Psychology of Learning Spaces: Impact on Teaching and Learning

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New research is emerging that focuses on the role the physical classroom space plays in the teaching-learning dynamic. The purpose of this exploratory research is to describe the students' and instructors' perspectives of how the classroom space and environment impact teaching and learning. Focus groups were utilized with data points coming from the transcribed interactions of the participants. There were four focus groups: two groups of college students (N=15), and two groups of college faculty (N=9). Results yielded three main themes: 1) the **Conditions** theme, which represented all the issues in the rooms such as space, temperature, and light, 2) the **Outcomes** theme, which entails all the consequences of the rooms, such as concentration, engagement, and student grades, and 3) the **Values** theme, which exemplifies the extent classrooms impact teaching and learning. Themes were also analyzed looking at differences between students and faculty. Conclusions center on how space and environmental conditions impact the teaching-learning process and how this concept should be studied within the context of the science of teaching and learning.

Introduction

From strategies for increasing enrollment to approaches for improving student success and increasing college graduation rates, there has been a dramatic change in recent years in the focus of higher education. Policy makers and politicians from over thirty states are either in discussions about, or are in the process of moving from, funding models based on enrollment to performance-based funding models (National Conference of State Legislatures, 2013). National initiatives, such as Completion by Design (Completion by Design, 2011), funded by the Bill & Melinda Gates Foundation, and Achieving the Dream (Achieving the Dream, 2012), funded by the Lumina Foundation, have developed best practices for institutions of higher education for improving the completion rates of students. This change in philosophy has prompted researchers of teaching and learning to examine the factors that characterize ideal educational experiences.

The approach to studying successful teaching and learning has centered on three general areas: characteristics of the student, characteristics of the faculty, and how content is delivered (Gurung, Daniel & Landrum, 2012). The student qualities related to success include certain demographic variables (i.e., gender, age, parents' educational level, rural/urban background, etc.), metacognitive strategies, motivation, self-efficacy, confidence, stress and emotional states (Chemers, Hu, & Garcia, 2001; Gurung, Daniel & Landrum, 2012; Kim, Newton, Downey & Benton, 2010; Nasir, 2012; Pritchard & Wilson, 2003; Robbins, et al., 2004;

Zajacova, Lynch & Espenshade, 2005). Faculty characteristics include being an effective communicator, having a passion for the subject matter, possessing good organizational skills, and methods for engaging with students (Ginsberg, 2007; Gurung, Daniel & Landrum, 2012). Finally, issues related to delivery method and student success might include textbook quality, distance learning modalities, lecture clarity, and active learning strategies (Gurung, Daniel & Landrum, 2012).

This research has been limited because of the difficulty in accounting for all the possible variables related to student success. Furthermore, defining and testing student success is complicated because of the primary and secondary factors related to the outcomes. For example, student engagement, which is the amount of time and energy students expend on their studies (Miller et al., 2011), has been linked to cognitive skills, college adjustment, and personal growth, all of which contribute to student success (Miller & Butler, 2011). Another possible variable influencing student success is the physical or virtual space the teaching and learning take place in and the environmental conditions within these spaces (Graetz, 2006).

Recently, higher education institutions have been challenged to rethink the formal and informal spaces where learning takes place (Long & Ehrmann, 2005; Oblinger, 2006). Traditional classrooms, characterized by sterile rows of desks with a single point of instruction, are being replaced with technology-infused classrooms with multiple points of instruction and flexible chairs, pod-style student seating, and moveable furniture that allows for a variety of configurations (Oblinger, 2006). These changes parallel the paradigm shift in education from lecture-based instruction

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to collaborative and active learning types of educational experiences (How People Learn, 2003).

Research on how classroom space and physical environment might impact teaching and learning is still relatively new. Davies, et. al., (2013) conducted a meta-analytic review of educational projects involving school-aged (K-12) children and found that physical environment contributed to pupils' creativity and communication between students and teachers. Neill and Etheridge (2008) as well as Wilson and Randall (2012) performed small scale studies at the college level, redesigning classrooms into pod-style seating (tables with six chairs facing each other), to test how teaching and learning differed from traditional setups. These studies demonstrated that both students and faculty felt the redesigned rooms enhanced interactivity between students and with faculty, which contributed to effective group work and improved learning.

Another set of studies and projects utilized pedagogy as a theoretical blueprint for designing classrooms (Brooks, 2012). Drawing on the best practice research for instructional methods, such as collaborative, problem-based, and team-based learning strategies, rooms were designed with enhanced technology, multiple display screens, flexible tables and chairs, with the absence of a "front of the room" instructor area. Massachusetts Institute of Technology's Technology Enabled Active Learning (TEAL) rooms (Dori, et al., 2003), North Carolina State University's Student-Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) rooms (Beichner et al., 2007), the University of Iowa's Transform, Interact, Learn, Engage (TILE) rooms (Van Horne, Murniati, Gaffney & Jesse, 2012), and the University of Minnesota's Active Learning Classrooms (ALC) (Brooks, 2010) were all designed specifically for the types of instructional methods faculty intended to use in their courses. Studies of these spaces have shown increased opportunities for interaction with other students, more classroom discussions, more student-faculty private consultations, and better grades and test scores, compared to comparable classes held in traditional classrooms (Beichner et al., 2007; Brooks, 2010; Brooks, 2012; Dori, et al., 2003; Van Horne, et al., 2012; Walker, Brooks, & Baepler, 2011; Whiteside, Brooks, & Walker, 2010).

These projects focused on the teaching and learning that took place in the physical classroom space; however, the environmental conditions within these spaces such as temperature, color of the walls and floor, lighting, air quality and acoustics also can impact student learning. Barrett, Zhang, Moffat and Kobbacy (2013) examined the learning improvement of 751 school-aged children (elementary and middle school) in 34 classrooms, across seven schools, to see if environmental conditions impact learning. Controlling for all other factors, they found that conditions such as light,

sound, temperature, air quality and flexibility of the furniture accounted for 25% (either positive or negative) of the students' performance. Since this study focused on school-aged children, who typically have shorter attention spans, it is unclear how these conditions would impact college students.

The purpose of the current study was to explore the students' and instructors' perspective concerning how classroom space and environmental conditions impact teaching and learning. Although previous research has pointed to space and conditions possibly impacting learning, they have been limited in describing the students' and faculty members' viewpoints, attitudes, and experiences with specific learning spaces. A qualitative approach was utilized because of the exploratory nature of the topic and because of the number of primary and secondary factors contributing to the overall experience of learning and teaching in the space. Theoretically, the information from this study can provide researchers yet another area of study in the science of teaching and learning.

Methods

This study employed the focus group method to discover views, attitudes and experiences of positive and negative learning and teaching experiences from students and faculty in regard to the classrooms and the conditions contained within the rooms (Morgan, 1997; Stewart, Shamdasani & Rook, 2006). The focus group approach was used because it allowed both students and professors to expand on their experiences of learning and teaching in various classrooms. It also allowed for reaction to, and expansion upon, comments made by other participants (Krueger & Casey, 2009). This method also allowed the researcher to follow up and clarify the information from the participants to gain a deeper understanding of their experiences (Morgan, 1997; Stewart, Shamdasani & Rook, 2006).

Participants

Four focus groups were conducted, two with students and two with faculty. Both students and faculty were chosen to provide a complete picture of the learning and teaching that takes place within the classroom. Participants were all from the same medium-sized, Midwest community college that has a history of experimenting with innovative learning spaces similar to the TEAL, SCALE-UP, TILE, and ALC rooms described in the introduction. Furthermore, this community college opened a new building with state-of-the-art learning studio classrooms (Lopez & Gee, 2006) which are characterized by flexible configurations for interactive

work between students. The participants in the focus groups had experience as students and teachers in both the learning studio classrooms and traditional-style rooms. This sampling and recruitment method ensured that participants had sufficient experience with the phenomenon being studied (Kuzel, 1992). The fifteen students (8 females and 7 males) had an average age of 30 and represented a wide range of educational backgrounds. The nine faculty (6 females and 3 males; 6 full-time and 3 adjuncts) had an average teaching experience of 13 years and represented disciplines including political science, math, psychology, history, sociology, and English. Participants were treated in accordance with the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 1992).

Procedures and Data Analysis

The focus groups were conducted in the same classroom. Participants were given introductory information about the focus of the study, and demographic information was collected before the groups started. The focus groups lasted approximately one hour and began with the same general instruction: to "describe the optimal and negative learning spaces on campus". The moderators asked some probing questions (i.e., "Can you explain that in more detail?"), and follow up questions (i.e., "Can you provide an example of the experience?"), but relied on the interactions between participants to build rich descriptions of the learning and teaching experiences. The focus groups were audio-taped and the conversations were transcribed verbatim, resulting in twenty-one single spaced pages. The transcripts were inductively analyzed using the procedures spelled out by Tesch (1990) and Creswell (1994); the authors have previously used these procedures in focus group research (Author, 2001).

The eight-step analysis involved breaking the transcripts up by noting transitions in topics, labeling the topics, organizing the topics, and gathering similar topics into themes for discussion. This process was performed independently by the two researchers; differences were discussed until a consensus was reached. Based on this independent process, very few changes were made to the actual topics or themes. Additionally, the nature of focus groups allowed for the moderators to verify and clarify information from participants so as to not influence the results being generated. Although the purpose of this research was not to analyze differences between students and faculty responses, the results will note when differences occurred in the respective viewpoints for the various themes and subthemes.

Results/Discussions

After transcribing and analyzing the information from all four groups, three themes surfaced: **conditions**, **outcomes**, and **values**. Differences between students and faculty, where they were present, will also be noted. The **conditions** theme represented all the classroom and environmental issues. (See table 1). The students and faculty described their optimal and negative learning and teaching spaces on campus, and the **conditions** theme contained the elements that either enhanced or detracted from the learning and teaching.

Table 1. Issues theme

Conditions	**Space**	Work space
		Actual space in the room
	Light	Artificial room light
		Natural light
	Temperature	
	Acoustics	
	Clutter	On the walls
		In the room
	Furniture	Desk/chairs
		Board Space
		Flexibility
	Technology	Display screens

The condition that was mentioned by all the students, and many of the faculty, dealt with both the working space, on a desk or table, and the actual room configuration space. Students emphasized optimal work-top space to take notes and follow along in the book, whereas faculty focused on actual classroom space. Students said rooms that provide space to spread out and take notes worked best for learning; conversely, traditional rooms with rows of "small work area" desks contributed to poor learning outcomes. Some students and faculty said that everyone gets a "claustrophobic" feeling when too many desks and/or students are forced into a small ("cramped") space. Some of the quotes that exemplify this part of the theme include:

- "It's bad enough they have these little desks in the PS building, but then they try to cram as many students as possible into one room, and it is not supportive to learning" {Student}.
- "We liked that we weren't shoved in rows like a normal classroom. The professor had enough space to move around the room" {Student}.

- "The desks take up so much room that there is no space down any of the aisles. The students would be in trouble if there was ever a fire" {Faculty}.
- "In the learning studios, there is enough space to walk around and make sure the students are paying attention" {Faculty}.

A related issue is the amount of clutter within a room. Some of the students and faculty have classes in rooms that were used for history courses, with large stand-alone maps in the front of the room. Although they took up very little space, these maps give the appearance that the room was cluttered. The technology in the new rooms allow faculty to pull up maps from internet resources. Additionally, some students did not like the fact that some classrooms have several advertisement posters displayed in the back of rooms.

Other issues mentioned by students included temperature, acoustics, and lighting. Some of the participants said they have had classes in rooms where they have become physically ill from the heat. This may be because older rooms on campus have poor temperature controls making conditions uncomfortable for learning. The new buildings on campus have state-of-the-art climate control, eliminating this variable. Hearing soft-spoken faculty members can be a challenge for students, and spacious rooms can impair learning. Finally, the artificial light in the classroom and the natural light coming in from a window, or a skylight, can impact learning. Students have different preferences about the amount of light within the room. Several students said that a dark room naturally encourages them to fall asleep, thus impacting his/her learning.

A number of student and faculty participants discussed the importance of technology in the classroom; however, the experiences were distinctive between students and faculty. Students felt that some subjects were more appropriate to be taught with technology and for those subjects, the faculty should try to incorporate it into their teaching. Furthermore, students believed that faculty should be fully trained in how to use the technology. For example, one student said, "the professors not knowing how to use the technology or not using it in a meaningful way, doesn't leave a good impression for students". Another student gave the example of a classroom where a faculty member uses a SMART board with an overhead projector. Students also said the new classrooms with multiple screens improved the learning experience. The faculty members, on the other hand, spoke of the need to have updated technology in the classrooms to assist in delivering the materials. This was problematic for adjunct professors who generally use a wide range of rooms on campus. These faculty members said it was discouraging

to structure a class around one type of classroom only to be moved to a less desirable room the following semester.

Finally, several participants mentioned how the furniture can impact the classroom experience. The rooms that have chairs and tables with wheels for multiple configurations were preferred by both students and faculty. Faculty enjoyed rooms with flexible furniture so that they could quickly transition between lecture and group work. For example, one faculty member states, "the rooms with rows of desks are not conducive to group work such as group activities, group discussions, and even debates or role plays, anything at all that might engage students in active learning. However, the learning studio classrooms with moveable tables and chairs are perfect for these types of activities".

The second theme of **outcomes** represents the consequences that come from the issues encountered in the classroom and the environment (See table 2). For the students, the biggest consequence from positive or negative learning spaces was the ability to concentrate on what was being taught. Rooms with large numbers of negative environmental conditions served as distractions from learning. For example, student participants commented, "You have to be comfortable when you're learning. If you're not then it's going to distract you and you're not going to be able to pay attention" and "It's either too cold or too hot. I don't understand how an institution could be around for so long and not get the temperature right, because it detracts us from learning".

Table 2. Outcomes theme

Outcomes	Concentration	Distractions
		Ability to focus
	Engagement	Between students
		Between faculty and students
	Attendance	
	Grades	
	Learning approaches	Lecture
		Collaborative learning
		Activity-based learning

Optimal learning conditions research points toward students remaining fully absorbed in the material and to avoiding distractions to achieve deeper level understanding (Corno, 2001; Wei, Wang & Klausner, 2012; Zimmerman, 2001). Although most students are able to ignore the negative conditions in the classroom, there are some types of students for whom this could become problematic, such as

nontraditional students, underprepared students, and students with learning disabilities. Several faculty members brought up this point in the focus groups, illustrated by the following quotes:

- "If I have a student who is not prepared for college and we now place them in a room with no space and is too hot, then we really decrease the likelihood that they will be successful".
- "I see some older students who are not dumb, but have not been to school in a number of years, and we put them in some of the bad conditions in the classrooms and it lowers their motivation".
- "For a kid who has ADD too many distractions in the room could really cause them to fail in our classes. If they are dealing with noise and the room temperature, it is difficult to pay attention"

There were two related outcomes from the focus groups. First, theme of engagement, both between students and other students, and between students and faculty, showed up in each focus group. Second, the different teaching/learning approaches utilized based on the configurations and physical space within the classrooms. Every student and faculty member commented on how the setup of the classrooms impacted the amount of interaction that took place between students and with their professors. The communication channel in traditional rooms tends to flow in one direction, from the teacher to students, with students saying they felt "alienated" and "excluded" and faculty saying the students seemed "disengaged". Conversely, the learning studio classrooms open the communication flow. These learning studio classrooms also allow faculty to structure their class time differently. Both students and faculty said that class time was spent on more activity-based curriculum (or projects) and collaboration when in rooms that foster this method. Some of the testimonials for this outcome include:

- "The environment contributes to the type of teaching we see our faculty doing. If we have rooms that foster more interaction, you might find some faculty who will start doing more group work because the classroom setting makes it easier to do so" {Faculty}.
- "I like the concept of a learning studio classroom. It eliminates the front and back of the room concept. It allows the professor to walk around and talk WITH us and the students to work together" {Student}.
- "The learning studio classroom lends itself to more activities and interaction both between students and faculty, and between students and students" {Faculty}.
- "We liked the lack of lecture because it kept us more involved and we could not daydream as much" {Student}.

All of the faculty and three of the students felt that rooms and conditions can impact attendance and grades. It makes sense that more faculty mentioned this because they have increased points of comparison within and between semesters. Students may not have the cognitive awareness of differences between classes and why those differences exist, but faculty utilize this as a point of informal evaluation of their teaching methods. As one faculty member remarked, "I think my students did better in the learning studio; they were comfortable and wanted to learn. The worse the environmental conditions in the classroom become, the bigger these issues become within the student success context". Another faculty member stated, "When I taught in the learning studio, the attendance was phenomenal and they had the best overall scores on tests—I only had two people withdraw from the entire semester".

The final theme that emerged from the transcripts was the **values** that the students and faculty felt the learning spaces and room conditions contributed to the learning experience (See table 3). All participants thought the rooms and conditions were important in the teaching-learning dynamic; however, the students felt that these play a much greater role than the faculty did. Some students said the room impact can be as much as 75-80%. As one student said, "for me the learning space makes a difference because you can be a great teacher, but if I'm uncomfortable, then how am I going to learn". Another student said, "the environment would not make me think that a great teacher was bad, nor would it make me think a bad teacher is good, but I feel like my learning experience can go from good to great just by the positive conditions in the room". The faculty felt that while the room space and conditions had an impact, it was not as great an impact as the type of faculty member a professor is and the types of students in the class. A history professor mentioned, "The two big factors are me and the individual students, but the room can have some impact. I think it is part of the whole, but most of the whole is the student and the faculty member".

Table 3. Values theme

| Values | Perception of importance | Student perspective |
| | | Faculty perspective |

The results demonstrate, from the perception of both students and faculty, that classrooms and the conditions within the rooms can have an impact on teaching and learning. These results are consistent with past research, which shows that the physical layout of classrooms can influence student success (Beichner et al., 2007; Brooks, 2010; Brooks, 2012; Dori, et al., 2003; Van Horne, et al., 2012;

Walker, Brooks, & Baepler, 2011; Whiteside, Brooks, & Walker, 2010). However, this study extends to room conditions such as temperature, light, and sound which are not typically mentioned in learning space research. The environmental conditions and space, where teaching and learning take place, should be considered as yet another variable in educational research into factors related to how well students perform.

Furthermore, the results also show that the room, including the conditions in the room, can dictate, to an extent, the types of teaching modalities employed. For example, learning studio classrooms typically have tables with chairs arranged to face each other (Lopez & Gee, 2006). This configuration would probably hinder a class that was primarily lecture-based because the natural tendency, when sitting in a circle facing each other, would be to talk and tune out a speaker from another part of the room. Learning studio classrooms would be better for faculty who employ a great deal of group work, and/or operate from a flipped class model (Granito, 2013). Administrators may need to assess room assignments for faculty to better match the subject matter and teaching style with the learning space.

The results also showed differences between student and faculty attitudes toward the classrooms. Faculty, while acknowledging the importance a room can play in the learning process, also believed that the faculty member and student play a major part in the student learning. Students listed several factors within rooms that impact their ability to concentrate and felt that the rooms are a key element in learning. Students and faculty sometimes have different viewpoints concerning student success (i.e., Wyatt, Saunders, & Zelmer, 2005) which may contribute to disconnection between students and professors. It may simply be an issue that most faculty do not think about because their focus is on delivering the course content, while students tend to focus on conditions in the room.

Caution should be taken when interpreting these results. The themes and observations come from a small sample, which might limit the overall experiences of college students and professors. There was no control for the types of students and faculty who made up the focus groups. It is possible that students from other schools with different backgrounds might have different positions on how space influences teaching and learning. Moreover, faculty with greater years of teaching experience and diverse teaching styles might feel differently about learning spaces and room configurations. Faculty and students who utilize space in evening sections of a course might also feel differently about the educational spaces. For example, it is possible that older students going at night would prefer a more traditional space with a more traditional teaching format. Future research should examine the differences between space use,

and day vs. night classes. This sample also came from a distinct context in that both students and faculty had experiences with learning studio classrooms as learning spaces are a main focus on this campus.

Regardless of these limitations, the exploratory nature of this project points toward further research that should be more empirical and should control for confounding variables -such as student, faculty and delivery characteristics - so that only the space and environmental conditions influencing teaching and learning are tested. These future research projects should endeavor to connect the best practices of teaching to the development of learning spaces that foster these methodologies. If the study of learning spaces continues to point toward a connection between classrooms and learning, then schools should consider reevaluating their current classrooms and plan for the development of rooms that contribute to student success.

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