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Promoting Collaboration Using Team Based Classroom Design

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Abstract

An important goal of learning space research is to investigate how an environment impacts instructor behavior and student collaboration. Team Based Classrooms (TBC) are learning spaces designed to promote active and team-based learning. We evaluated the extent to which TBC influenced modes of teaching and student engagement by comparing observed frequencies of activities in a TBC with those in a traditional classroom. Results indicated that the TBC had a higher frequency of student-led discussion and a lower frequency of instructor-led pedagogy and classroom discussion. This investigation suggests that TBC design positively impacts student collaboration.

Keywords

Team Based Classroom, Modes of Teaching, Student Engagement

1. Introduction

A key goal in learning space research is to investigate the extent to which the physical environment can affect classroom activities and pedagogy, especially practices that can foster active and collaborative learning. However, few studies provide strong evidence linking physical space and student engagement. A recent learning spaces report emphasized the need for evidence-based design to guide research on the effect of physical spaces on teaching and learning (Painter et al., 2013).

Recent research in educational theory has pointed to the importance of student engagement in learning (Bransford, Brown, & Cocking, 2000), and particularly to collaboration as an essential skill to succeed in the 21st century (National Education Association, 2010). Many studies have demonstrated the positive impact of collaboration on student learning outcomes. Gokhale (1995) found that students who studied collaboratively scored significantly higher on measures of critical thinking than students who studied individually. Terenzini, Cabrera, Colbeck, Parente, & Bjorklund (2001) compared students' cognitive and psychological changes in an

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intervention program that used active and collaborative approach to those in a traditional lecture approach. There were many self-reported course-related differences in learning outcomes with high effect sizes, such as overall design skills, problem-solving abilities, group management, and communication skills. A meta-analysis of 168 studies indicated that collaborative learning led to higher achievement levels than competitive or individual approaches (effect size = 0.49 and 0.53, respectively) (Johnson, Johnson, & Smith, 1998). This included measures of knowledge acquisition, retention, creativity, procedural skills, and higher-order thinking, as well as indicators of student motivation, perseverance, self-esteem, and meta-cognitive thought. These results held true across math, science, engineering, and verbal domains.

In this study, we investigated the impact of classroom layouts on modes of teaching and student engagement using evidence-based design. We compared the same course taught by the same instructor in two different classrooms: a traditional classroom and an innovative classroom. We hypothesized that the innovative learning environment, called Team Based Classroom (TBC), enabled active, team-based learning and fostered collaboration. The purpose of our research was two-fold: to show the impact of TBC design on student engagement and teaching methodology, and to provide a broadly applicable method of studying student engagement within the classroom.

2. Classroom Design

We compared two classrooms for this study, both of which had new furniture, technology, finishes, and whiteboards. The classroom layout of each respective classroom differs in important ways. The traditional class contains rows of movable tables and sled-based chairs facing the primary instructional wall (see **Figure 1** and **Figure 2**). Technology includes an integrated multi-media lectern with a resident computer, but no content sharing software or student laptops.

The innovative classroom has eight tables with six movable chairs (see **Figure 3** and **Figure 4**). Six of the

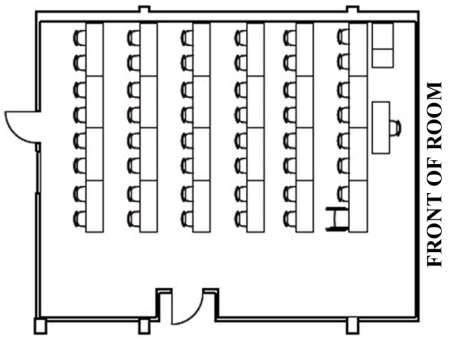

Figure 1. Traditional classroom layout.

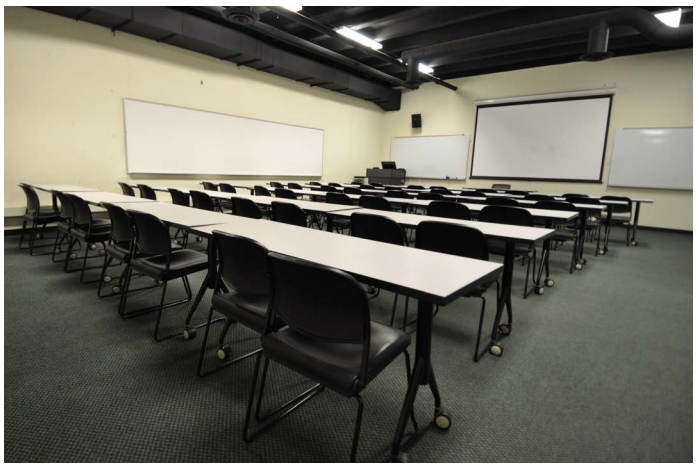

Figure 2. Photo of the traditional classroom.

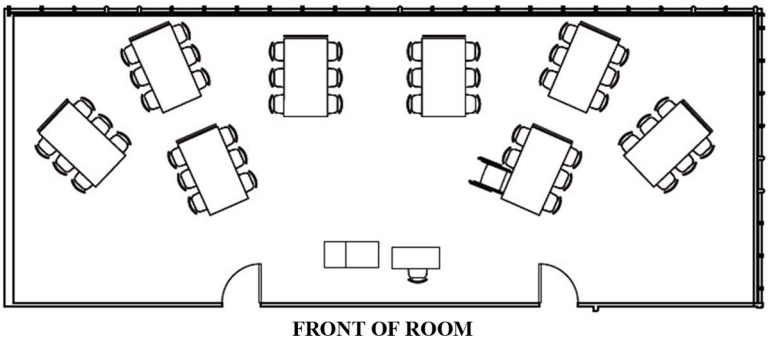

Figure 3. Team based classroom layout.

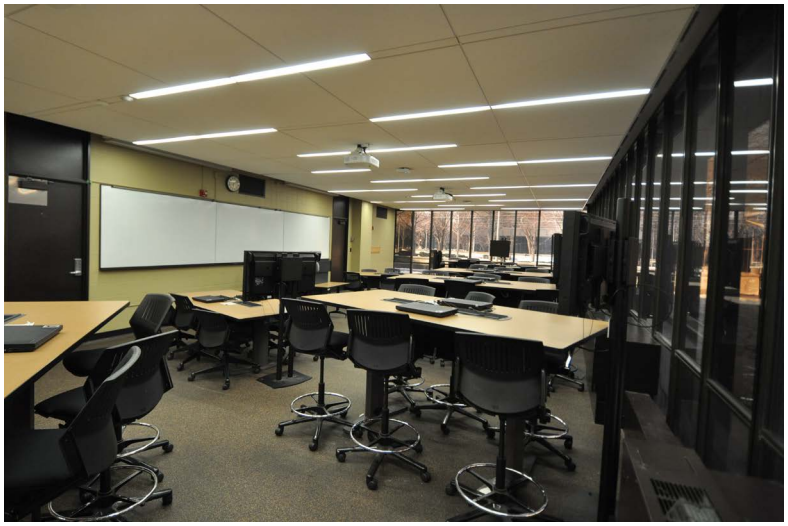

Figure 4. Photo of the team based classroom.

tables and associated chairs are at café height for sightline reasons and the remaining tables and chairs are at desk height. Each table is supplied with two laptops (one for each group of three students) and a monitor that displays images from the laptops. The room also features an integrated multi-media lectern with a resident computer that contains collaborative software. This software allows the instructor to share content from any laptop to the rest of the monitors and/or to two large centrally positioned projection screens.

3. Methods

To investigate the impact of classroom design on student engagement and interactions, we observed and coded student behavior of the same course in two different classrooms. We also interviewed the instructor at the end of the semester to understand his experience teaching in the two different classrooms.

Two researchers coded classroom activity in 3-minute intervals during the semester and compared the frequency of codes across classrooms. Our coding method was based on the Classroom Observation Protocol for Undergraduate STEM, a validated protocol in which observers code student behavior at regular intervals (Smith, Jones, Gilbert, & Wieman, 2013). There were five defined codes: Instructor-led, Class Discussion, Group Discussion, Exam, and Individual Work. Instructor-led classroom activities consisted of times the instructor was lecturing, announcing, or providing instructions. In Class Discussions, the instructor was engaging with all of the students in class. In Group Discussions, the students were interacting in groups of two to six. Exam was when students were taking tests individually. Individual Work was when students were working on an assignment individually. Two observers trained in this method coded the same two classes, for a total of 145 observations. Cohen's κ was run to determine rater reliability. Resulting codes had high interrater reliability, $\kappa = 0.959$, $p < 0.005$.

Data was collected during the fall semester of 2014. The same instructor taught Managerial Communication in both classrooms, a course about how to communicate in business effectively through writing, speaking, and team work. The instructor reported that identical lesson plans were used in each class. There were 29 students in each class. Students in both rooms had similar prior test scores and grades. Prior average American College Test (ACT) scores did not differ significantly, t (38) = 0.54, p = 0.53. The traditional classroom had an average ACT score of 22.96 (SD = 2.28), while the TBC had an average ACT score of 23.4 (SD = 2.77). Prior grade point average (GPA) also did not differ significantly, t (56) = 0.77, p = 0.44. The average GPA for the traditional classroom was 2.93 (SD = 0.61) and for the TBC the average was 2.89 (SD = 0.70).

We totaled code counts for the whole semester and compared observed counts to those expected if there were no difference in instructional modes across classrooms. We compared code counts for instructor-led modes of teaching to Class Discussion, Group Discussion, Exam, and Individual Work.

4. Results

Results indicated significant differences in the frequencies of codes for each classroom. **Table 1** presents the counts of codes over one semester. **Figure 5** is a mosaic plot showing a visual representation of differences of counts across classrooms.

The traditional classroom had 289 instances of instructor-led activity versus the TBC, which had 237 instances. Class Discussion has a greater count in the traditional classroom (78 versus 38 for TBC). Group Discussion, on the other hand, was less for the traditional classroom (209 versus 270 for TBC). We compared these frequencies and found that code counts differed significantly by classroom, χ^2 (1, N = 1288) = 27.40, p > 0.01.

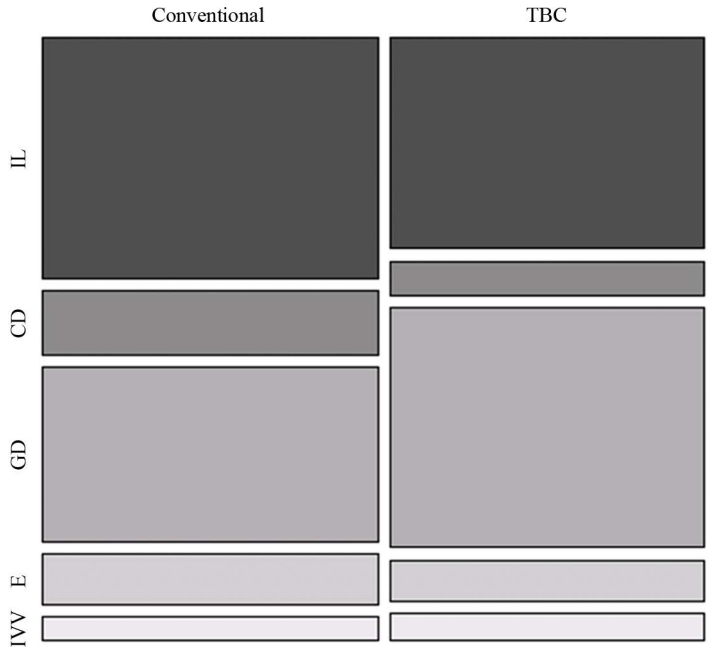

Figure 5. Mosaic plot of student engagement code frequencies by classroom.

Table 1. Counts for student engagement codes throughout the semester.

	Student engagement codes					
	IL	CD	GD	E	IW	Totals
Traditional	289	78	209	61	29	666
TBC	237	38	270	46	31	622
Totals	526	116	479	107	60	1288

a. IL = Instructor-Led; CD = Classroom Discussion; GD = Group Discussion; E = Exam; IW = Individual Work.

We interviewed the instructor after the semester was over to better understand the impact of the classroom designs on conscious decision-making for teaching. The instructor noted that the table setup of the TBC facilitated relationship building between students, which helped formulate community among them and stronger ties with the university. Cultivating such a student community within the classroom motivated students to do better academically and stay on task, which impacted learning outcomes. In traditional classrooms with front-facing desks, students often hesitate to ask questions because they do not want to appear unintelligent in front of their peers. With the tables and swivel chairs, students were able to turn to face each other and ask questions about content and in-class assignments. The TBC layout also resulted in ample room to move around the space. This allowed the instructor to approach each student group and help re-direct their focus when they got off topic.

In addition, the instructor noted that the TBC complemented the subject-matter. Using lectures solely to teach writing is difficult and often ineffective; the instructor prefers to take the role of a guide and let the students "get their hands dirty" with writing as much as possible. The height of the majority of tables and chairs in the TBC room were elevated so that the instructor would be on an equal level to the students when he was walking around the room and checking in with students. This not only made it easier for the instructor to look at the students' work and provide feedback, but it had a psychological impact as well: no longer was the teacher "looking down" at the student, but rather guiding them as a mentor.

Overall, the instructor preferred the TBC for teaching. Features of the room—the group seating, the swivel chairs, the elevated tables—made students more comfortable asking both the instructor and their peers questions. In this way, the room facilitated dialogue between students and made teaching more interactive. The TBC would "let the students do the talking".

After the semester ended we shared the results of the code distributions with the instructor, particularly that he spent significantly more time on group discussions and less time on lecture and classroom discussions in the TBC compared to the traditional classroom. These results did not surprise the instructor. Accordingly, the TBC facilitated group discussions since the class was already broken up into groups. Even though the instructor had planned the same lessons in both classes, ultimately the room design had an impact on student behavior and classroom activities.

5. Discussion

These results support the original hypothesis that classroom design impacts modes of teaching and student engagement. In this study, the TBC had significantly more instances of collaboration between students than in the traditional classroom. This held true even though the instructor, course, and lesson plans were the same for both classes. Having students sit at tables in groups facing one another helped facilitate group discussion. One student interviewed from an earlier study of a TBC noted the following:

> "[*When the professor*] *would say something and we wouldn't understand and the group would help each other… If we needed help then we would just ask across the table, 'Do you understand this or not?' and other people would get involved. But, it's not like something he said, 'Oh, ask your group mates how to answer this problem.' It was just more on our own.*"

In other words, the design of the space organically led students to interact more with each other, even unprompted by the instructor. Conversely, in the traditional classroom, students appeared to spend less time interacting with fellow students when they were all facing one direction and were forced to either move furniture or lean over their desks to communicate with one another.

The traditional class had a higher frequency of instructor-led codes overall. It may be that the professor felt more comfortable lecturing since there was a clear demarcation between the instructor and student zones, all the seats were facing one direction, and there was not enough room between rows of desks to approach each student. However, one form of active student engagement was more prevalent in the traditional classroom: classroom discussion. In this case, students did not need to move in order to discuss with the instructor. Moreover, the instructor often led the classroom discussions; he dictated the topic of discussion, chose which student would speak next, and responded to student comments. The rows of tables and chairs facing the podium may be more conducive to classroom discussions.

Although these findings have implications for classroom design, there were a few limitations to the study. First, the instructor was not familiar with all the technological capabilities of the TBC and therefore did not take

advantage of the screen sharing capabilities the classroom had to offer. It would be beneficial to do another study where the teacher was more familiar with the classroom affordances so the collaborative technology could be better used to complement the curriculum.

Second, the sample size for the study was small; differences in code frequencies could be due to idiosyncrasies of the professor, course, or students within the class. Although we investigated the impact of classroom layout/design on overall course grades, the number of students was too small to achieve statistical significance. In order to understand the extent to which these results are replicable in other classrooms, we would need to extend the study to include other factors such as professor and course on student engagement. It would also be worthwhile to investigate how different professors use the TBC, and in turn how these differences impact student engagement. Nonetheless, this study holds promise for further research about the direct impact of learning space design on student engagement and instruction, as well as provides a method for investigating the relationship between physical spaces and learning.

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