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Perceptions of Classrooms Physical Environments and Nature on College Students

Benjamin Williams

COLLEGE STUDENT PERCEPTIONS OF THE PHYSICAL ENVIRONMENT AND NATURE IN THE CLASSROOM

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Benjamin Bao Williams

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CERTIFICATE OF APPROVAL

MASTER'S THESIS

This is to certify that the Thesis of

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Dr. Drew Moser, Ph.D. 05/11/22
Thesis Supervisor

Dr. Kelly Yordy, Ph.D. 05/11/22
Member, Thesis Hearing Committee

Dr. Skip Trudeau, Ed.D. 05/11/22
Member, Thesis Hearing Committee

Dr. Skip Trudeau, Ed.D. 05/11/22
Director, M.A. in Higher Education and Student Development

Abstract

The purpose of this study is to discover how students are affected by the physical environment they learn in and if the restorative benefits of nature add to the positive experience of learning. The physical environment, or the classroom, can complement the learning experience alongside the curriculum that is being taught, but the problem is that the physical environment is often overlooked. The research asks how students perceive the physical environment of college classrooms, whether they see it affecting their classroom learning, and if they perceive nature to affect classroom learning. A convergent parallel mixed methods approach is used to answer this research question.

A 19-item survey was administered to university students to gain feedback from their experiences in two types of classrooms: (1) an atypical classroom and (2) a typical classroom setting. With 220 responses, the results indicated that students found the physical environment, and specifically how nature is incorporated, influences their learning experiences. Students had more positive learning experiences in the atypical classroom than the typical classroom due to the lighting, arrangement, openness, and overall inviting nature of the class. With this knowledge, higher educational professionals can begin to see the importance of how the physical environment can affect student learning, which would help inform the decision making process when constructing new learning spaces on campuses.

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P.S.: Cohort XIV, let's get tatted; SAC, I'd die for you; friends, see you at Jake and Emma's wedding; and family, thanks for the support both financial and emotional! Love you all!

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Chapter 1

Introduction

Conventional teaching spaces that highlight the role of the instructor are being replaced by spaces designed to afford students greater opportunity to positively engage in their education (Brown & Lippincott, 2003). Classroom design flaws resulting from misunderstanding of how the teaching space will be used is a continuing problem in post-secondary education (Brase, 1988). As university administrators, faculty, and professors consider the importance of students' learning and success, there needs to be attention given to classroom design and space.

Physical Environment and Space

The design of the physical space in an environment can provide benefits for the learner in terms of creativity, productivity, and comfort environments (Ado, 2015; Cheryan et al., 2014; Earthman, 2002; Hannah, 2013; Kuo et al., 2019; Maxwell, 2016; Stave, 2020; Suleman et al., 2014). The physical space of an environment includes the land, air, water, organic life, man-made buildings, and the natural infrastructure of an area. Students spend a significant amount of time in classrooms, yet students dread going to class. Students reported being bored and tired, experiencing feelings of anxiety and stress, not considering it a fun space, and more when asked to describe their environment (Perks et al., 2016). Classroom spaces should create comfortable, calm, productive, and inviting learning spaces. If the classroom is not set for a conducive learning environment, then it hinders the students to succeed to the best of their ability (Perks et al., 2016).

Educators and administrators need to be informed about the learning environments that complement student learning. The traditional university classroom, with its unidirectional design and tiered, fixed, theatre-like seating, is insufficient to accommodate what have increasingly become more varied teaching and learning practices (Perks et al., 2016).

A Look Into Nature

An interesting development in the social sciences is the idea of *biophilia*. Harvard biologist E. O. Wilson coined the term biophilia in 1984 to describe humans' innate connection to nature and theorized that access to nature could improve mental and physical health (Ulrich, 1993). Wilson understood the restorative benefits of spending time in nature. Applying Wilson's principle and theory to work and learning environments can be beneficial in a variety of ways for students. People are spending less time outdoors, and this decline of connectedness to nature has sadly been linked to a rise in many negative health problems for today's society including obesity, hypertension, diabetes, and emotional and mental health issues. (Claffey-Bow, 2017).

"Scientists are beginning to find evidence that being in nature has a profound impact on our brains and our behavior, helping us to reduce anxiety, brooding, and stress and increase our attention capacity, creativity, and ability to connect with other people" (Suttie, 2016). Nature can have restorative benefits and can create an atmosphere of calm and stress relief in the work environment and in learning when students are brought outside for class or are involved in nature conservation projects (Berry et al., 2014; Chow & Lau, 2015). Findings on how nature improves our brains bring added legitimacy to the

call for considering natural spaces. Few researchers have studied the implication of these ideas in a college academic setting.

The Gap

Some of the greatest assets of a college are its students (Birnbaum, 1991). Cultivating a purposeful learning environment for students is vital in supporting them well. The learning environment influences individuals' cognitive and emotional states, concentration, behavior, actions, and abilities (Falk, 2009; Fell, 2010). Can universities better create a setting that makes learning come alive, complements student–professor engagement, creates a warm and stress-reducing space, and potentially enhances student performance? Often administrators do not consider student experience when creating new classroom space, so this study helps to unpack student experiences on classroom design.

What can be learned about physical space and nature elements as pertains to their effect on the experiences of students in the classroom? What are students' perceptions of nature references, and how do they relate to classroom learning? Little research is out there, and so further research needs to be explored to better understand these questions.

Purpose and Benefits

Colleges and universities should strive to make the classroom environments as suitable as possible to promote positive and enhanced learning experiences for students. Challenging administration and classroom designers to rethink what a classroom might look like can help students succeed and learn in a way that is catered toward a new discovery on learning styles (Rands & Gansemer-Topf, 2017).

Great attention should be dedicated to this endeavor because higher education desires to inform and create the best educational practices to secure a student's success in

school. This research will help to inform practice in learning spaces for educators, professors, and higher educational professionals. There is a "growing realization that as the nature of teaching and learning evolves so too must teaching and learning spaces" (Perks et al., 2016). This research intends to investigate the link between student perception and the physical space in the classroom and thus leads to two guiding research questions:

1. How do students perceive the physical environment of college classrooms, and do they see it affecting their classroom learning?
2. Do students perceive nature to affect classroom learning?

Chapter 2

Literature Review

Higher education is a fundamental stage in developing students to be prepared for living and contributing to society. Developed countries, such as the United States and many in Europe, focus their attention on research to explore better solutions to the escalating and emerging problems that universities and students face. Administration and faculty should expand their view of holistic development of students and consider how changes to the campus environment might improve student learning and success. The influence of university architecture has been discussed for over 200 years and the specific study of campus ecology has been prevalent for decades, yet institutions still design buildings and campus landscape without student engagement or learning as a priority (Stave, 2020). What are the elements that go into effective and resourceful learning environments? How are students and teachers interacting in the learning environment, and how does it affect performance outcomes? These are the questions that lay the foundation for the literature review below.

The rest of the literature review will help to define physical space in the classroom to show how altering these spaces will lead to changes in the learning environment. Then going into the benefits of nature on learning will help develop an understanding of the purpose of the study. Classroom environment or the physical environment refers to physical characteristics of the room and will be used as interchangeable terms.

Physical Space and the Classroom

The purpose of a classroom is to promote learning and the flourishing of students. Two educational architects found a relationship between environment and design within the classroom from a theoretical perspective. They discovered that the physical environment of the classroom acts as "silent curriculum" (Taylor & Vlastos, 2009). This means that classroom environmental design can facilitate and improve the learning process like the overt curriculum.

Suleman et al. (2014) define the physical classroom environment as a "combination of different things i.e., lighting, temperature, ventilation system, size of the room, floor, walls, desks, chairs, rugs, whiteboards, [and] computers" (p. 72). Teachers and students are considered the main elements of the classroom environment (Suleman et al., 2014). Overall, the literature shows the classroom environment plays a crucial role in improving learning and keeping students engaged. This allows them to be successful within the classroom, which is a universal mission for educators (Ado, 2015; Cheryan et al., 2014; Earthman, 2002; Hannah, 2013; Kuo et al., 2019; Maxwell, 2016; Stave, 2020; Suleman et al., 2014).

Buildings

School facility conditions affect student academic achievement (Earthman, 2002). The overall impact of a school building on students can be either positive or negative, depending upon the condition of the building (Cheryan et al., 2014; Earthman, 2002). In cases where students attend school in substandard buildings, they are at a disadvantage in their academic achievement. Correlation studies show a strong, positive relationship between overall building conditions and student achievement (Cheryan et al., 2014;

Earthman, 2002; Suleman et al., 2014). Studies have repeatedly found a difference of between five and 17 percentile points between achievement of students in poor buildings and those students in standard buildings, when the socioeconomic status of students is controlled (Suleman et al., 2014).

In a study conducted in Nigeria, researchers asked why it is that some schools in Nigeria outperform others when they have the same government curriculum and syllabus (Ado, 2015). Ado (2015) dives into this question by looking at the influence of learning environments on students' academic achievement in mathematics at senior secondary school level. The researchers in this study arranged two classrooms. One was an experimental group—given a proper classroom arrangement, furniture, well painted walls, whiteboards, charts, models, overhead projector, proper lighting, ventilation, drinking water, a continuous power supply and reliable technology, and a large spacious room. The other was a control group, which was a classroom arrangement that is typical of the classrooms in the school district. It was less comfortable in that it had less than standard classroom amenities. It was concluded that a favorable classroom environment has a significant positive effect on the academic achievement scores of secondary school students.

The students of the experimental group showed better performance as compared to the students of the control group. Based on the findings, it was recommended that the classroom physical environment should be well-organized, equipped, and facilitated (Ado, 2015). Taken together, the research study cited above, along with the studies dealing with age of buildings, presents a formidable body of research that demonstrate

that the condition of the school building has a sizable and measurable influence upon the achievement of students.

The Environment and Learning

What is a learning environment? Ado (2015) says the learning environment refers to the "whole range of components and activities within which learning happens" (p. 40). Hence, the learning environment considers several variables that have direct and indirect effects on students. What then is an effective learning environment or effective education?

> Effective education depends on having a goal, the appropriateness of the physical and social environment of class, motivation of teachers and students for teaching and learning, the students' cognitive, emotional, and motor preparation, sound management of class by teachers, their mastery over the subject, and their passion for their work and the students' progress. (Gilavand, 2016, p. 360)

Gilavand (2016) writes that the classroom learning environment is important because it can dramatically affect the learning outcomes of students. Hannah (2013) says that educators should strive to make the classroom environments as suitable as can be to promote a positive learning environment if the school's role is to be "teaching the next generation how to be successful members of society" (p. 11). Hannah argues "one of the first areas that makes a notable impact on student success is the physical environment of a classroom," for example, how warm and inviting is your classroom and the setup of a classroom arrangement (p. 2). The second dynamic of a classroom that can be impactful to a student's learning is the nonphysical environment. This consists of things such as sounds, temperature, seating arrangement and others (Hannah, 2013). Scientific studies

revealed the physical classroom environment is important and affects students' academic performance. Review of the research will give clarity to the relationship between academic performance and classroom physical environments (Ado, 2015; Cheryan et al., 2014; Earthman, 2002; Hannah, 2013; Kuo et al., 2019; Maxwell, 2016; Stave, 2020; Suleman et al., 2014). Following will be an investigation into studies that show these physical environmental elements specifically affecting students' success, learning outcomes, and academic performance.

Cheryan et al. (2014) tested how "classroom physical environments" like noise, lighting, and symbolic "everyday objects" affect student achievement. They found that the optimal temperature range for learning appears to be between 68 and 74 degrees (Cheyan et al., 2014). Suleman supports Cheyan by proposing the reason for this optimal temperature is that if the heating and ventilation of the classroom is too hot, then people get fatigued and tired and make mistakes, but if it is too cold people do not concentrate (Suleman et al., 2014).

Lighting and how it influences the mood, perceived outcomes of learning, and comfort has been long studied as one of the most important elements that affect students and workers alike. Hannah (2013) states how light can play a major role in determining whether a student is engaged in the lesson. From his study, he and his colleagues found larger amounts of exposure to natural light increased test scores among students. In Latin America, source of power has been a presiding problem for many of the countries and its people. To address this problem, an initiative was created called Light for Learning. Interestingly, findings show countries that implemented the Lighting for Learning project in rural schools had their dropout rates decline considerably (Hanley et al., 2017).

Illumination has a strong effect on the learning environment because of its influence of comfort and focus on a particular space (Gilavand, 2016).

An intriguing study used eye-tracking techniques to explore the impact of visual displays on attention and learning for children, specifically those with autism. Hanley et al. (2017) noticed how attention in classrooms is a critical step in learning, yet students were having a hard time focusing. Visual displays in classrooms hold multiple purposes for learning, but some have argued that having visual displays harms learning by distracting students from the curriculum. Hanley et al. wanted to test this by exploring the impact of classroom visual displays on attention and learning in children with and without autism using eye-tracking techniques. They found that the presence of visuals had a significant impact on attention for all children, but even more so for children with autism. Additionally, children with the "high visual displays" in their lessons did worse on the learning worksheet than children with none at all. This study, conducted with both children with and without autism spectrum disorder, found that indeed high visual stimuli can affect learning in a negative way (Hanley et al., 2017). For Hanley and many others who study the correlation between visuals in classrooms, the targeted demographic is usually those in primary through secondary education. Little research has been conducted on these effects at the university level.

The classroom physical arrangement provides students with effective instruction and promotes a smooth teaching learning process. Proper arrangement makes for a more encouraging atmosphere for learning—like when furniture is placed so that students feel comfortable. If students are uncomfortable, they fail to get some information from teachers (Lyon, 2001). MacAulay (1990) and Walker et al. (1995) found that a well-

structured classroom can enhance students' academic and behavioral outcomes. Navarro Jover and Martínez Ramírez (2018) asked: What would it look like to arrange seats where all students felt closer to the lecturer, would this help with attention and performance? The found out that performance is not related to the average seating place occupied by students in the classroom and the degree of distraction depends on students, not where they sit.

A new facet of education on a steady rise is the architecture of educational spaces. According to educational experts the physical environment and space of classrooms such as light, color, temperature, layout, sound, and equipment, can impact student learners (Gautheron, 2014; Hannah, 2013; Holden & Mercer, 2014; Kuo et al., 2019; Stave, 2020). It is clearly articulated that the physical environment in the classroom plays a crucial role in keeping students attentive in the classroom. All these physical elements and their effects in a classroom matter not only in K–12 education but also in higher education. If the goal of higher education is to support and create scholars, then anything that helps improve student achievement should be considered. Identifying the means to improve students' learning outcomes remains the subject of continuous academic investigation and is the key objective of this literature review. Most universities have a baseline standard for classroom environment. How can these spaces be enhanced to increase learning outcomes and academic performance? Few researchers have studied the connection between nature and humans in an academic setting, pertaining to physical space.

Benefits of Nature

Nature and Humanity

The study investigates if students perceive nature to affect classroom learning. The intuition that "nature is good for people" is widely held. There is a lot of research that is supportive of this claim. The dictionary defines nature as the elements of the natural world, such as mountains, trees, animals, or rivers (Webster, 2021), but it can also refer to the out-of-doors. Nature can be a wild and natural setting or one that has been tamed, such as a park or a garden. Due to the rise of urban cities and civilization, people groups are starting to have less and less exposure to the outside world and nature at large. The decline of connectedness to nature has sadly been linked to a rise in many negative health problems for today's society including obesity, hypertension, diabetes, and emotional and mental health issues (Claffey-Bow, 2017). Harvard biologist E. O. Wilson understood the restorative benefits of spending time in nature, and applying this *biophilia* principle and theory to work and learning environments can be beneficial in a variety of ways for human connection, health, and performance (Kellert & Wilson, 1995; Ulrich, 1993).

A great organization or business is one which supports its assets well. A business's greatest asset is its employees. Thus, taking care of the workplace environment for employees is vitals in supporting them well. The workplace environment influences individuals' cognitive and emotional states, concentration, behavior, actions, and abilities. It plays an important role in the employees' engagement as well as in their performance (Falk, 2009; Fell, 2010). If performance and productivity are affected by the workplace, then how can architects and designers shape spaces to best suit an employee's

level of productivity and performance? Wood interiors have been shown to have a positive impact on residents, especially in relation to benefiting stress (Falk, 2009; Fell, 2010) and potentially restoring performance (Ulrich et al., 1991). In a study conducted in China, Shen and his colleges (2020) were intrigued by the relationship between nature and human productivity. In an experimental design they set up four rooms that had varying amounts of wooden elements embedded in the architecture of the walls to investigate the effect of wooden elements on the occupant preference and cognitive performance of 20 adults. The results support the biophilic hypothesis; incorporating wooden elements into interior design may improve both occupant satisfaction and cognitive performance (Shen et al., 2020). Noteworthy is the difference in attention between participants being in the different rooms. Participants gave significantly lower ratings in the concrete room than the room with 100% light brown wood walls (Shen et al., 2020). Although the work environment differs from the college environment, both productivity and performance are qualities that are desired outcomes. What would it look like to implement these concepts into the learning environment at schools?

Nature and Classroom Learning

In a book with detailed lesson plans, Sweeney (2013) discusses a holistic approach to reconnecting with nature. She encouraged patients in her psychiatric practice to immerse themselves in the natural environment as one would immerse oneself in a foreign culture (personal communication, December, 2014). She identified 54 “natural web-string senses and sensitivities.” These senses include radiation, mental, feeling, and chemical abilities of humans to connect with nature in ways that modern people have forgotten (Sweeney, 2013).

In the past decade school programs began to offer many choices including outdoor electives, class field trips to national parks, study programs in nature, clubs and conferences pertaining to a green environment, and increases in school ground greening. This is a result of the growing literature indicating the benefits on nature for student growth, performance, and development (Berry et al., 2014; Chow & Lau, 2015). While not designed for treating behavior issues, anecdotal evidence pointed to the fact that participants in these programs felt restorative effects from the incorporation of nature in their experiences in learning (Blair, 2009; Claffey-Bow, 2017; Kuo et al., 2019). Two recent and intriguing trends have arisen from these developments: gardening clubs at schools and school ground greening initiatives. Gardening clubs take place in many schools throughout the nation. Blair (2009) reviewed research in the U.S. on school gardening and its relationship to children's learning and behavior. Based on her review of the literature, Blair determined that, overall, current research indicates that gardening can have a positive impact on student achievement and behavior. A report by Dyment (2005) presents findings on the impacts of green school ground initiatives at 45 elementary, middle, and high schools in the Toronto District School Board. School ground greening initiatives are programs that help schools turn their campuses into areas of nature friendly learning, interaction, and discovery through innovative design and landscaping (Dyment, 2005). Dyment's findings showed engagement in learning increased on green school grounds as compared to teaching indoors, and 70% of respondents reported that their motivation for teaching increased on green school grounds. Additionally, this study demonstrates the benefits of school ground greening initiatives, and in other recent studies, students and teachers report strikingly high levels of student engagement and

motivation, during both student-elected and school-mandated nature initiative and activities (Blair, 2009; Lekies et al., 2015).

It should be noted that researchers have cited the viewing of nature as restorative, which allows for more attention functionality and is important for learning to take place (Duncan et al., 2007). Claffey-Bow (2017) further investigates the concepts of nature and attention. The researcher asked if a group of children diagnosed with ADD/ADHD would exhibit behavioral changes after a brief exposure to natural surroundings. Attention Fatigue is mental fatigue associated with directed attention, often accompanied by impulsive behavior, lack of focus, and inability to concentrate, is an aspect of the classroom (Kaplan, 1995). Those who more often struggle with attention fatigue, that is, students with ADD/ADHD, Claffey-Bow (2017) hypothesized, would benefit from exposure to the outdoors. The question was, if students with attention issues are given a brief (e.g., 20 minute) walk outside, might they be better able to focus in the classroom? Might they be better able to concentrate on lessons? Could this lead to better performance on later tests? This is exactly what was discovered. The dramatic changes in behavior among the study participants after the walks in nature were all positive. For a classroom teacher, the addition of short nature breaks, either in the form of walks outside or nature in the classroom, could aid in classroom management (Claffey-Bow, 2017). Although this study displays the benefits of being outdoors upon focus and attention in classrooms for younger students, the application would have to look different when applied to higher education. In a university setting classes have more variation and thus taking twenty minutes out of class to walk outside may be more distracting than beneficial to the learning environment.

Kuo et al. (2019) also researched nature and its effects on learning. They asked, does nature have effects on academic performance and learning for students? Their article is a review of what has been studied and what empirically driven studies say about the relationship of nature and learning pertaining to attentiveness, stress, discipline, motivation, and peace. Learning is likely to improve when a learner is more attentive, less stressed, more self-disciplined, more engaged and interested, and more physically active and fit. Evidence suggests that contact with nature contributes to each of these states or conditions in learners (Kuo et al., 2019). They review an article by Li and Sullivan which found that students randomly assigned to classrooms with views of greenery perform better on concentration tests than those assigned to purely "built" views or windowless classrooms. An experimental study showed that a window view of vegetation from a high school classroom yields systematic decreases in heart rate and self-reported less stress, whereas built views did not (Li & Sullivan, 2016). Another intriguing find is that learning in and around nature is associated with intrinsic motivation (Fägerstam & Blom, 2012). Ultimately nature may promote learning by improving learners' attention, self-discipline, interest, enjoyment in learning, physical activity and fitness, and lowering levels of stress. Nature also appears to provide a calmer, quieter, safer context for learning; a warmer, more cooperative context for learning; and a combination of "loose parts" and autonomy that fosters developmentally beneficial forms of play (Kuo et al., 2019).

Nature is a serious resource in supporting learning. The research cited helps deepen our understanding of the cause-and-effect relationship between nature and learning. Evidence strongly suggests that experiences of nature boost academic learning

and personal development (Kuo et al., 2019). Nature stimulates the brain, and the incorporation of nature, from an educational instruction point of view, can benefit students' academic achievement. But how would the presence of nature through classroom physical spaces affect college student academic performance? Little research has been conducted with this in mind.

Rethinking how students in higher education have traditionally been expected to learn and in what environments they learn in can help to create new initiatives for student learning as theories and ways of learning change for students. The literature review shines light on how physical environments can affect student learning, focus, comfort, academic performance, and more (Ado, 2015; Earthman, 2002; Hannah, 2013; Kuo et al., 2019; Maxwell, 2016; Shen, 2020; Stave, 2020; Suleman et al., 2014). What would it look like to implement these concepts into the learning environment at institutions of higher education? Few researchers have studied the implication of the connection between nature and humans in the physical environment of academic settings. The target of this study is gain understanding in how students perceive the physical environment of college classrooms, and if they see it affecting their classroom learning? It also helps to ask if students perceive nature to affect classroom learning.

Chapter 3

Methodology

The proposed study investigated the questions: How do students perceive the physical environment of college classrooms, and do they see it affecting their classroom learning? And do students perceive nature to affect classroom learning?

Design

In this study the researcher combined elements of quantitative and qualitative research through survey analysis methods to answer the primary research questions. The researcher used a convergent parallel mixed methods design. They collected quantitative and qualitative data at the same time and analyzed them separately. After both analyses were completed, they compared the results to draw overall conclusions based on the research question. Blending qualitative and quantitative data together with the study of college students' perceptions of classroom spaces shaped a deeper understanding of classroom physical spaces. Mixing methods allowed for richer detail and more credible results. The result of this type of research is a harmonious blend of qualitative data, user opinions, and organized quantitative data (Creswell & Guetterman, 2021).

A Likert scale was used to assess opinions, attitudes, or behaviors and represented the quantitative side of the mixed method. Likert scales allowed easy operationalization of personality traits or perceptions relating to the students' experiences in the classroom. The researcher created a Likert scale that is based on agreement statements that shined light on student perceptions. This scale was created by the researcher and can be seen in

the Appendix. Using a mix of both statements and questions keeps participants engaged and attentive during the survey. The researcher used Likert scale questions with a continuum of possible voting responses from (1) Strongly Agree, (2) Agree, (3) Neutral, (4) Disagree, to (5) Strongly Disagree. The Classroom Physical Environment Instrument is the name of the scale created, and it has 15 Likert scale questions and four open-ended questions. These questions were tested and reviewed by peers and colleagues in a test run and had been administered to a group to gain feedback for improvement. Once improvements were made, the researcher administered the survey to the classes and their students.

Open-ended questions are questions that do not provide participants with a predetermined set of answer choices; instead they allow the participants to provide responses in their own words. Qualitative, open-ended questions provided a holistic and comprehensive look at the issues of classroom physical space. Using open-ended responses permitted respondents to provide more options and opinions. This allowed for more diversity in the data (Creswell & Guetterman, 2021). The open-ended questions followed the quantitative Likert scale questions but were administered together with the quantitative questions at the same time. These questions were created by the researcher and asked students to elaborate on their experiences in their respective classrooms.

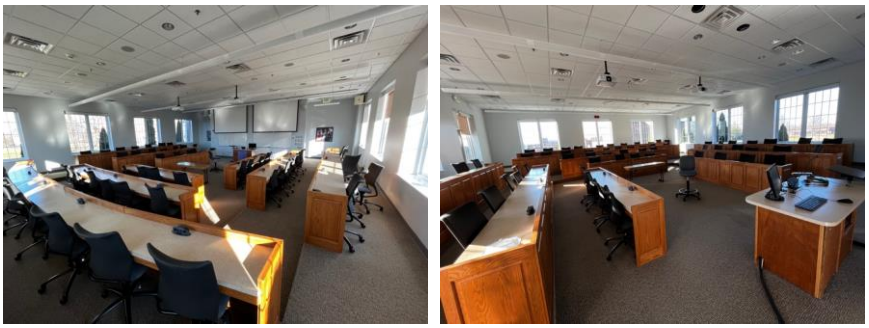
The convergent parallel mixed methods approach helped the researcher gain a more complete picture of student perspectives, more than a standalone quantitative or qualitative study would.

Context

The study was conducted at a university in a small town in rural Indiana. The small collegiate university has about 2,000 undergraduates and is a faith-based religious institution. The research worked with multiple classes that meet in two classroom locations on campus that demonstrate the operational definitions of a typical college classroom and an atypical experimental college classroom. Classroom A (see Figure 1), the atypical classroom, is an experimental classroom. This classroom is considered a state-of-the-art classroom, referred to as the "Courtroom," and is located on the main floor of the building with high, open ceilings. The design of this classroom was created with both students and professors in mind. It has two entrances. There are three raised sections of student seating. The professor is in the center, which allows for all students to engage. The classroom has floor to ceiling windows on two sides of the room.

Figure 1

Classroom A



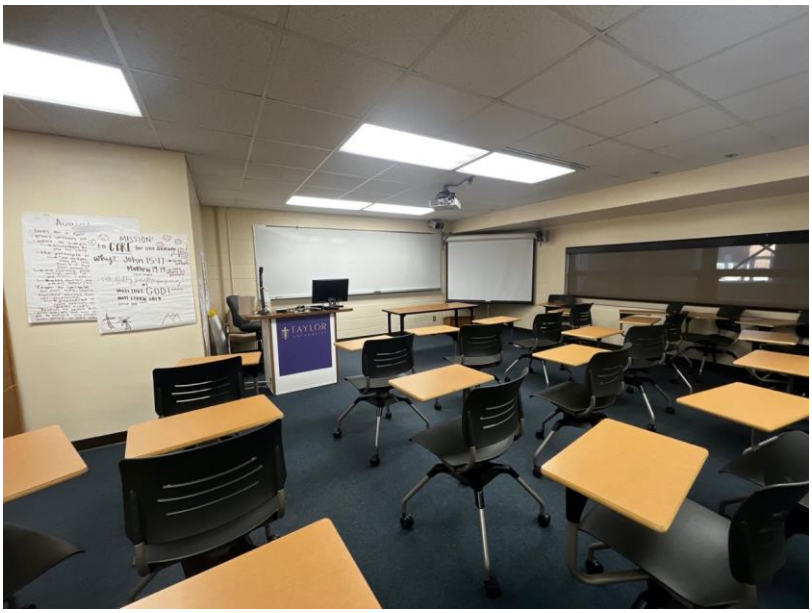
Classroom B (see Figure 2), the typical classroom, is set up where the professor is at the front of the class and students are at desks that are in rows facing the professor.

There are a few small high windows that allow minimal light. There is a whiteboard, projector screen, and blank walls. It has one entrance.

These two classrooms are vastly different and represent a typical classroom and a classroom that is more experimental in nature. Using classrooms A and B and assessing the students that experience learning in them helped shed light on the positive and negative benefits of different types of learning environments through the perceptions of students.

Figure 2

Classroom B



Participants

University students were used in this study to examine the perceptions of classroom physical environments on their classroom learning. Nine classes are held in

Classroom A; each class ranges anywhere from 15 students to 50. Seven classes are held in Classroom B; each class also ranges from 15 students to 50. Both classrooms held classes at various times throughout the week, and the type of classes were of different disciplinary backgrounds. The number of students who ended up participating in the survey was 220. Classroom A had 174 students and classroom B had 46 student participants. The student participants came from various majors, socioeconomic backgrounds, genders, races, grade point averages, and college range ages.

Procedure

The researcher worked with 16 professors and their classes to administer surveys that assessed the students' experiences in the physical environment. The survey created was given out to students at the end of their semester during the week before finals, in the fall of 2021.

The survey was administered through SurveyMonkey for efficiency and ease of data gathering. The researcher asked the professors to take 15 minutes at the beginning of their class time to administer the survey with a brief explanation beforehand. This explanation of the survey was written out prior to the day students took survey. The students who participated in the survey opened a SurveyMonkey link to a created survey form. This survey provided a small summary of the research and its purpose. Consent to the survey appeared in the form of a check box in the created survey (i.e., "By clicking this box, you are agreeing to move on, participate in the survey, and consent to being at least 18-years-old.")

The Classroom Physical Environment Instrument (see Appendix) consists of 15 items followed by four open-ended questions. Students were asked to respond to each

item using a five-point Likert scale indicating if the statements or the items represent their experience as, (1) “Strongly Disagree,” (2) “Disagree,” (3) “Neutral,” (4) “Agree,” or (5) “Strongly Agree.” The four open-ended questions provided students the space to think about their experiences and put them into their own words. Once the surveys were completed the data were compiled and analyzed and then interpreted into results.

Data Analysis

For quantitative analyses, both descriptive and inferential analyses were performed on the quantitative data. A t-test was used to compare means, and descriptive analyses were conducted. The study used measures of central tendency to estimate the mean, median, mode, and standard deviation of data sets to draw conclusions from the surveys. With tables and graphs, the researcher summarized the frequency of the value of a variable in numbers and percentages of classroom A and classroom B. Measures of variability gave a sense of how spread out the response values were from the survey. The study looked at the classes’ individual descriptive statistics as well as compared the means of the two classes. The researcher used an Independent Paired Sample T-test (with significance level of p-value < .05) to compare the means for significance. Effect size was also calculated. Hedges’ g is referenced for effect size. This means d = 0.2 is considered a ‘small’ effect size, 0.5 represents a ‘medium’ effect size and 0.8 a ‘large’ effect size. If the difference between the two classrooms’ means is less than 0.2 standard deviations, the difference is negligible, even if it is statistically significant. The researcher analyzed the data using SPSS, Excel, and SurveyMonkey to make conclusions from the data.

Coding and theming strategies were used to make conclusions on the open-ended questions in the survey. The researcher used the inductive coding method, also called open coding. This phenomenological method starts from scratch and creates codes based on the qualitative data itself. All codes arise directly from the survey responses to gain a deeper understanding of participants perceptions about their classroom physical environment.

Chapter 4

Results

The purpose of this convergent parallel mixed methods study was to investigate the impact of the physical environment on students' perceived classroom learning as well as see if students perceive nature elements to affect their learning. Out of 220 students who participated, there were 93 men, 126 women, and one other who were involved in this research study during December of 2021. This chapter reports the results obtained in the analysis of the survey.

Demographics

Of the 220 college age students at the small liberal arts college in the Midwest, 174 respondents were surveyed from classroom A and 46 respondents were surveyed from classroom B, producing a response rate of 100%. Over two-thirds of the sample was female, and there was only one student that identified as other gender. In classroom A, most participants were freshmen, because at the time, most classes held in classroom A were freshman level courses. Classroom B had significantly less students, having only 46 participants and representing less than a third of all the students who participated. The participants from classroom B represent a couple of different classes with different disciplines, such as a politics course and history course. A greater number of professors decided to participate in the research from classroom A than B, and for this reason there is a greater number of students from classroom A compared to classroom B. More

courses were assessed in classroom A than B so there were more students from class A. Table 1 contains a summary of the participant demographics.

Table 1

Participant Demographics

	Classroom A *N = 174*		Classroom B *N = 46*	
Demographic	Total	%	Total	%
Gender				
Female	97	55.8	29	63.0
Male	76	43.7	17	37.0
Other	1	0.6	0	0
Class				
Freshman	103	59.2	33	19.9
Sophomore	52	29.9	26	15.7
Junior	15	8.6	60	36.1
Senior	5	2.9	47	28.3

Quantitative Analysis

The researcher sought to investigate how the physical environment in college classrooms impact students' academic experiences in the classroom. They also wanted to see if students perceive nature to affect classroom learning. The three categories—awareness, learning, and nature—each had five questions that related to their respected themes. The results demonstrate the relationship between the perceptions from classroom A and classroom B. Depending on the survey question asked, the two classrooms had significantly different or similar perceptions and experiences based on their classroom environment. This was determined by running descriptive statistics, using an independent paired t-test (specifically Welch's t-test), and calculating an effect size. A *p*-value less than 0.05 (typically ≤ 0.05) is statistically significant. The researcher wanted to describe

the results in terms of measures of magnitude—not just does the physical environment affect students, but how much does it affect them? Effect size 0.2 is considered a 'small' effect size, 0.5 represents a 'medium' effect size, and 0.8 a 'large' effect size.

Differences of Groups

Students from classroom A and B had differing perspectives on the inviting atmosphere of their classroom, on the way their classroom supported their ability to learn, and on classroom conditions.

The very first question asked to students was, "The classroom space I am in is inviting." More students in classroom B reported disagreeing with this statement. There were 19 students (41%) who disagreed and 11 students (23%) who agreed. Students in classroom A found their classroom space to be very inviting. The survey indicated over 90% of students from classroom A chose to agree or strongly agree when asked if their classroom space is inviting. Only four people disagreed, and not one student strongly disagreed. There was a big difference between mean scores, classroom A (M = 4.3, SD = 0.7) and classroom B (M = 2.91, SD = 1.0), which led to a statistically significant difference of perceptions level ($p < .001$). These data show students from classroom A find their classroom space more inviting. A large effect size was found (d = (2.91 - 4.3)⁄ 0.863134 = 1.610411).

The survey also asked whether (Q.3) "the physical environment enforces my learning" and (Q.8) "the classroom physical environment helps me to learn well." These two questions both target student perceptions on how their classroom space may influence their learning. Classroom A, on Q.3, had 140 students (85%) who agreed or strongly agreed that learning was affected by their physical environment during the semester. Classroom B on Q.3 was more of a split opinion with half of the students

agreeing (17) and the other half disagreeing (16). There was a big difference between mean scores between Classroom A (M = 4.06, SD = .65) and Classroom B (M = 3.15, SD = 1.03), which led to a statistically significant difference of perceptions level ($p < .001$). A large effect size was found (d = (3.15 – 4.06)/0.86122 = 1.056641).

147 of students (84%) from classroom A on Q.8 agreed or strongly agreed that the classroom environment that they are learning in positively impacts their learning. No more than six students disagree with this statement and not one student put down that they strongly disagree with this statement. A significant number of students from classroom B checked “disagree” (43%) when asked Q.8, believing that classroom B was not helpful for learning. Classroom A (M = 4.09, SD = .73) and Classroom B (M = 2.9, SD = .91). There was a big difference between mean scores, which led to a statistically significant difference of perceptions level ($p < .001$). A large effect size was found (d = (2.91 – 4.09)/0.824924 = 1.430434).

Classroom conditions were assessed, and students from classroom A (M = 4.37, SD = 0.74) were more satisfied with temperature, lighting, décor, comfortability, space, and visuals than classroom B (M = 2.41, SD = 0.85). The means differ by almost two and the p-value of $p < .001$ supports a significant difference between classes. A large effect size was found (d = (2.41 - 4.37)/0.7969 = 2.45953). The students from classroom A (M = 4.51, SD = 0.63) specially indicated a higher satisfaction for the classroom condition of lighting than classroom B (M = 2.7, SD = 0.95). A large difference between mean scores was indicated, which led to a statistically significant difference of perceptions level ($p < .001$) A large effect size was found (d = (2.73 - 4.51)/0.80604 = 2.208328).

A higher percentage and frequency of students from classroom A positively agreed with the survey questions than classroom B. Students from classroom A had a

bigger mean score and different dispersions for the survey questions than students from classroom B. The students from A thought their classroom was more inviting, conducive to learning, and had better conditions for learning than students from classroom B. Reference Table 2 for descriptive and mean comparison.

Table 2

Differences of Groups

	Class A *N = 174*		Class B *N = 46*			
	M	*SD*	*M*	*SD*	*p*	*Effect Size*
Inviting (Q.1)	4.30	0.74	2.91	1.00	.001	1.73
Enforces Learning (Q.3)	4.06	0.65	3.15	1.03	.001	1.22
Helps Learning (Q.8)	4.09	0.73	2.91	0.91	.001	1.53
Conditions (Q.7)	4.37	0.74	2.41	0.85	.001	2.56
Lighting (Q.12)	4.51	0.63	2.73	0.95	.001	2.51

Similarities of Groups

Students agreed from both classrooms that it is important to have natural light in classroom spaces and that it is important that students can see nature out from classroom windows. It is also important to understand that students from both classes are aware that the classroom affects their learning, specifically the amount of natural light on mood. This gives a broader understanding of students' perspectives.

Students from classroom A and B had similar perspectives on the importance of natural light, seeing nature in or from the classroom and its effects, and the awareness of physical environment on classroom learning.

Students from both classrooms agreed the most similarly on the question, “It is important that there is natural light in the classroom.” Strongly Agree was the most selected answer for this survey question, bringing in 106 students votes (61%) from classroom A. Agree, was the second most chosen choice with 53 students who agreed (30%). Only two students disagreed with the survey statement and not one person strongly disagreed. In classroom B, 39 students (84%) in classroom B chose to agree or strongly agree with the importance of natural light in classrooms. Students from classroom A and B felt it is important to have natural light in the classroom, and there was no significant different between the two means ($p = 0.475$) for classroom A ($M = 4.51$, $SD = 0.68$) and classroom B ($M = 4.40$, $SD = 0.85$). Interestingly, students from both classrooms agreed that natural light is important, but classroom A had higher satisfaction scores on lighting conditions ($M = 4.51$) than classroom B ($M = 2.73$).

Students also came to the verdict that it is important to see greenery or nature from their classrooms and that greenery affects their mood. Although the dispersion of scores were higher when the researcher asked, “It is not important to see some short of greenery from or in the classroom.” This question was a reverse question, which really indicates that students want to see greenery in their classrooms. Between classroom A ($M = 3.57$, $SD = 1.15$) and classroom B ($M = 3.59$, $SD = 1.12$), the data show no statistically significant difference between the two means above ($p = 0.924$).

Students from both classroom A ($M = 4.00$, $SD = 0.81$) and classroom B ($M = 3.89$, $SD = 0.76$) grasped awareness that the physical environment affects their class learning, and the difference had no statistical significance ($p = 0.377$). Students were then asked, “Window views from nature help me to feel relaxed and calm.” More than 50% of students surveyed from classroom A (90) concluded that they “strongly agree” that nature

contributes to creating a calm and relaxed student experience. Notably the most picked answer was for this question was Strongly Agree, followed by Agree. There were 22 students (47%) from classroom B that described the nature views from windows in the physical environment affects students' relaxation and state of being calm. Classroom A had a mean score of $M = 4.40$ ($SD = 0.71$) and classroom B had a mean of $M = 4.30$ ($SD = .86$). It was not statistically significant ($p = 0.482$).

The two classes had similar perspectives of nature and its effects on classroom learning, and differing *p*-values, dispersions, means, and effect size are seen among answers in the importance of natural light and how nature affects mood. Table 2.1 shows a full summary of the descriptive statistics, *p*-value, and effect size.

Table 3

Similarities of Groups

	Class A *N = 174*		Class B *N = 46*		
	M	*SD*	*M*	*SD*	*p*
Importance of Natural Lighting (Q.11)	4.51	0.68	4.40	0.85	0.475
Importance of Green (Q.15)	3.57	1.15	3.59	1.11	0.924
Awareness of Classroom Learning (Q.2)	4.00	0.81	3.89	0.76	0.377
Relaxed & Calm (Q.14)	4.40	0.71	4.30	0.86	0.482

Aggregated Themes

The Classroom Physical Environment Instrument consisted of 15 items, followed by four open-ended questions. The 15 items were categorized into three themes with five

questions for each theme. The first series of five questions asked was to see if the participants had an awareness of the physical environment and its effects on classroom learning. These five questions were categorized as awareness items. The awareness level of students from classroom A (M = 3.98, SD = 0.74) was hypothesized to be greater than the awareness level of classroom B (M = 3.35, SD = 0.95). There was a significant difference in the awareness between classroom A and classroom B, ($t(8) = 1.99$, $p < .05$) The p-value is less than the significance level (i.e., 0.05). The difference between the two means is statistically significant. The samples from the two classrooms are strong enough evidence to conclude that students from the two classrooms have a difference of opinions. Table 4 displays these data.

Table 4

Independent Paired t-test: Awareness Items

	Statistics			
	df	*t Stat*	*p*	*t Critical*
Awareness	8	1.99	.04	1.85

The second series of five questions revolved around how well students perceived their physical environment to help them learn. For example, the third learning question asked, “The classroom physical environment helps me to learn well.” Descriptive statistics were taken on the five questions and then the means of the questions between the two classrooms were compared. The degree in which students perceive their environment to affect their learning positively from classroom A (M = 4.11, SD = 0.8) was hypothesized to be greater than the degree from classroom B (M = 3.10, SD = 0.92). This difference was significant, $t(8) = 3.80$, $p = .0025$. There was a significant difference with student perceptions on how their physical environment affects learning between

classroom A and classroom B. Students from classroom A perceive their physical environment to help them learn better than classroom B. Table 5 shows the data.

Table 5

Independent Paired t-test: Learning Items

	Statistics			
	df	*t Stat*	*p*	*t Critical*
Learning	8	3.80	.0025	1.85

The last five questions asked to student from both classrooms involved recognizing the importance of nature on classroom learning. The awareness and perception of nature to help in classroom learning from classroom A (M = 4.21, SD = 0.8), was hypothesized to be greater than that of classroom B (M = 3.79, SD = .93). This difference was not significant, $t(8) = 1.15$, $p = 0.139$. The difference between the two means is not statistically significant. Both classes see the importance of nature in the classroom and can see its positive effects on classroom learning. Table 6 describes the data for the independent t-test on nature perceptions between the two classroom and Table 7 is an over-view summary of the descriptive data for the aggregation of the three themes and their questions.

Table 6

Independent Paired t-test: Nature Items

	Statistics			
	df	*t Stat*	*p*	*t Critical*
Nature	8	1.15	.139	1.85

Table 7

Aggregate Descriptive Statistics

	Classroom A *N = 174*			Classroom B *N = 46*		
	M	*SD*	*Median*	*M*	*SD*	*Median*
Awareness	3.98	0.38	4.06	3.35	0.59	3.15
Learning	4.11	0.31	4.09	3.10	0.51	3.02
Nature	4.22	0.42	4.40	3.79	0.70	4.06

Qualitative Responses

In determining the effects of classroom space on student perspectives concerning classroom learning, analysis of all eight-hundred open-ended responses from both classrooms made up the themes and findings from the survey and allowed for accuracy, reliability, and validity. Four questions were asked to help gain a richer understanding of student experiences.

Classroom Description

Students were asked: What words would you use to describe the current classroom space you were in this semester? Students from the two classrooms described their rooms in significantly different ways. The most frequently commented theme and word associated with Classroom A was “open,” meaning spacious, large, airy, or spread out. Out of the 174 students who commented, 123 students (71%) of those surveyed mentioned this word in their response. One student said, “it is a nice sized classroom that isn’t too big, and it allows everyone to space out easily and see everything well.” The number two word associated with classroom B, was “small,” which made up a significant

41% of the students' responses. "Small" is an antonym for the word used to describe classroom A, "open."

Students also described their classrooms in terms of mood and feeling, not solely referencing physical attributes. Students from classroom A described their classroom to be relaxing, comfortable, cozy, inviting, and a calming space. These words are positive descriptors which 67% of students mentioned as they answered. Students from classroom B used negative descriptors. A significant percent of students (57%) mentioned these negative descriptors. These negative descriptors represented the idea that the classroom is "uncomfortable," using words such as cold, sterile, isolating, uncomfortable, depressing, and sad. These findings are a powerful indicator of the attitudes that students have for their respective classrooms and their differences.

Effects on Classroom Learning

Another question asked, How does the physical environment affect your classroom learning? How students in the different classrooms described the physical environment and its effects on classroom learning or academic performance was quite similar. Students from both classrooms mentioned the importance of lighting and the arrangement of the space. Lighting is referred to by students in both classrooms as the amount of light and type of light that illuminates the space. Arrangement is described as the layout of space, movability and shaping of furniture, location of students to each other and the professor, and location of learning materials.

For students from classroom A, arrangement is noted as the most important indicator of how the physical environment affects classroom learning. There, 67% of students mentioned the arrangement and how it is impactful to classroom learning. Arrangement in classroom A contributes to visibility, engagement, and comfort, but

students also comment how the arrangement is a hindrance to collaboration saying, “It negatively affects my learning in the sense working in groups is slightly more complicated because there’s no ‘common’ table space.” Students from classroom B also indicate the importance of arrangement, but from their experience the arrangement of the classroom has affected their learning in a negative way only. One student said, “the arrangement makes it hard to be comfortable in class and collaborate.”

Lighting significantly impacts how students perceive their learning experience in classrooms. In classroom B lighting is mentioned the most, making up 28% of students’ answers. Lighting for classroom A was mentioned second most, making up 56% of responses. These students from both classes mentioned how natural lighting was the best source of lighting in a classroom setting. Students from classroom A noted that, “having in natural light and visibility of trees calms my stress throughout the class which affects my learning.” A student from classroom B said, “being able to see natural light and look out windows helps me to not feel sleepy during class,” and another noted, “focus and concentration is affected by the natural light that is let in.” The responses from students who had class in both classrooms acknowledge that the physical environment, specifically the arrangement and lighting of their classrooms, affect their ability to focus on learning, their mood, and their motivation to learn.

Dream Classroom

Students were asked, What would make an ideal classroom environment for learning? The ideal physical environment included in descending order for classroom B: attention to nature through natural lighting and greenery (80%), comfortable and movable seating for collaboration (43%), lots of space for comfort and collaboration (30%), and an aesthetically pleasing space with decor such as pictures and plants (30%). Four out of

five students mentioned the idea of looking outside, having natural lighting, and seeing some reference to nature. Specifically, students in Classroom B commented on a preference for natural light over artificial light, a need for bigger windows, and views that "look out to nature" rather than man-made structures. Additionally, 43% of students commented on the seating space of an ideal classroom. Students wanted their ideal classroom space to feel warm, welcoming, inviting, and calming.

Students from classroom A remarked that an ideal classroom environment for learning would be the very classroom they were being assessed on. Contentment was heavily expressed from students in classroom A. Classroom A was one of the best classrooms students have experienced learning in and wished they had class there more often. A significant proportion of students (27%) stated that they would not change a thing a about their classroom, while not one student from classroom B said such a thing about their classroom. What made students adore classroom A was the natural and warm light that was brought in by the large windows which surrounded the room. Out of 174 students, 155 (89%) mentioned a positive comment on how lighting is of great importance in an ideal classroom. Views of nature were expressed as important to students, with one saying that "it is good for natural beauty to be integrated into the classroom design."

Students from both classrooms indicated the desire and appreciation for natural light. Natural light, students report, creates a space that is warm and inviting which is a positive contributing factor toward student learning in the classroom. Another notable characteristic of an ideal classroom that students from both classrooms report on is the type of seating and arrangement in a classroom, with 43% of students from classroom B and 33% from classroom A discussing the impact of seating and arrangement. Students

from classroom A voiced that “an ideal environment has different options for seating rather than just chairs like the classrooms in the [fitness center] that have yoga balls.” In classroom B students talk about how the terrible seating made it uncomfortable and not a hospitable place for learning.

There is clear evidence that students from classroom A and B have a difference of opinion about how inviting their classroom space is, how satisfied they are with lighting and the conditions of the classroom, and how positively the room they are in helps them in the learning process. There were also some similarities seen, for both classes thought natural light, greenery, and seeing nature were important in their learning space. Students from both classes thought that it is important to incorporate natural lighting into the classroom setting. There were also strong opinions that arrangement, space, and décor can be helpful in classroom learning. The physical environment, according to student opinions, does contribute to their academic performance or to the classroom learning experience as a whole.

Chapter 5

Discussion

This study analyzed how students perceive their physical environment affecting classroom learning. A subset of the research investigated the role of nature and its effects on learning in classrooms. The purpose of this research is to develop a richer understanding of the students' experiences of classroom space. This is critical for the decision-making processes when creating new classroom spaces on college campuses and helps administration, staff, and faculty create a more conducive and consistent learning environment for their students.

For the scope of this project, the researcher considered two on campus classroom spaces from a small liberal arts college in the Midwest, to gain more insight regarding students' perceptions. Classroom A is represented the atypical classroom (e.g., alternative layout and more amenities such as multiple projector screens and multiple remote-control blinds for large floor to ceiling windows). This classroom is not like other college classrooms that are seen on campuses; it is unique and experimental. Classroom B represents what most institutional classrooms look like (e.g., rows of desks facing a professor who sits at the front of the class with the bare minimum amenities). When comparing these two spaces of learning there is profound realization that the classroom space students learn in can affect their learning and that students have strong preferences on the classroom spaces.

Nature and Light

Natural light and seeing greenery in or from a classroom affect students' mood and learning in ways that are beneficial and preferable in the eyes of students. How students engage with nature and how the classroom design takes nature into account (e.g., lighting and greenery), is critical to consider for faculty and administration as they continue to support students' wellbeing and learning.

Students prefer naturally lit classrooms and found lighting to be important. The importance of natural light in classrooms was the most agreed upon finding of this research. Students strongly agreed when asked, "it is important to have natural light in the classroom?" In fact, for the two classrooms assessed, both had Strongly Agree as their most common response choice from students. Although natural light is preferred as an important element in classroom design by both classes, the classes have different satisfaction levels with the lighting in their classroom. Classroom A gave a great review of the lighting in their classroom from over 150 out of the 174 students assessed, while classroom B gave a very poor response, with 43% strongly disagreeing or disagreeing. The reason students prefer these spaces with natural light and find them more satisfactory is because it affects their mood and engagement with academics.

Most students from both classrooms agreed or strongly agreed that visuals from nature are important and many commented on the open-ended portion of the survey how relaxing it is to have a view of the outdoors. A student from classroom A proclaimed, "having in natural light and visibility of trees calms my stress throughout the class which affects my learning." There have been studies that explored the benefits of nature and its' calming effect on people (Blair, 2009; Claffey-Bow, 2017; Kuo et al., 2019). Students also experience this in the classrooms, and it affects their mood. Student responses

support the idea that nature has restorative benefits in a college setting. Looking out to nature was important for students because it lifts students' mood and affects their wellness. The care for student wellness and mindfulness should be an important factor when creating learning spaces.

Past studies showed engagement in learning increased on green school grounds as compared to teaching indoors and that nature affected the learning of students in K–12 schools (Kellert & Wilson, 1995; Ulrich, 1993). Is the principle of nature affecting learning prevalent among college age students? What does this demographic think, and how can this inform classroom designs? These thoughts and questions often have little research and thus guide an in-depth investigation into the topic for college age students. Classroom A had bigger mean scores and a larger effect size than classroom B when asked if the physical environment affects their learning. Open-ended questions gave a more in-depth look into these experiences. The second most noted comment on how students think their physical environment affects their learning was the influence of light on their learning. Natural lighting and views of the outdoors, specifically nature scenes directly affected the motivation students had in class, their focus on lectures, and their overall mood and relaxation.

The English word "heliophile," comes from helio- (concerning the sun) and -phile (lover). In other words, heliophile means "lover of the sun" (Etymologeek, 2021). Recalling from the literature before, biophilia is used to describe humans' innate connection to nature, and it is theorized that access to nature could improve mental and physical health (Ulrich, 1993). Student responses support the idea nature has restorative benefits in a college setting.

In the current study, 56% of students mentioned lighting and said natural lighting was the best source of lighting in a classroom setting. Some students said, “Having the natural light really helps because it keeps me more awake,” and, “It greatly affects my learning. I concentrate a lot better in classrooms that are open and where natural light streams through the windows.” Another said, “If the room is too dark it makes me feel sleepy or tired and I can’t focus, when there is more lighting (white lights) and windows where I can see nature, it makes me feel more awake and alive.” High stress, tiredness, anxiety, and focus can all be affected by nature and lighting, students report.

Students already have so many extraneous variables that may be negatively affecting their ability to learn. Are classroom spaces one of these variables? They can be. Paying attention to student responses will help faculty and administrators understand a potential reason for why students may be tired, stressed, or not able to concentrate. How can academic professionals and higher educational professionals work together to encourage classroom spaces that help students focus, relieve stress, and stay awake and engaged in classes? One potential solution lies in the implementation of natural light and nature within classroom designs.

Arrangement

The research indicates that students perceive that the classroom environment affects classroom learning. How it affects learning was explored by asking students what it is about the physical environment that they seem to think affects their learning. Students indicated that arrangement can affect their engagement with each other, whether that be group work, feeling comfortable with the amount of space to work in, or engaging in discussion with peers and professors.

Arrangement was the most commented-on aspect of the physical environment (67%), and lighting was the second, for classroom A. With classroom B lighting was the most commented-on aspect of the physical environment and the arrangement is second. This is interesting because lighting seems to be the biggest issue in classroom B. Lighting is spectacular in classroom A, students reported. The only thing for improvement is arrangement of the class. Students were happy with being on different levels but did not always think that the levels allowed easy discussion and groupwork. One student said, "to be able to see my other classmates and the professor at all times increases my ability to focus and learn." Students can see their peers and professors in the atypical classroom based on its "U" shape and leveled seating arrangement which in turn promotes focus, stimulation, and concentration on classroom learning. This same setting can also be a hinderance. A student reported, "It is hard to work in groups in [classroom A] because of how really long the tables are designed." Another student said, "I think that the seating arrangement doesn't make a ton of sense, as we are often working in groups and that's difficult when the floor plan is designed around a lecture and a speaker in the center of the room."

Arrangement of classrooms can impact discussions, groupwork, and visibility which all affect student learning. Although classroom A has a lot of positives, there is always room for improvement. Student feedback gives an insight into the continuous improvement of student experiences.

Implications for Practice

The research investigated has multiple implications which can inform best practices for administrators, leadership, faculty, staff, and students who are creating new

classroom spaces, renovating classroom spaces, or simply choosing what classroom to teach in to best reinforce the student learning experience.

Classroom Conditions

There is an issue of the inconsistency of classroom spaces that students learn in. The problem is that students have a huge preference for one class over the other. From the effect sizes and significance levels presented in the results, there is a large difference in the perceptions of students from one class to the other. The effect size between classroom conditions and specifically lighting in the two spaces is drastic, which supports reason for change. What can be done to create more consistent classroom spaces on campus? To ensure student experiences are more consistent, administration and faculty should investigate how they might address this problem with practical solutions. These practical solutions can come through in large, medium, and small ways.

Some institutions are experiencing growth through the promotion of new programs and initiatives or through a growing number of student enrollment, thus new buildings will need to be constructed to accommodate the expansion. This is where this study and others can provide perspective on students' experiences and how the environment can help or hinder their learning experiences. When building a new classroom learning environment, keeping in mind how much students love an open concept and space to learn is important.

Renovating spaces can be an alternative solution for schools as well. If student enrollment is not growing, administration and faculty can work together to still provide continual improvements in the student learning experience. Renovation can be both big and small. For example, creating an open floor plan by tearing down walls for bigger classrooms, installing floor to ceiling windows and changing the material of the floors,

walls, or ceilings to incorporate wood can be a huge renovation. Smaller renovations may look like replacing technologies, painting walls in a warmer tone, adding plants, or changing light fixtures; both these types of renovations can help create a more conducive environment for learning.

Creating whole new buildings or renovations—big or small—costs a lot of money, and it often takes the convincing of administration and other parties. Sometimes it is forgotten that faculty have the influence of changing or creating an inviting and supportive learning environment for students. Faculty can leave blinds open, arrange furniture for more collaboration instead of being in rows, turn on all the lights if there are not many windows, and bring in a plant or nature decor to class if they are in a class that does not have windows. One student even voiced, "an ideal environment has different options of seating rather than just chairs like the classrooms in the athletic building that have yoga balls." Faculty and administration can incorporate more comfortable seating options, movable seating, alternative seating options, and spacious seating as an initiative that could be more cost effective. If student discussion and group work is affected by arrangement, professors can arrange classrooms with movable desk in "U" shapes in small groups, which intentionally engages students.

Turn to Nature

As individuals are drawn to nature and light, there is a lot that can benefit a person's wellbeing, mental health, and mood overall which all have been reported by students from both classrooms. The effect size for lighting is huge as it is but follows second to classroom conditions for largest and most significant effect size. These results give profitable reason for considering how nature, and specifically lighting, can affect the

student's experience collaborating with, focusing on, and learning the material presented in class.

Students, faculty, administration can all play a role in promoting the wellness that nature brings to a classroom from what students have reported. Professors have more power and authority than they believe. The intentionality of choosing your classroom space with the physical space and its effects in mind can be beneficial in supporting their students with academics. Choosing classrooms with an open floor concept, movable furniture, more windows, or views to nature can all be aids. Faculty can also take their classes outside when the weather is pleasant, or for longer two-hour classes, give students a break and encourage them to walk outside for a few minutes.

Mental health and wellness seem to affect how students perform in classrooms. An awareness of the conditions that can help with wellness in the classroom can benefit student learning. Students, professors, and faculty may be overlooking this "silent curriculum" or underplay how much nature can help simulate a great learning environment. Learning more could inform faculty. Partnerships with the counseling center and faculty to host trainings or informational seminars on these topics could benefit all parties (i.e., faculty, administration, students).

Improving student support in the classroom is vital for universities' missions toward academic excellence. Scientific research shows how the physical classroom environment influences student achievement (Rands & Gansemer-Topf, 2017). This study aimed to determine the experiences of college students' classroom learning and whether nature played a part in affecting learning. Educators, faculty, and administration can benefit from this knowledge by reforming school learning environments to be best suited for student learning. Many colleges and universities around the country are

committing resources to redesign classroom spaces to promote active, participatory, and experiential learning (Cheryan et al., 2014; Fisher et al., 2014; Harvey & Kenyon, 2013). Administrators, professors, and students all will benefit from this type of investigation.

Limitations and Future Research

This study has multiple limitations which must inform any attempts at future research concerning classroom learning spaces. Although students report scores that are significantly different in means and have large effect sizes, there is still only evidence of learning being affected by student reports. It would be fascinating to measure the strength of the relationship between test scores and the type of physical environment. If this study supports that students prefer or are more satisfied with classroom A than classroom B, do test scores reflect learning outcomes based on environment? Running correlations would help to find the strength of the relationship between the two variables which could give a more definitive answer.

Student perspectives were assessed, but learning cannot happen without professors. Surveying the perspectives from professors who facilitate learning would help give insight to how classroom design affects learning on an even deeper level. Future research could have professors give their opinions on how they see the physical environments affecting their own teaching and how students respond to them. Professors often also ask how they can create a more engaging learning experience from students.

A limitation was that only two classrooms were compared in this study. Classroom A was a classroom designed to improve student engagement and learning, and this study assessed if it did. Classroom B was a more typical classroom and students seemed to have opinions on improvements. The two classrooms are polarizing but there are many other types of classrooms that exist. The examination of more classrooms and

different types of classrooms, like lecture halls, could add to what students prefer and what assists them in their learning experience.

The survey administered had two faults. One was that it was created by the researcher and has not been tested for validity. Going through the process of getting this survey checked and validated for reliability and validity could help to strengthen the findings. The survey had a lot of participants, but these participants only gave surface-level responses. Conducting focus groups with students could give a deeper perspective on what students are feeling and help students hear what each other are thinking, which would build on their own perspectives. Focus groups help to understand a shared experience and would be a great way to continue the research.

Conclusion

There is a lot that can affect students' experiences with learning in the classroom. This study shows that students do perceive their classroom spaces to affect their learning by impacting things such as focus, tiredness, engagement with each other, and mood. Students rate classroom A higher than classroom B on factors such as lighting, the inviting feeling of the classroom, and essentially on how effective the physical environment is in helping them to learn well. This comparison assesses classroom spaces which informs administration and faculty on what to look for when creating new classrooms, renovating classrooms, or even choosing the best classrooms for their students. Discovery on the learning impacts of arrangement, natural light, nature and its effects on mood, and open spaces give deep insight into how students view and interact with their physical environment. These findings are informative and need to be considered when creating new learning spaces on campuses that support core educational values: student learning, growth, and success.

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Field Code Changed

Appendix

Student Survey: Classroom Physical Environment Instrument (CPEI)

Research Question:

(1) How does the physical environment in college classrooms impact students' academic experiences in the classroom?

(2) Do students perceive nature to affect classroom learning?

1. *The SurveyMonkey Sample.*

    a. Summary and Benefit of the Research

        i. Hello, my name is Ben Williams, and I am a second-year student in a Master's program for Higher Education and Student Development. I will be conducting a survey for my thesis research on classroom spaces.
        ii. Making a commitment to cultivate learning spaces is one of the most important components of supporting students through the growth and learning process. But little research is done on college classroom environments and how they affect student learning. This survey will be used to assess students' perspectives on various classroom environments across campus. I desire to help both professors and students create more spaces that support teaching, learning, and overall growth.

        iii. Operational Definitions:

            1. **Physical Space:** The physical space of an environment includes: the land, air, water, organic life, man-made buildings, and the natural infrastructure of an area. This research focuses on the variety of materials and conditions within a designed environment. An example would be the floor, walls, lighting, decor, sounds, temperature, and more.
            2. **Nature Elements:** Nature elements include anything that is a sensory representation of nature such as the aromas of nature or visuals to nature. Some examples are windows to the outside, an indoor plant, pictures on the walls, natural materials used to construct a desk or work environment.
            3. **Perceptions of Academic Performance:** Academic Performance considers performance to be the quantitative result obtained during the learning process, based on the evaluations carried out by the teachers through objective

test evaluations (Noemy, 2017). It is the result of the efforts exerted by the students. It represents outcomes that indicate the extent to which a person has accomplished specific goals through testing.

By checking the box, I agree to be a participant in this research and note that I am 18 years of age or older.

2. *Demographic Information*
    a. Gender: Male / Female / Other
    b. Year: Freshman / Sophomore / Junior / Senior
    c. Major: _____
    d. Building Name and #: _____
3. *Actual 19 item Survey Questionnaire*

Chose (1) Strongly Agree, (2) Agree, (3) Neutral, (4) Disagree, to (5) Strongly Disagree. Cannot move on to the next questions without answer the previous

a. Students' Perception of Classroom Environments.
    i. Awareness Items (5)
        1. The classroom space I am in is inviting.
        2. I am aware of how the physical environment of the classroom affects my learning.
        3. The physical environment enforces my learning in the environment.
        4. The professor expertise in his/her academic area is more important to me than what classroom he/she will teach in.
        5. Classroom spaces are designed with students in mind.

ii. Physical Space Items (5)

1. My classroom arrangement offers excellent sight lines, enabling everyone in the room to easily interact with everyone else as well as see the professor.
2. I am satisfied with the classroom conditions: temperature, lighting arrangement, décor, comfortability, space, and visuals, that I learn in.
3. The classroom physical environment helps me to learn well.
4. The classroom environment feels sterile.
5. The classroom environment or condition is a distraction to what the professor is saying.

iii. Nature Items (5)

1. It is important that there is natural light in the classroom.
2. The lighting conditions of the classroom are satisfactory.
3. Visuals of nature whether through window views or pictures are important.
4. Window views to nature help me to feel relaxed and calm.
5. It is not important to see some sort of greenery from or in the classroom.

b. Open-ended to allow the participants to provide responses in their own words. (4)

1. What words would you use to describe the current classroom space you were in this semester?

2. How does the physical environment affect your classroom learning?
3. What would be an ideal classroom environment for learning?
4. What ways could the classroom be more inviting and hospitable?

Thank you for your participation in this research on classroom environments. The hope is to improve student learning and support in Higher Education.