegrity lectures even though they all took the Tegrity quiz. Apparently, some of the students did not feel the Tegrity lecture was necessary in order to complete the Tegrity quiz or to participate in the in class activity. In fact, only 78.4% of the students felt "viewing the pre-recorded Tegrity lecture was essential to successfully completing the in class activity" and only 76.9% said they "enjoyed being able to view the Tegrity lecture prior to the scheduled class as opposed to live class lecture." While the students may not have "enjoyed" watching the Tegrity lectures 100% of them thought "the instructors made meaningful connections between the topics in the pre-recorded lecture and the in class activities." Further analysis of the data is required to conclude whether or not the students who watched the Tegrity lectures were more or less successful in completing the Tegrity quiz and the in class activity. We still have to analyze the score from previous CLS 100 classes and compare them to the current class as well as analyze the statistical data via Blackboard in order to fulfill objectives 2a and 2b listed above.

The students did find the pre-laboratory videos both useful and enjoyable. 97.6% of the student thought "viewing the pre-laboratory video before lab prepared [them] for the laboratory activity" 84.6% of the students viewed the pre-laboratory video before class as opposed to the 77.5% that viewed the Tegrity lecture. 84.2% of the students felt that "viewing the pre-recorded pre-laboratory video was essential to successfully completing the in class activity as opposed to the 78.4% who felt the Tegrity lecture was essential. 92.5% "enjoyed being able to view the laboratory procedure(s) prior to the scheduled lab as opposed to only reading the procedure." 100% of the students felt they left CLS 100 with "a basic understanding of the various CLS disciplines."

Conclusions and Lessons Learned

Making the Pre-Laboratory Videos

As stated in the Summer Progress Report, I (the primary investigator) encountered numerous technical issues related to converting and editing the HD video files. While the final products turned out much better than I expected, troubleshooting these issues took up a substantial amount of time. I strongly recommend researching your exact camera and software requirements before you begin. I had to purchase unexpected conversion and editing software as well as a new computer with more memory and a more powerful processor in order to edit a video in a reasonable amount of time. Before the upgrades it took 8 hours to edit a 6-minute video. I also recommend posting the videos to a private YouTube channel instead of posting them directly to Blackboard. They playback is much quicker, better quality, and does not freeze or buffer.

Unfortunately some of these issues caused the videos to be posted in an untimely manner, which caused some confusion and frustration among the students. As the semester went on these issues subsided and the students did not have many problems viewing the videos. As demonstrated above, the students found the videos very helpful and in the course evaluation comments many stated they were what they liked best about the course.

With regard to filming the videos, I recommend filming only the hands of the person in the video. Have the person explain what they are doing in each step of the procedure. That way I was able to write a script and then narrate over the audio at the exact moments the actions were being taken. I also recommend creating a simple storyboard before filming so you know exactly how you want to

frame the shots before you begin. We did not draw up any actual storyboards but we did verbally plan out the shots and the sequences in which they were to be shot. One additional piece of advice is to make sure to communicate with our actor the parameters of the shot. For example, there were instances where we would have to reshoot a scene because the actor's hands or the test tube were out of frame.

Tegrity Lectures

While over 75% of the students felt the Tegrity lectures were useful and they enjoyed watching them, some of the students felt the Tegrity lectures were too long and that they were too similar to looking at a PowerPoint without voiceover. This is something that each instructor needs to improve upon, creating effective and engaging Tegrity lectures. In addition, the Tegrity quizzes did not seem to be as effective in ensuring the students watch the lectures. As stated above some felt they were not necessary for participating in the in class activity. Perhaps having the students take the quiz in class would provide more motivation to carefully watch the lectures and to take notes. Another reason the Tegrity quizzes may not have been effective is that, as one student stated in the course evaluation, "even if you get one wrong, you could retry and get 100% since it gave the answers in the key." This was entirely my fault. I must have not set up the parameters for quizzes correctly on Blackboard.

78.4% of the students felt the Tegrity lectures were necessary for completing the in class case studies. As the primary investigator, I would like to see this number improve. I believe this number could be low due to the size of the class and the composition of the classroom. There were 44 students in the class and the classroom was capable of holding 50 students. The students sat at long tables that were not easily movable. This made it difficult to break the students into groups for group problem solving. It also made it difficult as an instructor to ensure the students were on task. I would be interested to see if the scores improve with a smaller class size.

It also became apparent that I (the primary investigator) needed more practice in leading and facilitating group work/discussion.

As with any semester there were obstacles that fell outside of our control that impacted student perception. For example, there were a few days that needed to be rearranged in the course schedule. This caused some confusion among the students. Since CLS 100 is an introductory course that traditionally and purposefully uses a variety of teaching styles the students were confused as to what was expected of them when the schedule was rearranged. This resulted in a few weeks of traditional lecture in a row and when the students were expected to resume watching the Tegrity lectures and Pre-Laboratory videos, they failed to do so (even though I sent out an announcement reminding them of what they were to accomplish before class).

Laboratory Activities

Students were required to view these prior to attending the associated laboratory and then completed a laboratory exercise reflecting objectives stated in the online lecture and video. Statistically, there was weak to moderate positive correlation between percent of online lecture watched and laboratory or quiz performance, but not both. This spotty association indicates a need to better align all course components. A comparison of student performance on laboratory activities using the traditional lecture model versus the flipped classroom model was performed using SAS 9.3 and a Pooled or Satterthwaite independent samples T-test showed no statistical improvement. In fact, student scores on one laboratory activity significantly decreased.

Additional Questions

With regard to different teaching styles, it would also be interesting to see which type of learning styles favors the flipped classroom model of instruction. In the comments section of the course

Amanda Reed, Donna Duberg, and Mona Hebert

evaluation some students referred to being “visual learners” and that they “appreciated seeing beforehand what [they] would be doing in the lab.”

As stated above, it would be interesting to investigate the role class size plays on the effectiveness of the flipped classroom model of instruction.