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Do Flipped Lectures Increase Student Engagement With Course Material?

Educational Research Mini-Grant Final Report
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Summary

I have flipped one day a week of my Cell Biology course. For the flipped day, students watch online videos before class. For the other two days of the week, students are assigned a textbook reading before the lecture. Although there are incentives for both types of pre-class preparation, studies have shown that students rarely read the textbook before class. I hypothesized that more students would watch the videos than read the textbook, and that reading the textbook and watching online videos would positively correlate with exam performance. To examine the effect of student engagement outside of the classroom, I used student surveys and data automatically collected by the video streaming software. Extra credit questions at the end of each exam on student reading and study habits were used to give a reading or studying rating. For student video viewing analysis, the percentage of total minutes of video watched was determined. I have collected data for four semesters with four exams each semester. Analysis of the data shows that exam performance usually (3 out of 4 semesters) correlates significantly to reading and to watching the online videos in a single variable analysis. Multivariate analysis to control for student GPA was also performed on one year's data. Reading and video viewing both have a significant positive effect, while time spent studying has no effect. Attitude surveys showed that students reported liking videos more than reading the textbook, and data analysis shows that watching videos with little reading occurs more frequently than reading the textbook without watching videos. In conclusion, although students prefer to watch videos, both reading the textbook and watching videos have an effect on their exam scores. Students perceive watching videos to be "extra" work, and additional flipping should result in decreased class time. The null effects of study time on exam scores may be due to "cramming."

Purpose of project

The purpose of my project was to determine if watching videos for a partially flipped course was preferred over reading the textbook and impacted student performance.

I had several related hypotheses:

- 1) Students prefer watching videos over reading the textbook.
- 2) Students are more likely to watch videos than read the textbook.
- 3) Student engagement with the course material, either by watching videos or reading the textbook, will have a positive effect on their grades.

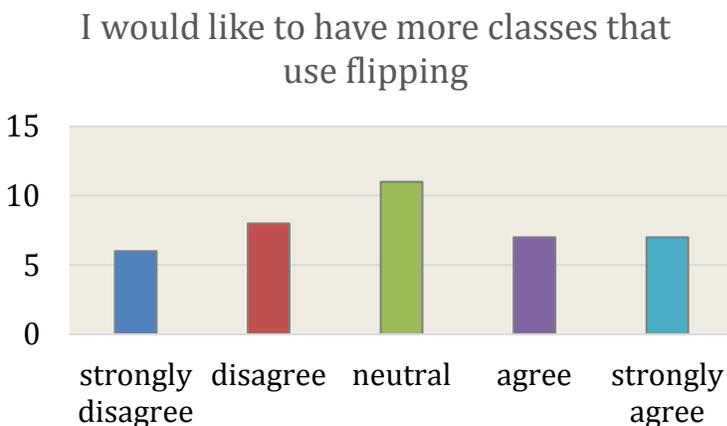
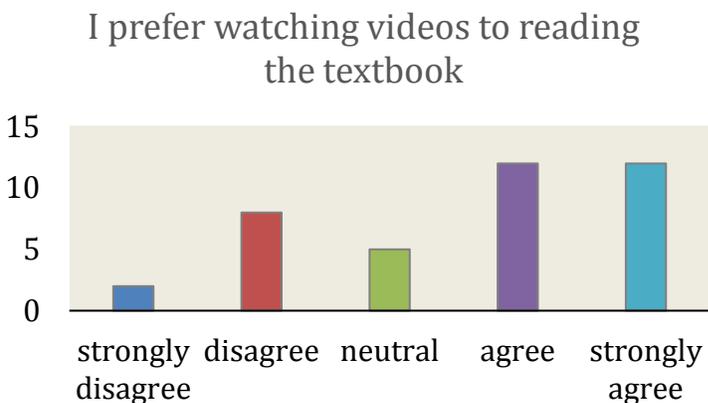
Methodology

IRB approval for this project was obtained. The online videos are posted on Blackboard using Kaltura, which provides a vast amount of data on student viewing including number of plays and total minutes watched. To measure student video viewing, the total time students watched videos was divided by total number of minutes of video

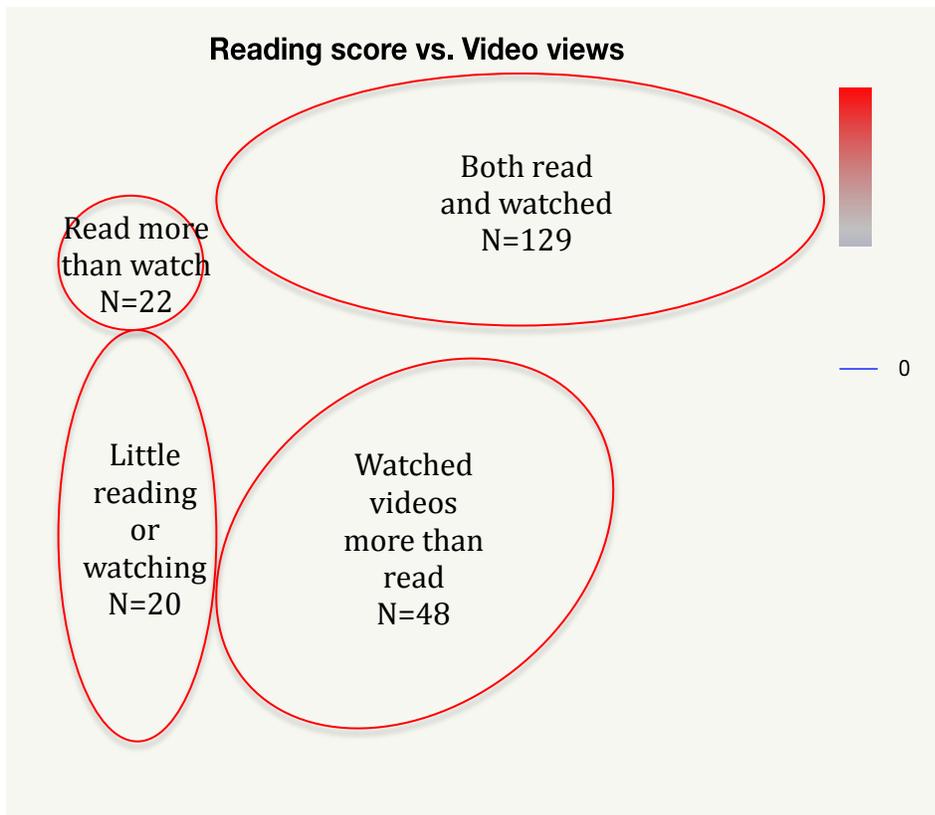
available for each exam to obtain percentage of video views. To collect data on student reading, I gave five questions at the end of each exam (4 exams each semester) asking how often they read the textbook before class and how they prepared for the exam. This data was given a score between 0-4 (0 for never read to 4 for always read). I collected data in fall 2014 semester, spring 2015, fall 2015, and spring 2016. With the help of Dr. Gayla Olbricht in Math and Statistics, I used the JMP program to do data analysis.

Results

Results of student surveys (Fall 2015) showed a preference for videos over textbook reading, but this did not translate into a desire for more flipped courses.



Graphing the video viewing data versus the reading score (from all four exams in one semester) shows that in most instances, students both read the textbook and watch the videos. There is a larger number of instances in which students watch videos more than they read the textbook, and a smaller number of instances in which students either read more than watch videos or do neither. Patterns were similar for all four semesters, fall 2014 is shown.

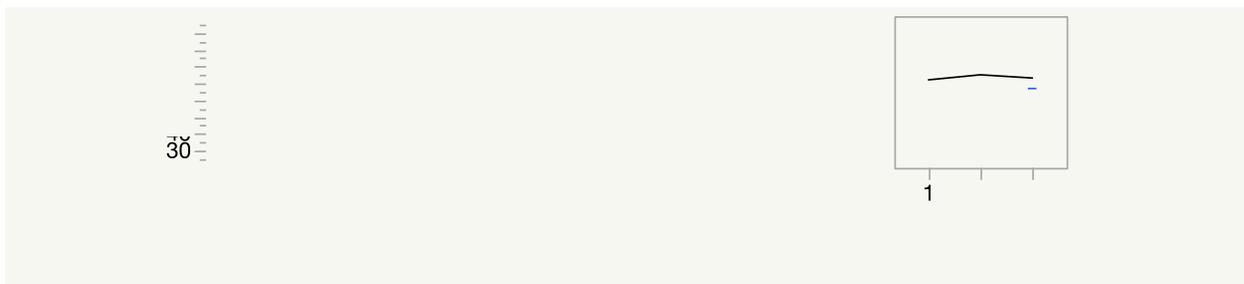


Pooled data for all four exams in one semester usually correlated significantly with reading score or video viewing, but not with amount of time spent studying. Correlations calculated using Spearman's Rho.

	Fall 2014 N=224	Spring 2015 N=140	Fall 2015 N=213	Spring 2016 N=128
Reading scores	Yes	Yes	Yes	No
Video viewing	Yes	Yes	Yes	No
Studying	No	Yes, but negative	No	No

Mixed multivariate model-Standard Least Squares Fall 2014 and Spring 2015

Source	LogWorth	PValue
GPA	16.265	0.00000
exam number-nominal	2.365	0.00431
Video views	1.966	0.01081
Reading score-ordinal	1.398	0.04003
study score-ordinal	0.867	0.13572
semester-nominal	0.623	0.23817



The results of the mixed multivariate model show that while GPA has the biggest effect on exam scores, both video viewing and reading have a significant effect on exam grades. The amount of time spent studying did NOT significantly affect exam performance.

Conclusion/future implications/plans for further dissemination

I have given four talks about this research, two on campus and two at national meetings.

Shannon, K. (2016) Measuring student course preparation and the effect on exam performance in a partially flipped class, American Society for Cell Biology (ASCB) mini symposium - *Evidence-Based Education: Innovations in Cell Biology* December 4, San Francisco, CA

Shannon, K. (2016) How do Online Videos and Textbook Reading Engage Students and Affect Exam Performance? Teaching and Learning Technology Conference, March 17-18, Missouri S&T, Rolla, MO

Shannon, K. (2015) Does watching online videos increase student engagement and performance? Association of Colleges and Universities for Biology Education, annual meeting, Missouri Western State University, October 23-25, St. Joseph, MO

Shannon, K. (2014) Flipped Fridays: Adventures in flipping Cell Biology, Teaching and Learning Technology Conference, March 13-14, Missouri S&T, Rolla, MO

I have given three poster presentations on this research, all at national meetings.

Shannon, K.B. (2015) Using flipped Friday video viewing data and student surveys to evaluate student engagement July 31, 2015 Society for the Advancement of Biology Education Research (SABER) Annual Meeting, Minneapolis, MN

Shannon, K.B. (2014) Flipped Fridays in Cell Biology. December 8, 2014 American Society for Cell Biology Annual Meeting, Philadelphia, PA

Shannon, K.B. (2014) Adventures in Flipping-Flipped Fridays in Cell Biology. July 18, 2014 Society for the Advancement of Biology Education Research (SABER) Annual Meeting, Minneapolis, MN

I plan to write up these results and publish in a peer-reviewed biology education journal.

References

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