Classroom Design & Student Learning in the Sciences

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Introduction:

The classroom is where students learn. Such a statement seems so obvious that it is not worth stating, but the significance of it cannot be underestimated. The location and setup of a learning environment can have a tremendous impact on how effectively students learn. The literature is rich in studies that attempt to find the best and most effective classroom formats. We sought to explore a selection of these studies in order to report on the difference between a variety of classroom environments, with an emphasis on how they effect students ability to engage with the instructor, learn the material and establish a collaborative environment.

Active Learning Environment:

On average, examination scores are seen to increase 6% in active learning classrooms compared to their traditional lecture counterparts. As a result students in traditional lecture style classrooms are seen to be 1.5 times more susceptible to failing the class. Active learning students have been found to grasp a more fundamental understanding of the material and are far better able to make connections between material.

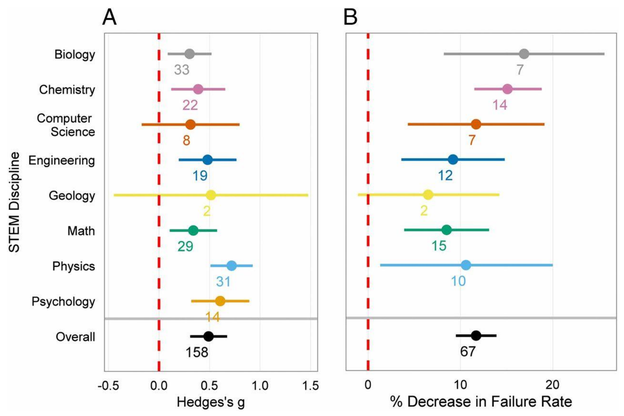

Figure 2. Effective sizes by discipline. (A) Data on examination scores, concept inventories, or other assessments. (B) Data on failure rates. Numbers below data points indicate the number of independent studies; horizontal lines are 95% confidence intervals[2]

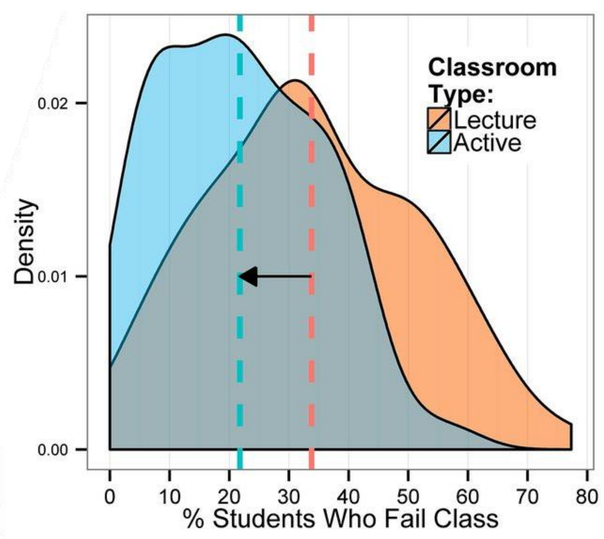

Figure 3. Kernel density plots of failure rates under active learning and under lecturing. The mean failure rates under each classroom type (21.8% and 33.8%) are shown by dashed vertical lines. [2]

Traditional Lecture Style:

Teaching styles have not been very flexible to accommodate every student's need as seen in history due to the space given for educational use. The most replicated format for students in larger courses follows the example of medieval university where desks were lined side by side in structural manner to face to teacher. This type of design follows the educational philosophy of essentialism where students are supposed to have knowledge "injected directly". Unfortunately, this setup does not support an active or engaging teaching method. Rather, this may seem like a step backwards from the ancient Greek system of having small open forums where students can directly employ conversation in parallel with the teacher's dialogue. Yet again, they were dependent on the space around, which could indirectly negate student engagement.

Landmark Studies:

The notion of a student driven course was pioneered by two landmark studies. The "inverted classroom model" - pioneered by Lange, Platt, and Treglia in 2000 in an introductory economics course taught at Miami University, created a classroom environment where the students first exposure to the material occurred outside the classroom in the form of a video lecture or an assigned reading and class time was dedicated to hands on work, asking questions, and working on practice problems together in student-driven groups. Lange, et al. concluded that this environment, where students could mediate their own learning, accommodated far more students than a traditional lecture model. The "peer instruction model" - pioneered by Mazur and Crouch in 2001 in an introductory physics course taught at Harvard University. The study followed students who took the course over a period of ten years taught in the peer instruction style. "Peer Instruction engages students during class through activities that require each student to apply the core concepts being presented, and then to explain those concepts to their fellow students." Mazur and Crouch concluded that the model more effectively caters to a wider range of students than traditional lectures. Notably, students who were taught with the Peer instruction model scored six percent better on a standardized exam as compared to students taught in a traditional lecture style. Students also reported enjoying class much more when taught with this classroom model.

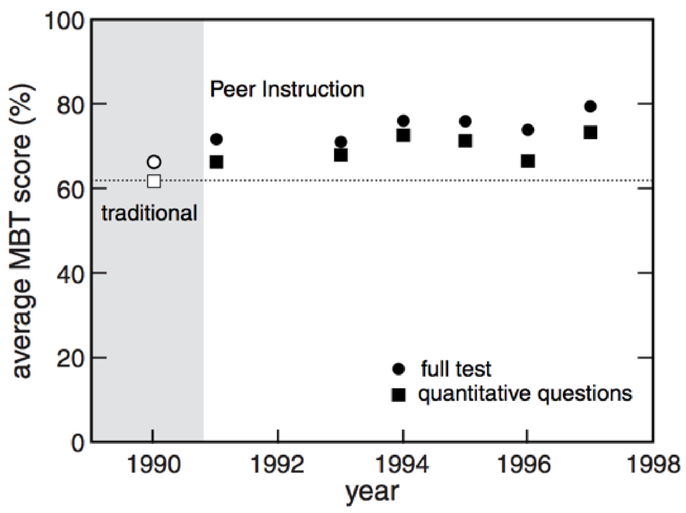

Figure 3. Plot shows consistent superiority of the peer instruction method.

Conclusion:

The classroom setup can be very influential in determining whether or not a majority of students grasp content material being taught. There has been an evolution within the teaching aspect about how a classroom setup can impact student's learning, starting from the ancient Greek's open forums to the inverted classroom and peer instruction models that are still being tested today. Though Mazur and Crouch both presented progressive models of learning, they both kept in mind that classes need to focus more on the productivity from learning; which is essential to help students understand, not memorize. Of course, no new model is going to fit every student's need; however, the more we understand the learning process it becomes more possible to maximize efficiency to translate knowledge from teacher to student.

References:

1. Park, Elisa L., and Bo Keum Choi. 2014. Transformation of classroom spaces: Traditional versus active learning classroom in colleges. Higher Education 68, (5): 749-771.Second reference in Calibri, 32 points, with a reverse indent: alphabetical or numerical order.

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3. Lage, Maureen J., Glenn J. Platt, and Michael Treglia. "Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment." The Journal of Economic Education 31.1 (2000): 30. Web.

4. Mazur, Eric, and Catherine Crouch. "Peer Instruction: Ten Years of Experience and Results." (2001): n. pag. Web.