Do My Students Watch My Pre-Lecture Videos?

K.C. Walsh
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Abstract and Background

I run a flipped classroom. Traditional lectures are parsed into short videos for students to watch before attending class. Front-loading the introduction of material before class allows lecture to be used practicing problem solving—actually doing physics. Out-of-class preparation is key to efficient use of in-class time. My action research started with a simple question: *Are my students watching the pre-lecture videos?* To assess that question a team of student's and I have created a website to deliver content and track student's usage. Student engagement with the materials on the site are then correlated with performance in the course. The hope is to not only learn if students are watching the pre-lecture videos, but also begin to understand whether they help, and to learn more about what else can help.

This Particular Study

- Introductory Algebra-based Physics 201, Fall 2015, weeks 4 -10
- 327 Students agreed to the tracking study, a little over half the class
- The BoxSand site hosted 35,000 sessions for 375,000 pageviews
  - Over 100,000 points constitute the study data set

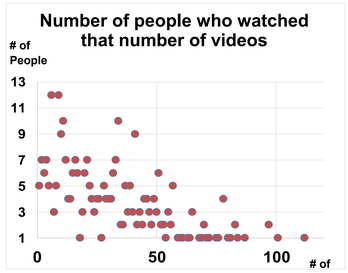
Project BoxSand

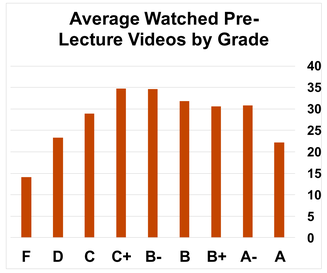
BoxSand is an open online webpage with links to: videos, practice problems, open source textbooks, educational websites, simulations... etc. The site is setup as a repository of content found at OSU and around the web. Students are guided through the site and their out-of-class activities with the course's Daily Learning Guide. The BoxSand site can track OSU students' progress through their out-of-class engagement with the site's content. The hope is this information can be used to help determine which content is best suited for the *Path to Mastery* laid out in the *Daily Learning Guide*.

Methods

- Participants are all OSU students from my fall PH 201
- Identifiable data was de-identified by a 3rd party to preserve students anonymity
- BoxSand website was built by OSU students using Drupal 7
  - Tracking aggregate data with Google Analytics
  - Tracking individual clicks with Drupal Tracking add-on
- Data has been analyzed using Excel
  - One of the goals of the study is exploring the data set to learn which methods can be employed to the larger data set coming next year

Watching Pre-lecture Videos



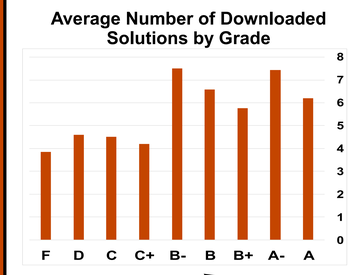


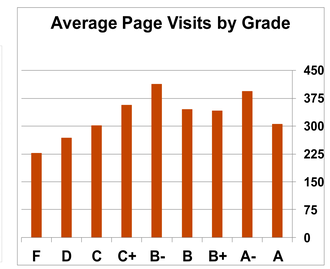
Data and Results

Most of the success of this study lies in new understanding of what the data sets look like and what types of analyical methods can be employed. Seeing trends in the data, as some of the results shown here display, has been considered added bonus and motivation for continued study.

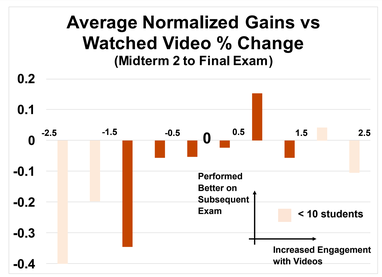
One note that should be made is to take caution when assuming causations in these data sets. Selection bias is prevalent in all these data and just because the students that watch more pre-lecture videos tend to do better on exams, doesn't necessarily mean that they do better on exams *because* they watched the pre-lecture videos. The variance in the data for any one individual student is also quite large, meaning that using this information to predict outcomes of individual students is potentially dangerous.

What Else Might Correlate?





Out of 6 homework and 2 midterms

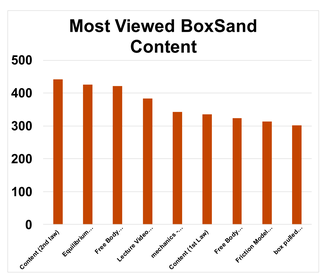


Does Changing Habits Help?

Normalized Gain is defined as the actual gain divided by the maximum possible gain.[1,2]

$$G = \frac{postscore\% - prescore\%}{1 - prescore\%}$$

While this method is more relevant to standardized test models, where the same test is given at the beginning and end of the term, this method still provides a measure of quantified change.



How about the Open Source BoxSand Content?

Future Work

This study has shown we can successfully track students' out of class engagement with learning tools we provide. Interesting trends and correlations inspire expanding the data sets and continuing to explore correlations.

Funds from a Learning Innovation Grant has enabled an expansion of the BoxSand site to incorporate an entire yearlong sequence worth of open source physics content. A second Action Research Fellowship will support the study, and next year's students will be tracked all year long. Hopefully a more complete picture of our students' habits will become clear with an entire year's worth of data. In the 7 months the site has been up OSU students have made over ***1 million*** pageviews.

Once the tools are in place and dashboard type reports can easily be generated the BoxSand project will be looking at expanding to other departments and other institutions. The real power will come when thousands of educators are sharing their content in the form of learning modules. Courses can be designed from open content and students' paths through the content can be tracked and correlated with performance. Studying 600 students will provide novel data but tracking and correlating performance on 600,000 students will hopefully provide robust data to drive instructional practice changes.

References

1. Vincent P. Coletta and Jeffrey A. Phillips, *Normalized gain, preinstruction scores, and scientific reasoning ability*, 2005 American Association of Physics Teachers
2. Lei Bao, *Theoretical comparisons of average normalized gain calculations*, 2006 American Association of Physics Teachers

Acknowledgements

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