Student Engagement in Large Scale First Year Physics Courses

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Abstract

We have used a modified observational protocol to observe a large scale first year physics course to monitor the engagement of students as a function of the position of the instructional team members throughout the classroom. We recorded student engagement, TA/instructor position, as well as class activities at 2 minute intervals to attempt to identify trends in engagement. We have found that there are weak but negative correlations between the distance between members of the instructional team and groups of students.

Introduction

In the university physics classroom, there has been a move from lecture-style courses to that of interactive classrooms[1], which employ a more involved teaching team. Thus the role of the TA has become a much more prominent and important aspect to consider when trying to develop methods to successfully deliver a course. There has been some research into the effect of TA's on student learning, indicating that active engagement between TAs and students correlates with better post-test scores, and that a TA's approach to active learning has varied levels of both buy-in and execution[2, 3]. Thus, it will be useful to further delve into simple ways to have TAs not only buy-in, but act in ways that are in agreement with reformed teaching practices.

This motivates the current study, which looks to identify if there is a link between the presence of an instructor team in the classroom and the engagement of students. Specifically, we've asked the question: **what effect does the presence of a TA/instructor near a group of students have on their engagement? Does the actual proximity of an instructor have an effect?** We hypothesize that the presence of the instructor will in fact keep students engaged.

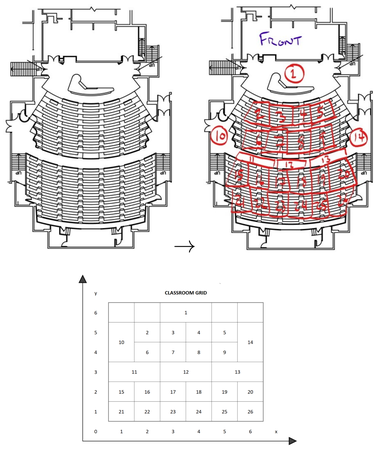

Figure: Classroom layout, showing the overall lecture hall layout (left), the map used by the observers (right), and the translation of that map to a usable grid (bottom). To simplify the system, arbitrary units of distance are used, with each grid location essentially being one unit wide.

Data Collection

Data were collected for classes that started at 8:00AM on Thursdays (∼70% attendance rate, 90 minute lecture), as well as 12:00PM on Fridays (∼80% attendance rate, 50 minute lecture). Data were collected over the span of 4 weeks, with a total of 8 classes being observed. This was done in a large scale first year physics course (Phys 100) at UBC, in a tiered seating lecture hall that incorporates active learning.

To collect data on the engagement of student groups, a modified BERI protocol was used[4]:

- Two observers monitor 10 students engagement each, one group in the back half, one group in the front half of class.
- Third observer monitors class activity and instructional team locations.
- Observations recorded every 2 minutes.

Analysis

We compiled all the data from every observation in order to search for correlations between the proximity of the instructional team to students and their engagement. We computed various statistical quantities:

- The overall engagement score (out of 10) is normalized by calculating an average score (and standard deviation) throughout a single lecture for a given observed group of 10, and then computing the z-score for each individual 2 minute snap shot of the students engagement.
- Pearson correlation coefficients, *r*, for all the correlations considered.
- Average engagement over the course of the class.
- Average engagement over the course of a sub-unit (worksheet, mini-lecture).

Important Result!

Maintaining activity and movement during the class, instead of staying stationary or in one sector of the room (possibly during lectures as well) is a simple task that a TA can adapt to help improve student engagement.

Effect of Instructional Team Proximity

Team Member	*All Data*	*All Groups*
Instructor	-0.057 ± 0.033	-0.118 ± 0.069
	-0.084 (0.081)	-0.154 (0.106)
Closest	-0.093 ± 0.049	-0.20 ± 0.10
	-0.091 (0.058)	-0.183 (0.045)

Team Member	*Front*	*Back*
Instructor	-0.33 ± 0.15	-0.106 ± 0.099
	$\mathbf{-0.287}$ **(0.030)**	-0.134 (0.333)
Closest	$\mathbf{-0.42 \pm 0.23}$	-0.22 ± 0.12
	-0.234 (0.081)	-0.221 (0.088)

Table: Top: **slope** between engagement and proximity of both the instructor and the closest instructional team member. The slope has units of z-score/grid spacing. Bottom: **Pearson correlation coefficient, *r* (p-value)**. Front groups seem to be more affected than groups in the back.

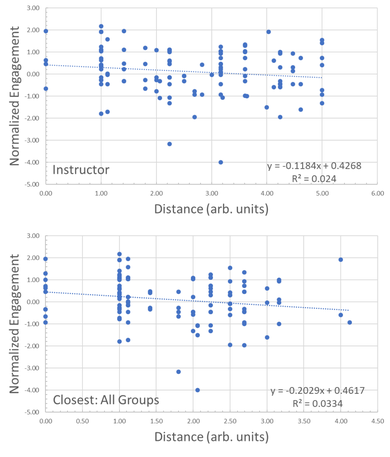

Figure: Student engagement against instructor (top) and closest instructional member (bottom). Included here is all the data points for when the instructor is not lecturing, including both front and back groups.

Bonus Results

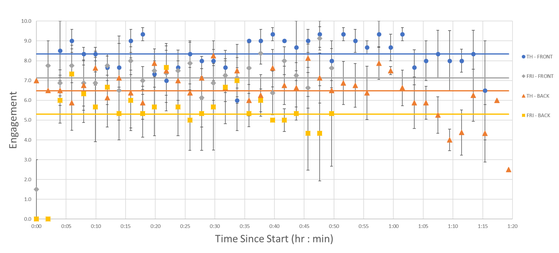

Figure: Student engagement across a lecture period. The horizontal bands indicate the average engagement for that particular group. Data is fairly well distributed randomly above and below the average, with a slight decrease in engagement in the longer lectures.

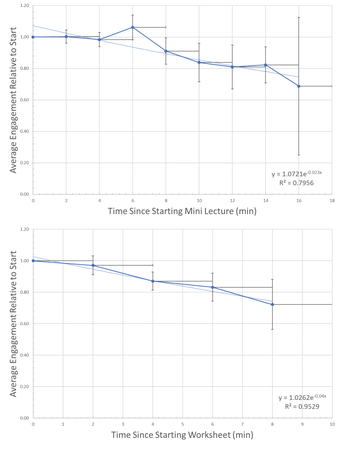

Figure: Student engagement across single mini lectures (top) or while working on worksheets (bottom). Attention does drop over each type of activity, but extended work would be required for concrete conclusions.

Conclusion

We have studied the relationship between student engagement and instructional team distance, and find that there is a small correlation between the two. **The strongest correlation corresponded to a Pearson score of *r*=-0.287, between the instructor and the front groups. The strongest effect measured is between the closest member of the instructional team and the front groups. These groups engagement-vs-distance plots have a slope of -0.42 ± 0.23, which corresponds roughly to an increase in 3.5 engagement z-scores as the instructional team member moves across the room.** These results confirm our expectation, but can help to inform the actions of TAs in future lecture courses.

There still remain unexplored questions about exactly how the relationship changes with distance: is there a drop-off after a certain distance away after which there is no effect? Would TA movement during lectures (of which there was very little) help improve engagement during this activity? Continued study could help to answer these questions.

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