

Ditch the Lecture So Students Will Learn

A CRLT Investigating Student Learning Project

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Background

The medieval practice of passive lecturing has dominated Engineering education despite numerous studies that suggest much more is learned if active methods are used. The study to the right may be the first direct measurement of brain activity during passive lecture compared to other typical student activities¹. These alone should worry anyone who is still practicing the time honored passive lecture style. This work is founded on decades of research², yet there is a clear need to hammer away at improving the classroom experience by eliminating passive lecture and replacing in with active learning experiences in class.

It is also interesting that watching television is right up there with attending passive lecture for brain activity. Hence, this work is **NOT** a typical flipped classroom, but rather an active learning replacement for lecture **WITHOUT ANY** screencasts or lecture recordings. The only video that is provided is inspirational video intended to convince students to spend the 10 hours or so that is needed to prepare for class.

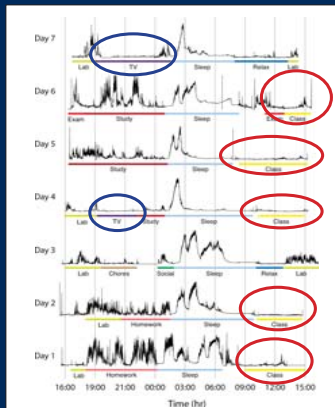


Fig. 9. Long-term in situ EDA recordings. Continuous skin conductance measurements were recorded for seven days in a natural home environment. Daily EDA waveforms displayed are normalized.

¹Ming-Zher Poh, Nicholas C. Swenson, and Rosalind W. Picard, *A Wearable Sensor for Unobtrusive, Long-Term Assessment of Electrodermal Activity*, IEEE Transactions On Biomedical Engineering, Vol. 57, No. 5, May 2010.

The Course

MSE 220, Introduction to Materials and Manufacturing, F2012 - 177 students Taught Monday, Wednesday, and Friday with a Recitation on Thursday

Experiment

Lecture as usual Mondays and Fridays
 Replace lecture on Wednesdays with active learning sessions
 Measure performance by tagging exam questions based on presentation style

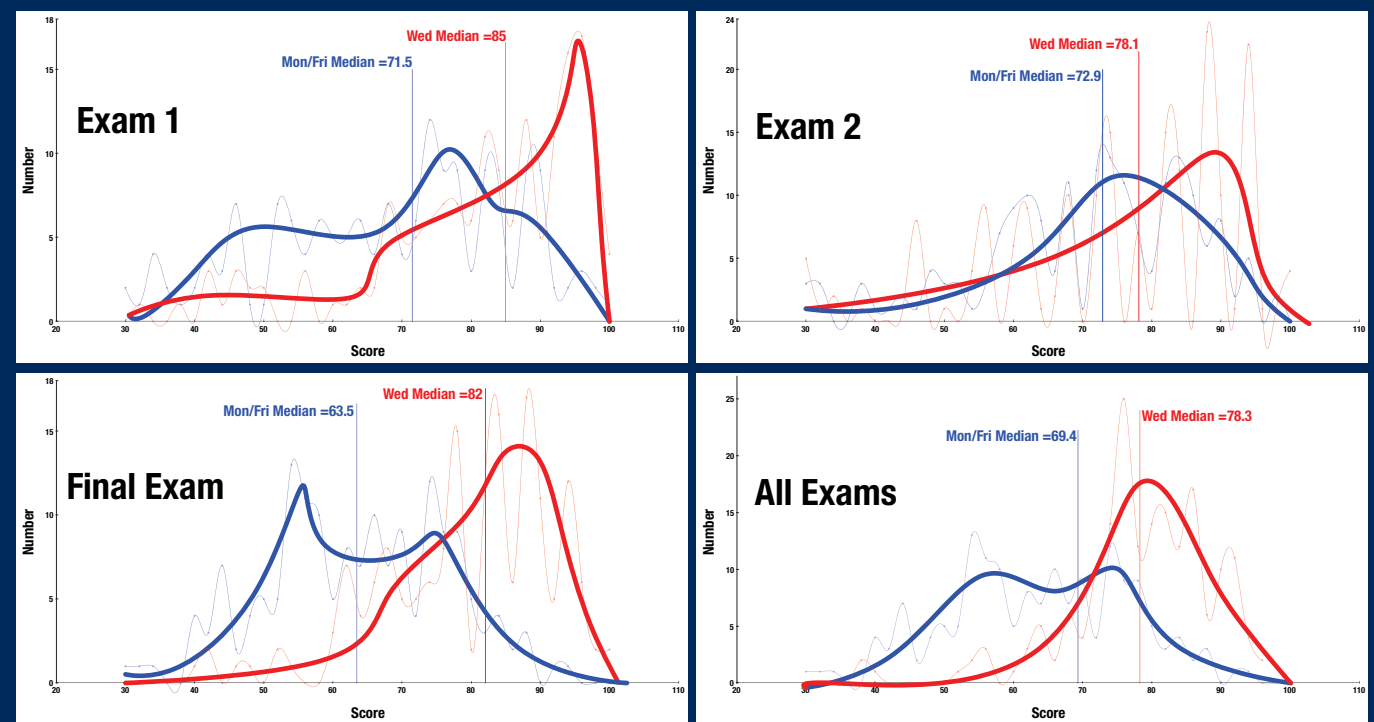
The Normal Lecture

Visually rich, high signal to noise ratio slides
 Demonstrations
 In-class activities ~10% of lecture time

Resources for students

Pencast and PDF homework solutions
 Lecture templates for optional study before and after class
 Lecture capture of Monday and Friday lectures (Wednesday sessions were not provided)

Results: Assessment of student performance as a function of pedagogy



Data was collected to assess the role of the pedagogical approach by tagging questions that were based on traditional lecture (blue) or on the active learning sessions (red). The figures above show that the distribution of the scores significantly improved in all exams. The final exam showed that the median shifted about 19 points for those questions that were based on the active learning sessions. The raw data is represented by the dots with light lines connecting them. The dark lines are drawn by hand to aid the eye.

Pre-work for Wednesdays

Online quiz based on book reading and an inspirational video to watch

In-class activities on Wednesdays

Guided inquiry homework, derivations and examples
 Story boarding approaches to teaching concept to high school students
 IF-AT questions (<http://www.epsteineducation.com>)
 Use of Instructional Aides to help GSIs help students during class

Other Peer Learning Activities

Use of Piazza to write multiple choice and fill in the blank questions

Next steps

- ✦ Completely eliminate lecture
- ✦ Downplay exams by making them worth less than 25% of grade
- ✦ Use a flat classroom with groups of 4 students
- ✦ Assign individual homework for review and refinement in groups
- ✦ Don't grade homework but do grade reflection on homework
- ✦ Expand use of Piazza type student interaction for reading the book (nb.mit.edu is an excellent option)
- ✦ Add project based learning into the mix