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A MIXED-METHODS STUDY: INVESTIGATING THE ROLE OF ENVIRONMENT-BEHAVIOR (E-B) ATTRIBUTES UPON FACULTY

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A MIXED-METHODS STUDY: INVESTIGATING THE ROLE OF ENVIRONMENT-BEHAVIOR (E-B) ATTRIBUTES UPON FACULTY

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This dissertation is dedicated to my dear parents and my husband, Faisal.

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Abstract

With the increasing costs in higher education and concerns regarding student retention and graduation rates, there has been an increased focus on innovative instructional methodologies and new templates for learning space designs. Schools are educational facilities that play an essential role in community building and education, and immediate attention is needed to improve classroom spaces. Unfortunately, schools have not facilitated changing educational standards and still follow old philosophies (Altinbasak, 2016; Baker, 2012). Even though there has been a worldwide transformation in the teaching and learning process, the US still follows the traditional classroom setting, no matter the instructors' instructional approach (Altinbasak, 2016). Research has become integral to the overall design process to provide better design solutions. Credible design research is a crucial part of the profession, uplifting and strengthening designers' credibility (Friedow, 2012) while providing improved client and consumer satisfaction.

The primary purpose of the current study is to better aid interior designers in educational environment designs, such as higher education classroom settings, and to add to empirical knowledge about design and behavior, with the applied aspect influencing future learning spaces' design. Therefore, the intent was to evaluate the existing higher education learning spaces from the perspective of one of the primary users of the space, such as instructors, because teaching is perhaps the most essential variable for the "improvement in the quality of education (Manville, 2004, p. 2)." There are numerous studies on classroom design from students' perspectives, but more from instructors' point of view still needs to be known. Since the learning space's physical design influences instructors' instructional methodologies, special attention has been given to furniture arrangement, furnishing, and equipment of the classrooms

for the overall academic performance and related behaviors (Steg & Reser, 2011). There is a hypothesized association between the classroom design and the instructors' instructional methodology.

Through the explanatory sequential mixed-methods design, the current research strived to examine the role of physical design attributes of traditional and active learning classroom designs on instructors' instructional methodologies. This mixed-methods research used two data collection methods: a survey and follow-up interviews to examine design-instructional methods in a triangulated fashion.

Data analysis revealed an association between classroom design and instructors' instructional approach. Contrary to previous literature, the quantitative data did not reveal a statistically significant difference between the traditional and active learning classroom designs regarding instructors' perceptions and values. However, findings from the qualitative data analysis revealed that there is a significant difference.

The emphasis of this academic environment's post-occupancy evaluations was to assess user needs, experience, and values concerning these environments' physical attributes. Results indicate that the instructors perceive active learning classroom designs as supportive of their instructional methodologies compared to traditional classrooms. Thus, the information collected from the POE of educational settings informed planning, design, and pedagogical practices throughout the whole evaluation process.

Chapter 1: Introduction

With the increasing costs in higher education and concerns regarding student retention and graduation rates, especially after COVID-19, there has been an increased focus on innovative instructional methodologies and new templates for learning space designs. Flexible teaching and learning settings are getting famous while the need for traditional classrooms is diminishing (Penrod, 2021). Social, political, and technological movements affect schools in many ways (Altinbasak, 2016). Schools are educational facilities that play an essential role in community building and education. For instance, after COVID-19, a combination of pedagogy and technology in a learning space to facilitate multiple instructional approaches and interactive learning has become necessary. Unfortunately, schools have not facilitated changing educational standards and still follow old philosophies (Altinbasak, 2016; Baker, 2012; Hensley-Pipkin, 2015; Penrod, 2021).

Research has become integral to the overall design process to provide better design solutions. Application research contributes to the improved client and consumer satisfaction. Knowledge of evidence-based design and its application is essential for design professionals and interior design students to apply to their projects in accredited institutions. Credible design research is a crucial part of the profession, uplifting and strengthening designers' credibility (Friedow, 2012). Design research also resolves numerous emerging design concerns.

Evidence-based design (EBD) is conducting credible design research to base decisions regarding the built environment for the best possible outcomes (The Center for Health Design, 2008). The overall purpose of EBD research is to research that reports the findings and implement those findings into the built environments for a better design solution (Nussbaumer, 2017). Therefore, designers must understand the importance of collecting new evidence to

create environments that increase productivity and improve consumer satisfaction. For instance, designing flexible educational settings that support multiple instructional approaches, student-student and student-teacher collaboration and engagement for better teaching and learning outcomes.

Overview of Classroom Environments

Classroom space is much more than just a house of furniture and furnishings; it is a space that will be adequately understood if it is seen as a system (Martin, 2002). Similarly, a classroom's physical attributes, such as its structure, furniture layout, and furnishings, have a complex relationship with the users of the space, i.e., instructors and students (Rivlin & Rothenberg, 1976; Gump, 1987). It is essential to know that classrooms serve as physical and organizational units, where their attributes can affect behavior and educational program (Rivlin & Weinstein, 1984). The design of the classrooms is a direct reflection of the schools' educational philosophy (Proshansky & Wolfe, 1975).

Numerous studies on classroom design highlight the classroom's physical environment with educational theory (Altinbasak, 2016; Castilla et al., 2017; Scott-Webber et al., 2018; Tookaloo & Smith, 2015). However, there is "a lack of analyses comparing the results obtained by different authors" (Castilla et al., 2017, p. 1), which could be why US schools have not improved much. Several studies highlighted that overall physical design attributes of classrooms are outdated, affecting teaching quality, motivation, and student learning and achievement (Altinbasak, 2016; Baker, 2012; Filardo, (2008); Hensley-Pipkin, 2015). Even to date, "the connections between the classroom design and use of space in higher education and the production of teaching, learning, and research are not well understood" (Temple, 2008, cited in Castilla et al., 2017, p. 1). Consequently, current classrooms are deteriorating and facing poor

space design, leading to overcrowding, lack of collaboration, and ineffective instructional methodology (Altinbasak, 2016; Scott-Webber et al., 2000). Most importantly, there is a considerable lack of collaboration between the school administration, instructors, environment-behavior researchers, and designers, which has led to a gap between educational programs and school design. In this case, it will be remarkable to investigate the role of the classroom's physical design attributes in teaching and learning, as more discussion will be found in the discussion chapter.

Immediate attention needs to be given to improving the classroom environment. Even though there has been a worldwide transformation in the teaching and learning process, the US still follows the traditional classroom setting, no matter the instructors' instructional approach (Altinbasak, 2016). Traditional classrooms consist of row-and-column seating arrangements, where students are seated facing the front of the instructor's podium. A lecture-style traditional instructional method is typically used in these classrooms. Moreover, the concept behind conventional classrooms is that instructor will be the sole authority. At the same time, student-student interaction is not encouraged but to rely on the instructor for knowledge acquisition. These kinds of classroom environments are also known as passive learning environments.

Moreover, due to an increasing interest in classroom designs that promote more collaborative and active approaches to teaching and learning within higher education institutions, there is also a growing need for flexible and adaptable learning spaces (Wood et al., 2012). An ideal classroom environment should allow student-student and student-teacher engagement through physical design and instructional approaches that facilitate students to interact actively and engage in class through problem-solving activities for better knowledge acquisition. These classrooms are commonly known as Active learning classrooms (ALC). Instructors' role is to

create an ACTIVE LEARNING environment for students through their instructional approach for better teaching and learning outcomes. "Teachers' role in classrooms and their interaction with students through their attitudes and motivational strategies play a crucial role in the overall teaching-learning process" (Altinbasak, 2016, p. 25).

However, the instructors cannot adequately implement an active learning instructional approach if the classroom design does not support it. Teaching and learning quality is negatively affected when the instructional approach does not align with the classroom design (Merrienboer et al., 2017). Though the literature on achieving a powerful alignment of instructional approach and classrooms' physical design is very little (Merrienboer et al., 2017), the present research will help fill this gap by investigating the role of classroom's physical design attributes on an instructional methodology based on instructors' perception.

Moreover, due to the spread of COVID-19 recently, many in-person classes suspended and switched to online and partial in-person classes. This abrupt change brought challenges for a smooth teaching and learning process, such as appropriate classroom design, for interaction and social distancing among students, and use of technology (Nubani, 2022). Significance of flexible furniture and classroom design, and use of optimal technology has increased many folds, as COVID-19 has changed how teaching and learning took place traditionally.

Due to the increasing interest in the part of classroom designs, numerous studies note the impact of physical design attributes and effects on student learning and engagement (Wood et al., 2012). Still, more needs to be explored about the potential effect of classroom design on teachers' perception of these learning spaces, especially after the pandemic. The present research addresses these debates by evaluating traditional and active learning classrooms through instructors' perceptions.

Overview of Environment Behavior Research in Classroom Design

Physical environment impacts occupant behaviors and how they act (Altman, 1970; Scott-Webber, 2009). Numerous physical design factors impact occupants' behavior, such as furniture, furnishings, culture, etc. (Scott-Webber, 2009). Therefore, it is essential to explore classroom designs and their impact on the users, such as instructors and students. Investigating the relationship between classrooms' overall physical design and teachers' teaching approach is crucial to better educational outcomes. Environment-behavior scientists have been examining different environments since the dawn of history. However, "researching a tool for designing better educational buildings is relatively a new approach" (Altinbasak, 2016, p. 10).

During the early 1950s, the relationships between the built environments and human behavior were mainly researched by environment and behavior (E-B) psychologists under a new area of study known as architectural psychology and environmental psychology (Altinbasak, 2016). With this new approach to exploring the built environments, the field of architecture started to examine the psychology of physical spaces through different forms and appearances that could influence occupant behaviors (Altinbasak, 2016). Furthermore, E-B studies claimed that not only does the environment influence the occupants, but the users' awareness can also affect the function of the space and its values (Ittelson, 1974). Therefore, human perceptions of the built environment can be beneficial in designing spaces.

Considering the need to support the educational sector, designers, environmental psychologists, and educationists strive to create a body of knowledge that will help in better designs and use of new and current learning spaces (Painter, 2012). Similarly, there is an emerging need to evaluate these learning spaces to investigate if they meet current teaching and learning needs (Painter, 2012; Scott-Webber, Abraham, & Marini, 2000).

Design researchers, environment-behavior psychologists, and educational experts are constantly striving to add to the body of knowledge by conducting a broad range of investigations on learning space designs and their impact on users, along with the examination of user behavior concerning the physical attributes of these spaces (Faisal, 2017; Altinbasak, 2016; Scott-Webber et al., 2000). Investigating the relationship between the environment and its users gets even more critical when understanding how a classroom's physical design attributes impact instructors. Therefore, research suggests that designers should consider spaces' physical aspects and responses to understand occupant behaviors (Altinbasak, 2016; Scott-Webber et al., 2000).

Traditionally, architects and interior designers are responsible for designing learning spaces, not teachers or academic practitioners (Ramli et al., 2013). However, not all design professionals are educational imaginary, which mostly leads to reproducing traditional classroom designs (Ramli et al., 2013). Therefore, it is critical to understand the end-users' perception of their classroom spaces and their preferences for better teaching and learning experiences (Ramli et al., 2013). Hence, the current research investigates instructors' perception of classrooms' physical design attributes to better their preferences. Evaluating the users' feedback resulting from the present study will aid design professionals, environment-behavior researchers, and educational psychologists in designing better learning spaces in the future.

To date, the research projects on the relevant topics are numerous and range from newly designed and analyzed spaces to the evaluation of existing classrooms using a variety of research approaches such as experiments, observations, surveys, etc. Moreover, review articles on philosophical approaches and present literature can be found on the topic. Even though numerous books and articles on the subject, design is still in its early developmental phase

(Painter, 2012). Most of these studies were conducted under a particular discipline such as education, psychology, or design.

Emphasizing the need to conduct interdisciplinary research studies, researchers believe that "the question of how the physical environment affects teaching and learning is rooted in the connections between architecture, design, and psychology" (Painter, 2012, p. 4). In a report by EDUCAUSE, Painter et al. (2012) highlighted the dilemma that the cross-disciplinary field of psychology and design still needs to answer what physical design factors within the built environment impact specific human behaviors during teaching and learning. Therefore, the purpose of the present research was to gather and synthesize the current body of literature and evaluate the existing higher education learning spaces from the perspective of one of the primary users of the space, such as instructors.

A variety of people, including students, teachers, and administrative staff, within a physical setting, such as classrooms, and outdoor spaces, combine to form schools' complex environments (Woolner, 2015). According to Pasalar (2003), formal or informal teaching methods, student interactions and communication, group activities, and movement within the school's learning spaces help achieve academic goals. Previously, research studies have revealed that physical environmental attributes can interfere with achieving overall educational goals without suggesting specific solutions (Altinbasak, 2016), as sometimes a solution to one problem can conflict with other elements. For example, proper ventilation can conflict with classroom acoustics. Similarly, the open shelving concept to facilitate independent student learning can pollute air quality by getting dusty (Woolner and Hall, 2010; Woolner, 2015; Stringer, Dunne, & Boussabaine, 2012).

Because numerous factors such as design, human behavior, and the overall physical environment play their role in achieving educational goals. Wooler (2015) calls for interdisciplinary research to understand better how schools and their physical design settings contribute to attaining academic goals. He further emphasized drawing architectural and educational perspectives to achieve the stated purpose. The present research is an effort to explore aspects of classrooms' interior space design in coordination with the instructional methodology to contribute to interdisciplinary school studies. Evaluating the currently occupied university classroom designs will help understand the physical and educational environments from the users' perception, i.e., instructors. The present research will also improve the overall design of higher education learning spaces.

Theoretical Framework

Classrooms are the spaces where teaching and learning take place. Attributes of these classroom environments include various furniture and furnishings, along with ambient conditions such as temperature, lighting, noise, and odor. Research suggests that the design of a classroom affects the overall teaching and learning (Castilla, Llinares, Bravo, & Blanca, 2017; Guardino & Antia, 2012; Scott-Webber, Strickland & Kapitula, 2013). Scott Webber et al. (2013) also found a relationship between a classroom's physical attributes and the learning environment, as built environments shape occupant behaviors. Therefore, it is necessary for the occupants to feel comfortable promoting better teaching and learning (Castilla, Llinares, Bravo, & Blanca, 2017).

One design fundamental is to connect the built environment with its intended purpose. Any built environment is considered meaningless without human interaction. Therefore, design professionals make some of the most critical decisions about our built environments. These designers work aimed to avoid potential problems related to the human-environment relationship. The presented study focuses on understanding how instructors perceive and use their current classroom environments concerning their instructional methodology in a post-secondary institution to aid designers in creating better educational settings. From an ecologist's perspective, "what people do is markedly influenced by where they are" (Kounin & Sherman, 1979, p. 145).

Therefore, the current study considers the lens of various social systems and Rapaport and Altman's ecological model of man. The central theme of this model focuses on human behavior as a "part of a complex ecosystem" (Altman, 1973, p. 108). The ecosystem, further elaborated by Rapoport (1973), demonstrates how the ecological model approach studies man in the built environment rather than man and the environment, indirectly relating several other

environment-behavior models (Rapoport, 1973). Altman (1973) further defined the significant concepts of the ecological model of a man and their interrelationship:

- "Environment and behavior are closely intertwined," meaning that this concept is more than the famous dictum 'environment affects behavior' (Altman, 1973, p. 108). Historically, behavioral and social science research has studied human behavior independent of his physical environment. However, interior designers and environment-behavior (E-B) researchers now consider man and the environment as one unit for design and research purposes.

- "There is a mutual and dual impact between man and his environment" (Altman, 1973, p. 108). According to this concept, man and his physical environment impact each other in a true ecological sense. This approach demands the flexible and changeable physical design of the settings for understanding man-environment relations, opposing the traditional idea of considering man as merely a recipient of the environment. A man should be capable of interacting with flexible spaces and acting as a change agent under the concepts of territory (utilization, possession, and control of areas) and personal space (optimal distances from others) (Altman, 1973).

- Another feature of the ecological model of man is the "dynamic, changing quality of man-environment relations (Altman, 1973, p. 109)." Based on this aspect of dynamism, the man-environment relationship should not be static. Instead, this relationship should shift territories, alter roles and responsibilities, or even change group compositions.

- Lastly, the ecological model of man emphasizes that "man-environment relations occur at several levels of behavioral functioning, and as a coherent system (Altman, 1973, p.

109).” The notion proposed here is that several levels of behavior occur concurrently, which must be considered a system. Therefore, the internal forces or covert behaviors, such as perception, emotional states, and cognitions, eventually transform into different levels of overt behavior. These overt behaviors include various verbal behaviors (aspects of speech), non-verbal behaviors (body movements and gestures), and environmentally oriented behaviors such as different ways of using and selecting objects and spaces within a physical environment (Altman, 1973). Continuing the discussion, Altman further explained that “this results in a wide repertoire of behaviors which are coordinated in various patterns (1973, p. 109).”

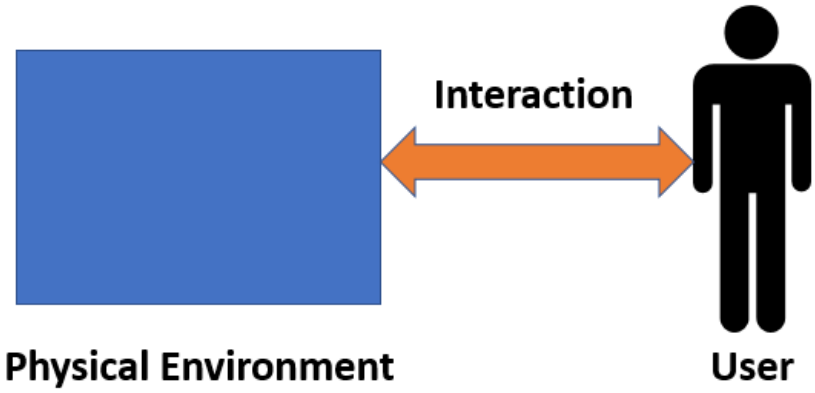


Figure 1. The ecological model of man

(Faisal, 2018).

Overall, according to Rapaport and Altman’s ecological model of man (EMM) theory, one can study the mutual relationship between man and his environment. The study can consider that influential contributions are essential and how these contributions have the opportunity to shape one another in a dynamic sense. It stresses the flexible nature of the design of environments and people who use them, where man is viewed as a change agent in shaping their environment (Figure 1).

User's Environment Interaction Framework

According to research, users of classroom space in higher education institutions, including instructors and students, are neither satisfied with their current classroom environments as these settings do not support all their needs for teaching and learning (Altinbasak, 2016; Scott-Webber et al., 2000). Given the early stage of the learning space design research, it is essential to understand how users use classroom environments and how they affect their behaviors. Understanding this environment-behavior interaction will provide designers with some guidelines for designing better learning environments. Therefore, in addition to EMM, the current study is guided by two different frameworks: the User's Environment Interaction Framework (UEIF) by Scott-Webber (1998), as it is well-aligned with the theoretical framework of EMM.

To understand the spatial and basic human needs in a built environment and its various affecting factors, Scott-Webber (1998) developed the UEIF that included territorial and environmental concepts. Although the Ecological Model of Man (EMM) theory provides a valuable framework for exploring complex environments such as classrooms, it is macro in its approach for the current research. Thus, the User's Environment Interaction model (UEIF) further investigates environment-behavior aspects within higher education classrooms. The two common types of classrooms used within higher education institutions are the traditional row-and-columned classroom and the ACTIVE LEARNING CLASSROOM with the grouped seating arrangement. However, these classrooms come in several different designs, more or less following the same design features.

The current study's investigation of environment-behavior aspects within higher education classrooms includes space and its function within the environmental dimensions,

social issues in behavioral responses, users' cognitive responses to areas under internal responses, corporate and personal concerns within the value dimensions, as well as the proxemic relationships between users, etc. (Scott-Webber et al., 2000). The current study views Scott-Webber et al.'s (2000) model as helpful for the presented classroom environments.

The User's Environment Interaction model (UEIF) categorizes "remedial actions/ responses of the user of space (Scott-Webber 1998, p. 19)." Under this framework, numerous aspects of the interior setting regard human perception and use of a particular space, in the case of current research, the classroom environment. The UEIF Environment Interaction Framework comprises the four quadrants of environmental, internal, behavioral, and value dimensions. The proxemics, territoriality, and privacy concepts are woven into the UEIF framework model, discussed further under the modified UEIF section (Figure 2).

Environmental dimensions

Environmental dimensions are the physical attributes within a space "designed to enhance the user's spatial requirements (Scott-Webber Abraham, & Marini, 2000)." These environmental dimensions comprise (a) ambient conditions such as temperature, noise, color, lighting, touch, etc.; (b) space's physical layout and its function; (c) equipment; (d) furnishings; (e) and (f) artifacts or the aesthetic quality of the classroom environment, such as in traditional and the Active learning classrooms.

Internal Responses

According to Bitner (1992), "users respond to dimensions of their physical surroundings cognitively, emotionally, and physiologically, and those responses influence their behaviors in any given environment (as cited in Scott-Webber et al., 2000, p. 21)." They further explain that emotional, mental, and physiological activities affect internal responses (Scott-Webber et al.,

2000). Individual users' perceptions are interconnected with emotions, thoughts, and physiological reactions to an environment, which combine to form internal responses (Scott-Webber et al., 2000). Similarly, perceptions regarding a particular environment produce cognitive responses within occupants, which affect their beliefs about that space and regarding people and products (Scott-Webber et al., 2000).

As perceptions about a space evoke both emotional and physiological responses within the users, these also impact their thoughts, actions, and reactions regarding that space (Scott-Webber et al., 2000). According to Bitner (1992), our perceptions regarding space's ambient factors can influence our fight or flight responses, such as whether to stay or leave that particular environment. Therefore, users' internal responses are closely tied to their external behavioral responses (Scott-Webber et al., 2000).

Behavioral Responses

Evidence suggests that users' behavior in a particular space is based on their perceptions about that space (Scott-Webber et al., 2000). These behavioral responses affect our feelings and proclivity to stay in a particular area, desire for space where social interaction occurs, and inclination to avoid a space (Scott-Webber et al., 2000).

Value Dimensions

For the current research's UEIF framework, values are defined as "standards or principles" on corporate and personal levels (Boyer et al., 1983, as cited in Scott-Webber et al., 2000). Corporate values are related to organizational culture, whereas personal values are defined as religious, moral, and ethical issues to which individuals give importance (Duerk, 1993). Building designs must incorporate issues related to values to fulfill user needs, as these values provide a basis for future design decisions and solutions (Duerk, 1993).

Interactions

According to UEIF, interactions are one or more variables that affect how people use their spaces, which could be at the same or different times (Scott-Webber et al., 2000). For instance, interaction items within the traditional and active learning classroom environments may include instructional technology and methods. Instructional technology, a vital classroom design feature, may be used by teachers, students, or both. As far as instructional method is concerned, instructors may choose different classroom activities. Adaptable furniture settings may be rearranged while maintaining the original classroom function to support these pedagogical and technological needs.

Proxemic Zones

Hall (1969) provided the concept of proxemic zones. In his research on human personality, Hall associated different personalities with intimate, personal, social, and public responses (Scott-Webber et al., 2000). Hall proposed that there are two senses, close and distant. These zones are present in environments and are connected by how people experience relationships and space with other people around them. In his research, Hall also determined an imaginary yet distinguishable line where one behavior can be distinguished from the other and is identified as intimate, personal, social, and public.

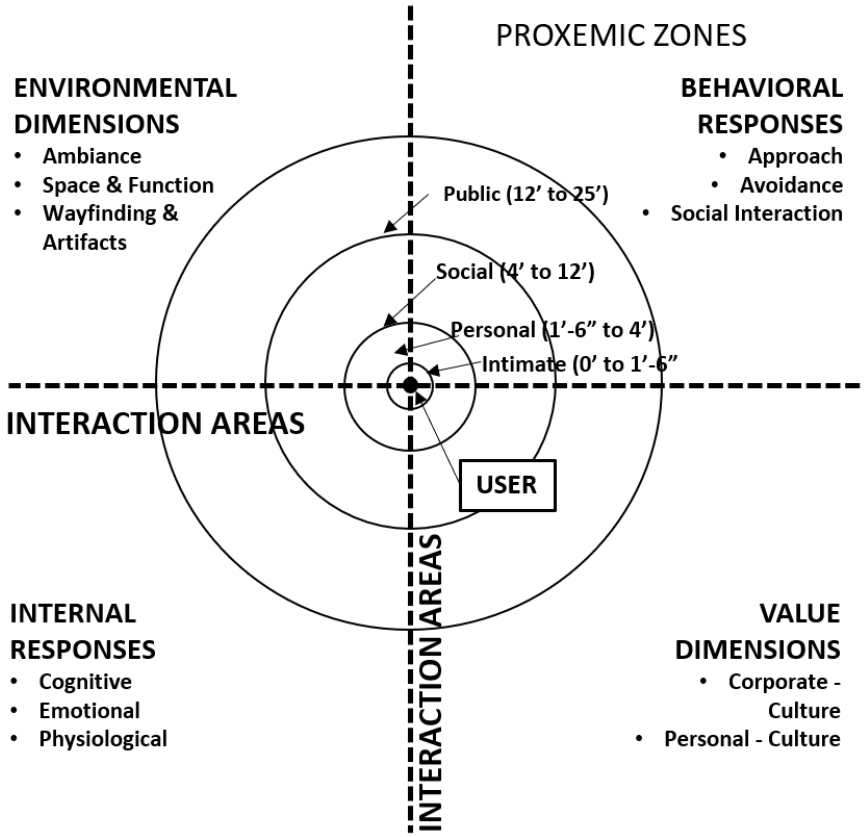


Figure 2. User's Environment Interaction Framework (UEIF)
(Scott-Webber et al., 2000)

Active learning Ecosystem Framework (ALES)

Another framework that was co-developed by Scott-Webber and has helped shape the current study's perspective is the Active learning Ecosystem Framework (ALES) (Steelcase, 2011) which is a three-interlocking circle Venn diagram (Figure 3). These overlapping circles in the Active learning Ecosystem Framework (ALES) diagram contribute to the fourth construct titled ACTIVE LEARNING. Central to the ALES framework emphasizes the interrelationship and harmony between three primary constructs: pedagogy, technology, and the physical space. It creates an ecosystem that fosters ACTIVE LEARNING through intended function and design (Scott-Webber 1998).

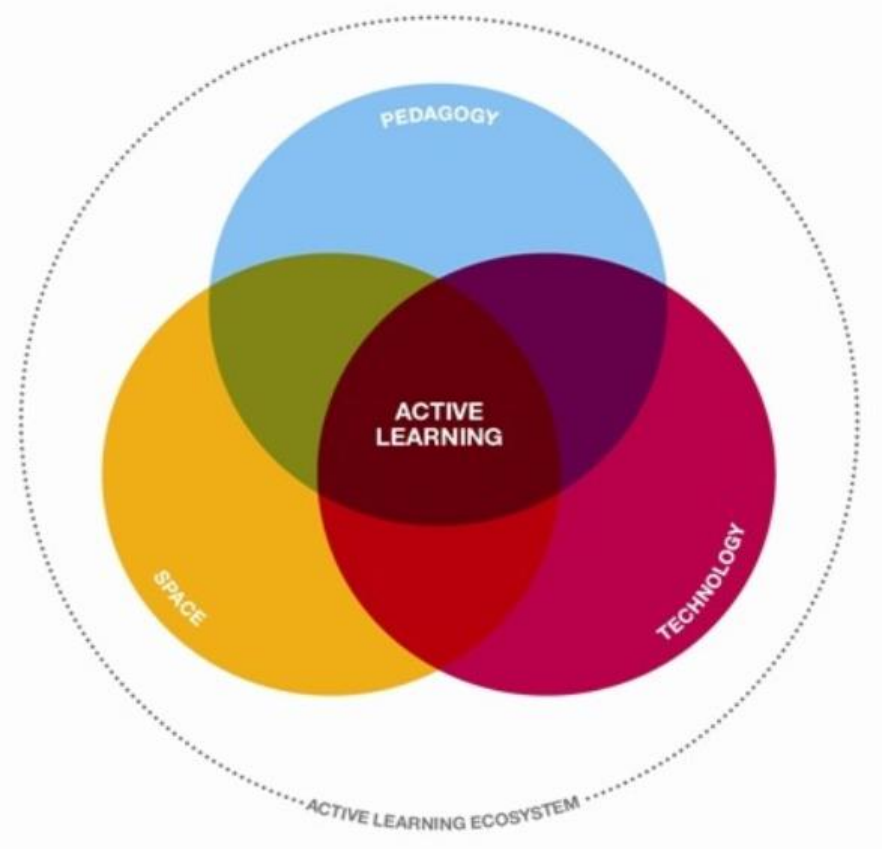


Figure 3. Active learning Ecosystem
(Steelcase, 2011)

Elaborating on the relationship between Active learning Ecosystem (ALES) and User Environment Interaction Framework (UEIF), Scott-Webber mentioned that the pedagogical aspect of ALES incorporates internal responses, behavioral responses, and the value dimensions of UEIF (1998). For instance, for the current study, instructors' cognitive, emotional, and physiological perceptions may or may not support their choice of instructional methods, use of technology, interaction with students, etc.

Similarly, the spatial and technological dimensions of the Active learning Ecosystem (ALES) cover the environmental dimensions of the User Environment Interaction Framework (UEIF), where the space is highlighted as a critical factor influencing user behaviors (Scott-Webber 1998). For the current study, the absence or presence of supportive classroom spatial

and technological aspects and ambient factors are expected to influence instructors' choice of instructional methods, use of technology, interaction with students, etc.

Therefore, to collect information regarding instructors' behaviors in classroom environments, the current study will seek guidance in the assumptions of an ecological model of man, User Environment Interaction (UEIF), and Active learning Ecosystem (ALES) frameworks for investigating the design of formal learning environments. Previously, UEIF was used to study traditional classrooms. However, incorporating ALES' conceptual framework in the current study will contribute to exploring Active learning classrooms. A few modifications have been made within the UEIF quadrants to combine the study of both classroom models, such as adding the ecological model of man, and ALES theoretical frameworks, for a comprehensive approach as presented in the current study. One of the significant benefits of these modifications is to help understand the vital environment-behavior aspects understudy while omitting the unrelated aspects of the original User Environment Interaction (UEIF) version, such as privacy, proxemics, etc. In addition, incorporating the ALES framework into UEIF has made explaining each quadrant within the modified UEIF clearer. These modifications by each UEIF quadrant have been explained in detail in the next section.

Modified UEIF

Modifications in the User Environment Interaction Framework (UEIF) consist of changes within the sub-categories under the four quadrants. Figures 4 and 5 illustrate the UEIF's modifications, redesigned and drawn out through this research (Faisal, 2018).

Environmental Dimensions

Sub-categories under the environmental dimensions have been rearticulated and aligned for the modified conceptual framework to include the classroom's physical design attributes.

These attributes include ambient factors, such as temperature, lighting, noise, color, touch, and smell. Similarly, space layout refers to the necessary classroom equipment and furnishings, type of furniture, setting, technology, and space function (how the area is used and tasks performed within it). Equipment and furnishing within a classroom space refer to markers, dusters, wall-mounted boards (black/ white), window blinds, projectors, and other technology available in the classroom, etc., required during a scheduled class period. Classroom furniture includes tables, chairs, podiums, etc., which can be either fixed and attached to the floor or semi-moveable, including immobile tables due to attachment with electrical outlets. Still, chairs are moveable or fully moveable furniture where tables and chairs can be easily moved around and rearranged within the classroom. Factors such as signs, symbols, and artifacts from the original UEIF are not part of the modifications, as they do not align well with the current study.

Internal Responses

Based on the user's perception of the environment's positive or adverse conditions, the body reacts accordingly (Scott-Webber et al., 2000). "Perception is the organization, identification, and interpretation of sensory information regarding personal experiences" within a classroom environment by the researched population (Weber-Bezich, 2014, p. 25)." Similarly, users' perception is deeply connected with their emotional and cognitive responses. The occupants' perception evokes these responses that influence their actions/reactions to an environment and social interactions within that environment (Bitner, 1992; Scott-Webber et al., 2000). Perception has been added as the central aspect of the internal behavioral response quadrant. According to Rookes and Wilson, "Perception is a process which involves the recognition and interpretation of stimuli which register on our senses (2005, p. 2)."

Environment and Cognition

Bitner (1992) defines an occupant's belief about an environment as a cognitive response that can influence emotional response and contrariwise. According to her, the perceived environment can elicit cognitive responses, affecting occupants' beliefs about an environment and anything within that environment (1992). In that sense, the physical attributes of a classroom environment may influence instructors' beliefs about whether the furniture and its setting are comfortable or uncomfortable, crowded or just right, welcoming or unwelcoming, and if it supports their choice of instructional method or not. Bitner (1992) further explains that the overall perception of the environment allows occupants to classify it mentally, such as the classroom environment in the present study.

Environment and Emotion

The perceived environment may also influence occupants' emotional responses, affecting their behaviors (Bitner, 1992). Research suggests that emotion-provoking environmental aspects are captured by two dimensions: pleasure/ displeasure and amount of excitement (Mehrabian and Russell 1974; Russell and Lanius 1984). Research shows that occupants' emotional responses can predict their behaviors concerning the environment (Bitner, 1992). In other words, environments that promote pleasure are where people feel welcomed, comfortable, and want to spend their time (Bitner, 1992). People associate this pleasure-eliciting (displeasure-eliciting) environment with positive (negative) emotions (Bitner, 1992).

Environment and Physiology

In addition to influencing cognition and emotion, the perceived environment may influence occupants' physiological responses. Research suggests that various ambient conditions, such as temperature, light, noise, odor, and design features, have addressed

physiological responses (Scott-Webber et al., 2000). For example, a classroom's too cold or hot temperature may make it difficult to perform routine tasks. Glare can cause eye strain or see correctly; noise and foul odor can affect occupants' hearing of lectures or group discussions. Uncomfortable and inappropriate furniture and furnishing design may cause physical pain, hinder circulation, and create an unwelcoming classroom experience for students and instructors. Therefore, all these physical responses directly affect occupants' feelings and beliefs about the built environment and behaviors within that place and the people there (Bitner, 1992). Thus, the physical design of the space should promote users' cognitive, emotional, and physical comfort and meet their needs as it influences their behaviors in a particular environment (Bitner, 1992; George & Erwin, 2009). Conversely, stressful environmental conditions can harm occupants' behaviors and perceptions (Bitner, 1992).

In the present study, instructors' perceptions of traditional and Active learning classrooms have been studied concerning classroom design, choice of instructional methodology, interaction with students, use of technology, and autonomy. For instance, if the physical attributes of classroom design, such as furnishings, furniture layout, equipment, or the overall space design, provide comfort or create discomforting teaching experiences, how do these attributes impact their general cognition, emotions, and physiology concerning their instructional methods?

External Behavioral Response

The quadrant composed of overt behaviors considers the instructor's external behavioral response. Since behaviors are the range of actions of oneself towards others or in reaction to their physical environment, instructors' choice of the instructional method, use of technology, and social interaction with students within their current classroom is operationalized as external/

overt behaviors for the present study. According to Bitner, a space affects the form and duration of social interaction occurring within it (1992).

Since positive and negative effects of the environment lead to positive or negative user responses, the current study will investigate how the instructors perceive traditional or ACTIVE LEARNING CLASSROOM designs. Do instructors perceive the design creation of the classroom environment as supportive of their environment instructional methods or not? etc., as people's responses concerning a physical environment are both predictable and measurable. Furthermore, research evidence demonstrates that classroom designs influence teachers' choice of instructions, use of technology, and interaction with students in accomplishing teaching and learning outcomes in higher education (Altinbasak, 2016; Czarapata, 2014; Loundas, 2001; Michel, Cater, & Varela, 2009; Schultz, 2012; Scott-Webber et al., 2000; Weber-Bezich, 2014).

Value Dimensions

As per the sub-categories of value dimensions, the dimensions have been changed to institutional culture and personal autonomy. Highlighting the significance of institutional culture in light of physical design as a part of teaching and learning culture, organizational development specialist Fritz Steele mentioned that design "stimulates people to develop new skills, abilities, knowledge, and understanding so that they grow incompetence" (1986, p. 149). Steele reveals that as a part of the corporate (institutional) culture, learning institutions should provide a physical environment that reflects their institutional values and importance for teaching and learning and those who encourage and support the teaching and learning process.

Similarly, the personal values of instructors, such as autonomy, are also essential to consider for desired teaching and learning outcomes. According to Ryan and Deci, "autonomy refers to the human need to determine, control, and organize your behavior and goals, or to see

yourself as having control in your world" (2000, as cited in DeCuir-Gunby & Schutz, 2017, p. 59). Therefore, one cannot ignore the significance of autonomy (Ryan & Deci, 2000) and instructional methods such as team-based, problem-based, and collaborative learning. Educational researchers believe that human motivation and well-being fulfill the psychological need for autonomy (DeCuir-Gunby & Schutz, 2017).

Within the traditional instructional method, teacher-centered autonomy and control only occur in teaching and learning. Students have no control over their learning, whereas student-centered-autonomy focuses on ACTIVE LEARNING or similar instructional methods such as team-based learning, problem-based learning, collaboration, etc. Research shows that instructors who are "autonomy-supportive (in contrast to controlling) catalyze their students' desire for learning" (Ryan & Deci, 2000, p. 71).

Under this value dimension or future needs quadrant, the present research examined the design of classrooms concerning instructors' perceived autonomy and choice of instructional method regarding the role of the physical classroom attributes in the teaching and learning process. Moreover, the present study determined the University of Oklahoma's values related to classroom design for better teaching and learning and instructors' feedback regarding better future classroom designs. As mentioned earlier, figures four and five illustrate the components and conceptual diagram of the modified UEIF (Faisal, 2018).

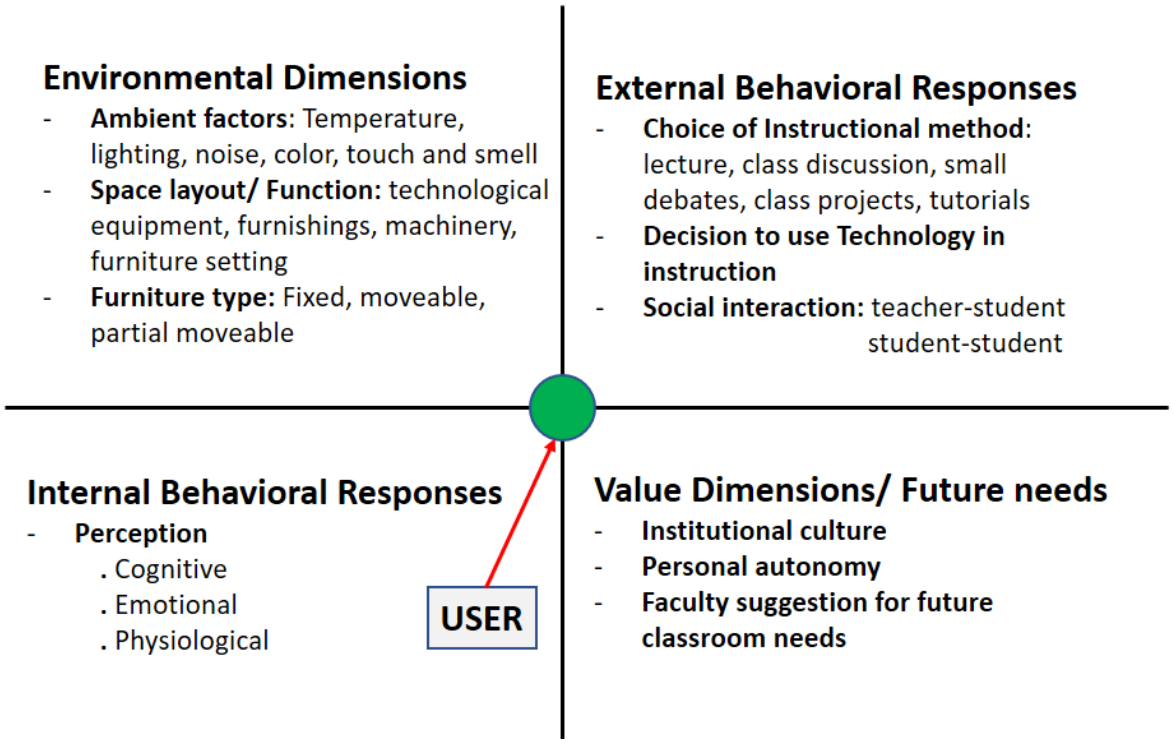


Figure 4. Modified User's Environment Interaction Framework (UEIF)
(Faisal, 2018)

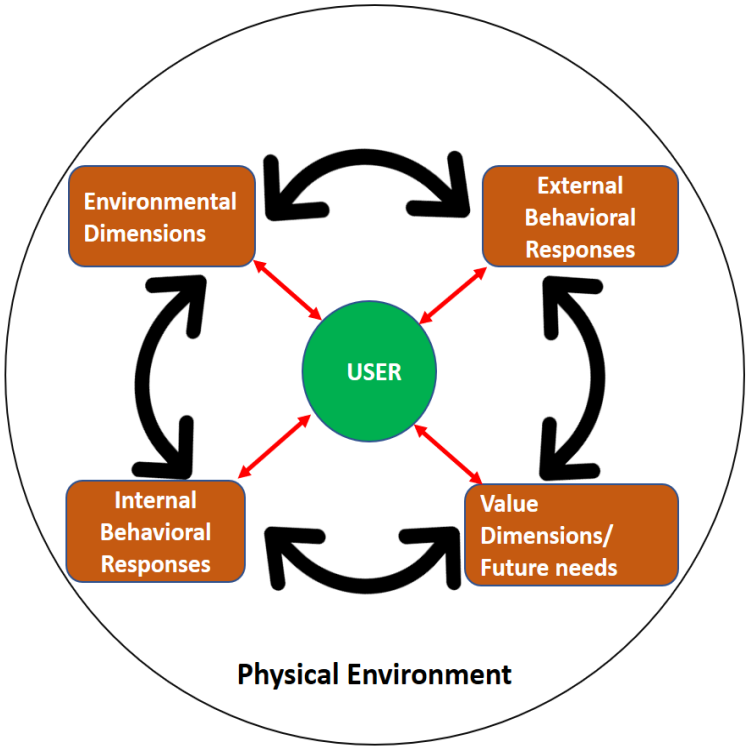


Figure 5. Revised Diagram of User's Environment Interaction Framework (UEIF) (Faisal, 2021)

Physical Classroom Environment Design concerning Instructional Methods

The defined environment has been widely used for several purposes across many disciplines, such as psycho-social environments, physical settings, and natural environments. The variance creates ambiguity and confusion (Heft & Wohlwill, 1991b). The current study operationalized the classroom environment as "the physical classroom setting and its physical components (Fisher, 2011, p. 3)."

The present study compared instructors' perceptions of their classrooms' physical design attributes, such as furniture arrangement, furniture type (moveable/ non-moveable/ partial moveable), and furnishings, based on their instructional methods. Guided by the perspectives of the environment-behavior model and various design frameworks and theoretical instructional approaches, figure six illustrates the conceptual diagram of the current study, showing the major constructs and their relationships.

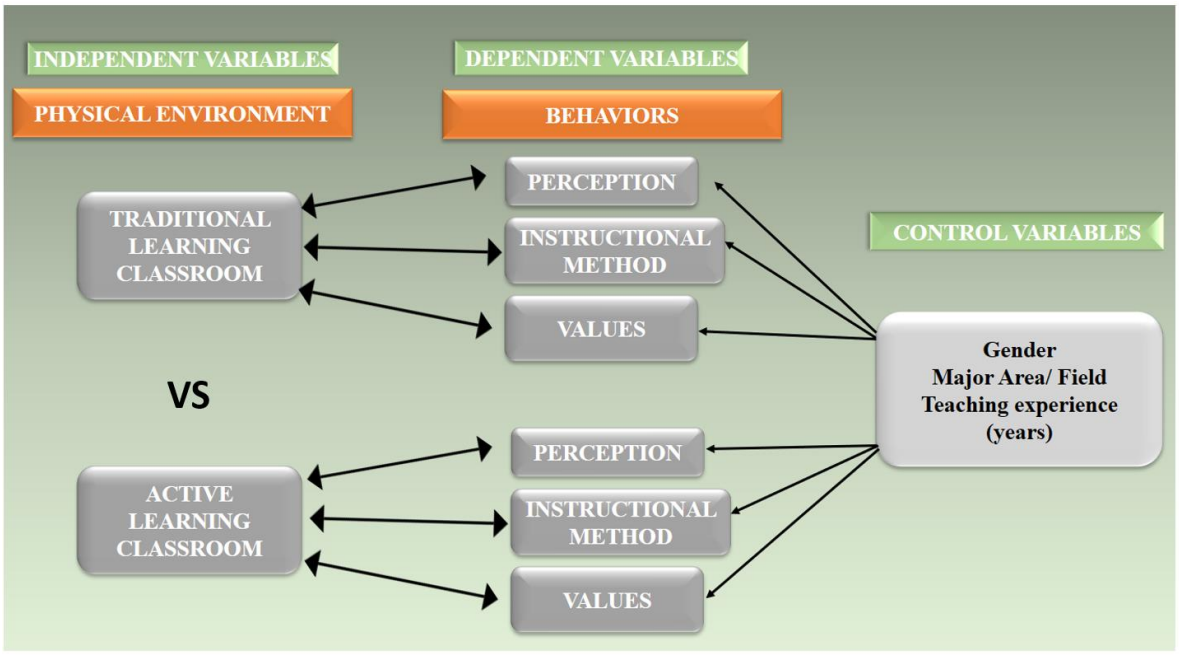


Figure 6. Conceptual diagram of the current study
(Faisal, 2021).

Chapter 2: Literature Review

History and Current State of Evidence-Based Design

Evidence-based design (EBD) is the process of design decisions about the built environment based on valid and reliable research for the best possible results (The Center for Health Design, 2020). Initially, other disciplines have used the evidence-based model and came up with the term evidence-based design to better guide decisions and practices in their particular fields. Evidence-based design is "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (Sacket, Rosenberg, et al., 1996, as cited in Friedow, 2012, p. 3). Practicing evidence-based design denotes implementing clinical expertise with the most proven research-based evidence available. According to the Center for Health Design (CHD), evidence-based design is based on evidence-based medical concepts (2020). Therefore, medical experts practicing the process can relate to the EBD process.

Although the evidence-based design movement started in the 1970s after Archie Cochran's book *Effectiveness and Efficiency: Random Reflections on Health Services* (Friedow, 2012), the book emphasized the 'evidence' concerning the built environment. Later, the study by Ulrich in 1984 on the role of natural view in patients' recovery was considered a pioneering work in the discipline now called evidence-based design (Friedow, 2012). The results of this evidence-based design study highlighted the therapeutic effects of natural views on hospital patients.

EBD Research and Interior Design Profession

EBD focuses on the built environment and other factors such as user comfort and safety, technology integration, care, and healing within environments. Numerous studies proved the built environment's impact on occupants' overall health and behavior. Kopec et al. (2012) also emphasized that the built environments lacking human interaction are meaningless. It is the responsibility of design professionals to make the most effective decisions related to our built environments. Therefore, acquiring evidence-based research knowledge, expertise, and professional experience is substantial for end-users life protection, safety, and well-being (Kopec, Sinclair, et al., 2012).

Design professionals have a long and prestigious history of designing environments. However, until recently, clients now demand credible data about building performance to justify the rising costs of design and construction projects. Therefore, to satisfy the design process's end-user, larger firms have started implementing rigorous research known as evidence-based design (Friedow, 2012; Kopec, Sinclair, et al., 2012). According to Hamilton and Watkins (2009):

> "If a modest change in practice can lead to better decisions, increased rigor, and the capture of relevant data that offer the potential for a competitive advantage, design practitioners would be well advised to adopt an evidence-based model. If widespread use of such a model improves the credibility and prestige of the profession, the leadership of the field should encourage its adoption. If such a model improves the standing and performance of the profession, the structure of professional education must adapt" (p. 6).

Kopec, Sinclair, et al. (2012) further elaborated that design research is a systematic process composed of an inquiry method, data collection, and analysis, along with a presentation of findings that guide design decisions. Collaboration among healthcare organizations, design professionals, and researchers must incorporate these steps into practice (Friedow, 2012). Evidence-based design is a practice that infuses these philosophies, targets, and expected results during building planning, designing, and running. EBD shows an organization's potential for change and a readiness to measure and face the results of measurement (Debajyoti 2011).

The sole purpose of design research involves reducing uncertainty when designing environments and facilitating crucial design decisions (Kopec, Sinclair, et al., 2012). In short, applying information from design research leads designers to make better design decisions. Design research emphasizes answering essential questions that designers come across during the design process, and it is applied to the design (Kopec, Sinclair, et al., 2012). The interior design industry is adopting evidence-based design to create successful commercial and residential projects. Therefore, it is vital to consult an interdisciplinary team of researchers before conducting research and drawing evidence-based conclusions (Friedow, 2012).

Interior designers spend most of their time designing building spaces through visual media, which contributes to why a few designers are into research writing (Friedow, 2012). There is a good literature volume from design professionals related to healthcare design (Friedow, 2012). However, there has been a modest amount of research on EBD in education. Evidence-based design research can help provide evidence of shortcomings in classroom design for better teaching and learning outcomes. However, it has always been a challenge for design practitioners to develop the tools to interpret the concepts of environment and human behavior in their work. "The basic purpose of design research is to reduce uncertainty or error when

designing environments for human occupation and aid in making crucial design decisions"; though not guaranteed, research can facilitate uncertainty reduction (Kopec, Sinclair, et al., 2012, p. 3). Design research differs from scientific research in the pursuit of evaluating and understanding the phenomenon of the physical environment in a systematic way (Kopec, Sinclair, et al., 2012). EBD researcher intends to understand research methodologies by evaluating the built environment's post-occupancy performance results (Friedow, 2012).

Physical Environment and Human Behavior

Environmental researchers have emphasized how space users respond to complex everyday scenarios (Steg & Reser, 2011). Every person's adaptation and response to environmental cues differ, and so does their environmental awareness of space's physical attributes (Steg & Reser, 2011). Steg and Reser (2011) further argue that every individual's environmental perception depends on personal and cultural differences and experiences. Thus, the same environment is often interpreted differently by people.

Numerous studies have highlighted the significance of understanding human experience and responses to different environments. According to Friedow, human experience in an environment is of both physical and social nature, from things to events that "are transformed through human perception" (Friedow, 2012). Simultaneously, physical and social environments and activities transform humans (De Botton, 2006). Therefore, every individual perceives the physical and social environment differently based on past experiences, affecting their behavior (Friedow, 2012; Zeisel, 2006). To understand this complicated environment-human behavior relationship, environmental researchers must investigate human behaviors in different physical environments. The current research strived to examine the impact of physical design attributes of traditional and active learning classrooms on teachers' teaching methodologies.

The physical design attributes of a learning space affect student and teacher outcomes as a whole (Steg & Reser, 2011). Since the learning space's interior design influences student learning and teachers' teaching methodologies, special attention should be given to furniture arrangement and furnishing the space for the overall academic performance and related behaviors (Steg & Reser, 2011). Since several variables contribute to a particular behavior, experimental design research should aim to understand behavior and make better design decisions related to a built environment. Therefore, evidence-based design researchers investigate individuals' perceptions related to their environment. These responses will provide in-depth information regarding people's values and standards (Friedow, 2012).

Numerous researchers have highlighted the relationship between different classroom arrangements and educational achievement (Altinbasak, 2016; Ge et al., 2015; Scott-Webber et al., 2018; Tookaloo & Smith, 2015) depending upon the academic level and the type of teaching methodology (Steg & Reser, 2011). For instance, crowding can hinder teaching and learning involving classroom activities and physical movement around the setting. Similarly, classroom space also affects student and teacher behaviors (Steg & Reser, 2011). Researchers believe that various furniture layouts can best achieve a satisfying physical arrangement; however, it cannot be achieved without the willingness of school authorities and feedback from teachers and students.

Post-Occupancy Evaluation (POE)

The Post-Occupancy Evaluation (POE) process systematically evaluates users' perspectives about the built environment (Preiser, Raboniwitz, & White, 1990). In other words, the POE process is a systematic research process that can help gather information on how well the built environment meets the user's needs (Friedow, 2012). Preiser (1995) describes POE as

an investigative tool for designers to evaluate a project. POE helps "to identify problem areas in existing buildings, to test new building prototypes and to develop design guidelines and criteria for future facilities" (Preiser, 1995, p. 15). POE mainly helps gather information concerning the positive and negative aspects of built design to improve future projects, which were higher education classrooms for the current research.

Nowadays, classroom environments are expected to be comfortable, safe, and adaptable to users' needs. However, most educational facilities are constructed based on previously developed design standards that typically do not meet the requirements of new pedagogical methods and user needs (Tookaloo & Smith, 2015). Today, people expect more than just safety and comfort from a building. They want built environments to be more efficient and adaptable to their needs, such as rearranging layouts or furniture, moving writing boards, etc. Therefore, post-occupancy evaluation is conducted to evaluate the building's performance through continued development, to make the built environment a better fit for its occupants, enhance their comfort, and reduce energy consumption (Tookaloo & Smith, 2015).

Post Occupancy Evaluation and Learning Environment

According to Tookaloo and Smith (2015), educational environments' Post-Occupancy Evaluations (POE) have always supported an institution's educational goals. The emphasis of the academic environment's POE is to assess user needs, experience, and value concerning these environments' physical attributes (Tookaloo & Smith, 2015), which was also the goal of the current study. Evaluation of learning spaces within educational institutions has significantly contributed to continuing POE's methods development, as it provides both subjective and objective analysis of the built environment (Tookaloo & Smith, 2015). Thus, the information

collected from the POE of educational settings informs planning, design, and pedagogical practices throughout the whole evaluation process (Scott-Webber et al., 2018).

A rich body of academic research strives to understand the complex relationship between the design and occupants of built environments (Jones & Grigoriou, 2014; Watson, Evans, Karvonen, & Whitley, 2016); especially over the last three decades, numerous quality design studies have addressed a variety of research on the impact of design on occupants' productivity in commercial workspaces, student attendance and retention, care facilities, and user satisfaction (Altinbasak, 2016; Armitage & Murugan, 2013; Baird, 2010; Leaman & Bordass, n.d.; Barnes, 2002; Barrett, Zhang, Davies, & Barrett, 2015; Durán-Naracki, 2008; Ulrich, 2008). Recently, Lennie- Scott Webber, along with other researchers, has also significantly contributed to student engagement by using post-occupancy evaluation strategies to understand the impact of learning spaces' design on student engagement behaviors (Scott-Webber, Mashall-Baker, & Abraham, 2000; Scott-Webber, 2014; Nissim, Weissblueth, Scott-Webber & Amar, 2016; Kilbourne, Scott-Webber & Kapitula, 2017; Scott-Webber, Konyndyk, French, Lembke, & Kinney, 2017).

After reviewing published literature on POEs, it was found that most post-occupancy evaluations of academic environments were conducted as a joint effort of educational institutions, design professionals, researchers, furniture manufacturers, and support from government entities. The University of Minnesota, The University of Colorado, The California State University, The University of Florida, The University of Missouri-St. Louis, etc., are also common examples that conducted research studies to investigate occupants' experiences within the learning environment. There are numerous other examples of POE research projects jointly undertaken by university researchers and architectural schools. Results were consistent with other institutions' user experiences. Teachers and students indicated easier student-teacher

interaction and collaboration and better comfort within active learning classrooms than in traditional classrooms (Weber-Bezich, 2014).

Even though POEs have been widely conducted worldwide by numerous academic and government institutions, it is still common to understand that the POE is extensively acknowledged but then hardly practiced. The reasons for the lack of application are lack of funding, time and commitment by design professionals and researchers, lack of expertise or professional help, lack of interest from the academic administration, etc. However, the biggest obstacle to POE research is that architects and design professionals do not want to compromise their reputations and avoid litigation.

There is a continued need to conduct post-occupancy evaluations for the educational environments to investigate physical design influence on the space users. The prime benefit of POE is its capability to collect valuable evidence that contributes to continuous improvement (Zimmerman and Martin, 2001). It is believed that the information obtained through POE can enhance the productivity of the occupants using the facility (Cohen et al., 2001; Gonzalez et al., 1997). Research suggests that users' satisfaction and feedback regarding educational environments' performance help prepare university administration and designers for better programming and planning of future projects and "the quality of design standards in higher education" (Tookaloo & Smith, 2015). However, just like the evolution of classroom design, it is essential to understand how teaching and learning paradigms shifted over time to evaluate learning environments better.

Paradigm Shifts in Teaching and Learning

To facilitate learning, educators benefit from the verified instructional strategies and techniques provided by the learning theories (Ertmer & Newby, 2013). Researchers say that the

learning process has significant implications based on situations educators desire to facilitate changes in people, like what and how people learn (Ertmer & Newby, 2013). There has been a significant revolution in learning theory (Jonassen, 1991). Around the mid-nineteenth century, learning psychology went through a paradigm shift, "in which theories and models of learning from the cognitive sciences are now more commonly used to explain learning processes than the behavioral explanations they supplanted, especially those that require higher-order thinking" (Jonassen, 1991, p. 5). Several scholars in education have addressed the paradigm shift in teaching and learning and its implications for the educational system (Jonassen, 1991).

The history of American schoolhouses reveals that the change in education was due to social, economic, and political changes. Numerous factors have changed the old one-room schools into classrooms today (Cullen, 2016). The evolution of educational goals and philosophies and the cultural background have significantly influenced the physical design, symbolism, and classroom layout of today's school buildings (Eberhard, 2009). Learning theories have undergone several developmental phases after evolving from philosophical writings by the founders of social sciences (Cullen, 2016). These developments led to new learning theories that helped identify students learning in different environments and instructional methods.

Overview of Learning Theories

Learning theories are generally divided into different paradigms, such as behaviorism, cognitivism, constructivism, humanism, etc. (Learning Theories, 2015). However, behaviorism and constructivism are commonly discussed schools of thought (Jonassen, 1991).

Behaviorism

During the early 19th century, behavioral laws introduced one of the most dominant conceptions of learning. This traditional education system promoted "the purposeful manipulation of students toward predetermined ends and ignored the experience of the students themselves, viewing it as a contamination of the process" (Hopkins, 1994, p. 3). According to behaviorism, learning is a change in behavioral characteristics, where learning behaviors "can be shaped by selective reinforcement" (Jonassen, 1991, p. 5). In other words, Behaviorists believe that learners learn only through observation because they equate learning with behavioral consequences, either positive or negative (Jonassen, 1991; Ertmer & Newby, 2013). Behaviorists excluded the role of mental processes and further emphasized that positive reinforcement increases the chances of reoccurring behavior, whereas negative reinforcement reduces those chances (Jonassen, 1991; Ertmer & Newby, 2013).

Behaviorist teachers do not attempt to explore the basis of students' knowledge nor assess their necessary mental processes (Ertmer & Newby, 2013). Students are considered reactive to different conditions within an environment rather than active members exploring the environment. Lectures and exams are the common examples associated with the Behaviorist approach to education, which is a part of many educational settings of today (Cullen, 2016). As stated by Jonassen, in learning psychology, "the exclusion of the mind from the learning processes by behavioral laws was a primary theoretical cause of the paradigm shift" (1991, p. 6).

Behaviorist Theory of Learning

As mentioned earlier, the main focus of the Behaviorist paradigm is on the consequences of positive or negative reinforcement that shapes the behavior of learners and the likelihood of reoccurrence of that particular behavior. Moreover, no attempt is made to understand and

structure the mental processes necessary to use during the learning process. The Behaviorist instructional method is characterized by lecture-style teaching and learning. Behaviorist instructors prescribe strategies they consider most helpful in building the stimulus-response relationship in the teaching and learning process (Ertmer & Newby, 2013). These strategies are believed to help students learn different skills, such as recalling facts, defining and illustrating other concepts taught, etc. (Ertmer & Newby, 2013).

However, acquiring higher-level learner skills demands critical thinking, discussion, problem-solving, etc., which are not adequately explained in the behavioral principles (Ertmer & Newby, 2013). Instead, the emphasis of Behaviorist principles is "on producing observable and measurable outcomes in students" through the utilization of reinforcement to affect their performance" (Ertmer & Newby, 2013, p. 49). The goal of the Behaviorist instructional paradigm is to provoke anticipated behaviors and responses from the learners when they are presented with the target stimulus (Ertmer & Newby, 2013). Therefore, these instructors prefer uniform instructional methods using standardized assessments, ensuring students' performance on pre-structured grade levels as mastery of skills and knowledge (Tollefson & Osborn, 2007). In these typical classroom environments, teachers control the content, the students' learning pace, and the classroom's physical setting with minimal flexibility (Hensley-Pipkin, 2015). Traditional teaching leads to passive learning because the classroom's physical setting hinders social interaction. Students' desks are arranged in row-and-column style, facing the teacher to the front for minimal interactions and distraction (Barbash, 2012), highlighting the belief that the teachers control the learning pace.

Even though this traditional learning environment has cons, such as minimal social interaction, repeated memorization, and the least provided opportunities to explore different

concepts, research shows pros to this traditional education. Researchers found that students who received lecture-style instruction received higher scores in standardized exams and learned more than those who were engaged in solving problems independently (Schwerdt et al., 2011). One explanation researchers give for such findings is that many teachers are more comfortable with the traditional teaching style while lacking the understanding of implementing and guiding constructivist style problem-based teaching and learning (Hensley-Pipkin, 2015).

Despite being valuable to students in the past, research suggests that traditional education, which focuses on factual memorization, may not facilitate students learning 21st-century skills (Hensley-Pipkin, 2015; Schwerdt et al., 2011).

Constructivism

Contrary to the Behaviorist education paradigm, constructivist teaching and learning demonstrate new and creative teaching and learning tactics (Brooks, 1999; Hensley-Pipkin, 2015). Constructivism associates learning with the search for meaning (Jonassen, 1991). The learner constructs the reality in their mind, where it is not waiting to be attained by the learner (Jonassen, 1991). This construction of reality is possible by engaging in those mental activities (Jonassen, 1991). In other words, constructivists believe the learners create that meaning of knowledge through their own prior experiences and beliefs (Jonassen, 1991; Ertmer & Newby, 2013).

During the 1990s, constructivism gained popularity as a new teaching and learning approach (Bonwell & Eison, 1991). A Constructivist instructor provides students with the opportunity to analyze facts. After critical thinking and discussion, a constructivist instructor creates an understanding of the information (Cullen, 2016). According to constructivism, "learners can only interpret information in the context of their own experiences, and that what

they interpret will, to some extent, be individualistic" (Jonassen, 1991, p. 11). Since the students will only interpret instructions based on their understanding, needs, and experiences, attention should be given to providing tools and environment through education to facilitate learners to interpret numerous world perspectives on their own (Jonassen, 1991).

Constructivism in education is an approach to facilitating spontaneous learning along with meeting learning standards and acquiring current skills to be productive in the field (DeVries, 2012; Hensley-Pipkin, 2015). This approach is also known as active learning, as it engages students in performing tasks and thinking about those tasks (Bonwell & Eison, 1991). Like other learning theories, there are multiple philosophical viewpoints of constructivism, especially in Piaget, Bruner, and Goodman (Ertmer & Newby, 2013). In recent years, it has received considerable attention from different disciplines.

Constructivist Theory of Learning

Derived from the constructivism paradigm, a more recent development in cognitive psychology is the Constructivist learning theory. This theory attempts to "explain how people come to know what they know" (Krahebuhl, 2006, p. 97). As a theory of knowledge and cognition, constructivism grew from Piaget, Vygotsky, and Dewey (Fisher, 2011). These leading educators considered constructivism the most efficacious educational approach (Fisher, 2011). Behaviorism is a passive approach and is also referred to as the traditional teaching and learning method (Altinbasak, 2016; Collins et al., 1991; Cullen, 2016; Weber-Bezich, 2014). Contrary to that, constructivism is considered an active approach to teaching and learning that encourages discussions and activities (Bonwell & Eison, 1991; Schunk, 2012; Altinbasak, 2016). Contrary to the Behaviorist approach, the Constructivist viewpoint revolves around the relationship between an individual and their physical environment and the social situations they

encounter (Schunk, 2012). According to Schwartz, Lindgren, and Lewis, "constructivism is a theory of knowledge growth and lifelong development built on a philosophy of pragmatism" (as cited in Tobias & Duffy, 2009, p. 34). This instructional method aims to "map the structure of the world onto the learner" (Jonassen, 1991, p. 10). During the Constructivist movement, there was a shift in instructional focus. The knowledge transmission style of behaviorism was changed to students learning through personal experiences of exploring, thinking, and creating.

Constructivists consider humans as perceivers and interpreters of an environment who create their reality through critical thinking and different mental activities (Jonassen, 1991). This teaching and learning approach encourages students to think critically, experiment, and make conclusions. This learning paradigm discouraged lectures and instead supported any teaching and learning approach that promotes the acquisition of knowledge by students (Weber-Bezich, 2014). Brunning, Schraw, and Ronning (1995) developed four main characteristics of constructivism that are believed to influence learning based on the Constructivist model, as shown in Figure 7. These four characteristics are considered the driving forces for the development of constructivist teaching methodology (Brunning et al., 1995).



Figure 7. Main Characteristics of Constructivism
(Brunning et al., 1995)

One of the most dominant aspects of this contemporary education is "student-centered" education. Therefore, higher education educators have started to reimage education objectives from the student-centric point of view (Krahenbuhl, 2016). Educators should now design "student-centered instruction" based on constructivism to maximize students' potential for learning, deep understanding, and future success. According to Richardson (2003), Constructivist pedagogy revolves around student learning and their interests.

A Constructivist approach to teaching encourages instructors to flexibly embrace and apply Constructivist principles depending on students' populations (Brooks, 1999). Principles of Constructivist learning theory help engage learners in different problem-solving exercises,

experimentation, trial and error, and interaction with peers and instructors through a flexible physical setting (Hensley-Pipkin, 2015). Constructivist educators take learning as a consistently adjusting mental model that facilitates new knowledge (Hensley-Pipkin, 2015). The teaching material introduced within the Constructivist-based classrooms motivates learners to see its relevance to their past knowledge and experiences (Hensley-Pipkin, 2015). All participants' active communication and participation reflect social and practical learning (Hensley-Pipkin, 2015). "Constructivist learning theory is based on the idea that the most meaningful and long-lasting learning occurs when a person is fully engaged in a given activity" (Fisher, 2011, p. 9).

According to Jonassen et al. (2003), technology-based environments are Constructivist learning environments where students are presented with problem-based projects that engage them with cognitive tools, information resources, learning strategies like scaffolding, etc. "Constructivist learning environments are student-centered and learner-controlled environments, emphasizing student responsibility and initiative in determining learning goals and regulating their performance toward those goals, not just determining the path through a prescribed set of learning activities" (Marra, 2005, p. 139). Constructivist instructors use classroom technology to promote student interaction and collaboration and encourage engagement through different group activities.

Teachers who embrace the Constructivist theory of learning aim to guide students towards gaining a deep understanding of the subject matter being taught and developing necessary skills for future success (Hensley-Pipkin, 2015). In this learning environment, the goal is to foster students' intrinsic motivation for care and responsibility (Dewey, 1987). It leads to critical thinking, communication, and cognitive skills, and learning becomes a self-motivated endeavor (Hensley-Pipkin, 2015).

Comparison of Learning Paradigms

The two opposite theories (Behaviorist and Constructivist) are commonly practiced in the university setting. "Transmission modes of instruction, such as lecture, are congruent with objectivism whereas Constructivist learning environments are an example of a learning activity congruent with constructivism" (Marra, 2005, p. 140).

Decades ago, there was a shift from a traditional learning environment to a Constructivist learning environment. Barr and Tagg (1995) have also discussed this paradigm shift within the educational system in their article *From Teaching to Learning – A New Paradigm for Undergraduate Education*. However, today this shift is not limited to undergraduate education and takes place at the graduate level. Barr and Tagg (1995) highlight the paradigm shift by referring to behaviorism as an approach that provides instruction, whereas the Constructivist approach tends to produce learning. In other words, they named the traditional paradigm the "instruction paradigm" while the Constructivist paradigm the "learning paradigm."

Explaining the purpose of this shift from teaching to learning, Barr and Tagg (1995) stated that the Learning Paradigm facilitates uninterrupted productivity improvement. Contrary to that, the Instruction Paradigm promotes institutions to optimize faculty well-being and success. They further compared the teaching and learning frameworks of both paradigms, that instructors and students act isolated and independent in the instructional paradigm. In contrast, the learning paradigm directly engages instructors and students to collaborate in teams and groups (Barr and Tagg, 1995). They also reminded educators that the learning paradigm's mission is to provide an environment for students that promotes discovery and knowledge construction through critical thinking and problem solving, opposing the instructional paradigm (Barr and Tagg, 1995). However, Windschitl (2002) argues that Constructivist-oriented

epistemology is vital yet lacks ideal circumstances for a teacher to design and apply constructivist ideas in the classroom. Constructivist instructors also strive to provide classroom spaces that facilitate students' needs and interests, intending to involve them in active learning to promote skill and knowledge development for future success (Hensley-Pipkin, 2015). Research suggests that it would be valuable to examine the association between teaching practices and learning space design (Hensley-Pipkin, 2015).

Design of Classroom Spaces

At higher education institutions, learning spaces are most commonly classified as formal and informal learning spaces. Classrooms are typical examples of formal learning spaces, whereas indoor spaces such as libraries, study halls or rooms, lobbies, and different outdoor areas are informal learning spaces. Even though researchers from diverse backgrounds conceive the classroom space or a learning space distinctively, they mostly agree on one point, that classrooms are places where teachers and students strive to make students efficient problem-solvers and active learners (Altinbasak, 2016). More importantly, the classroom environment should demonstrate the educational philosophy that plays an active role in the educational process (Altinbasak, 2016). Yet, at the same time, they are complex environments comprising diverse aspects and variables, as shown in Figure 8.

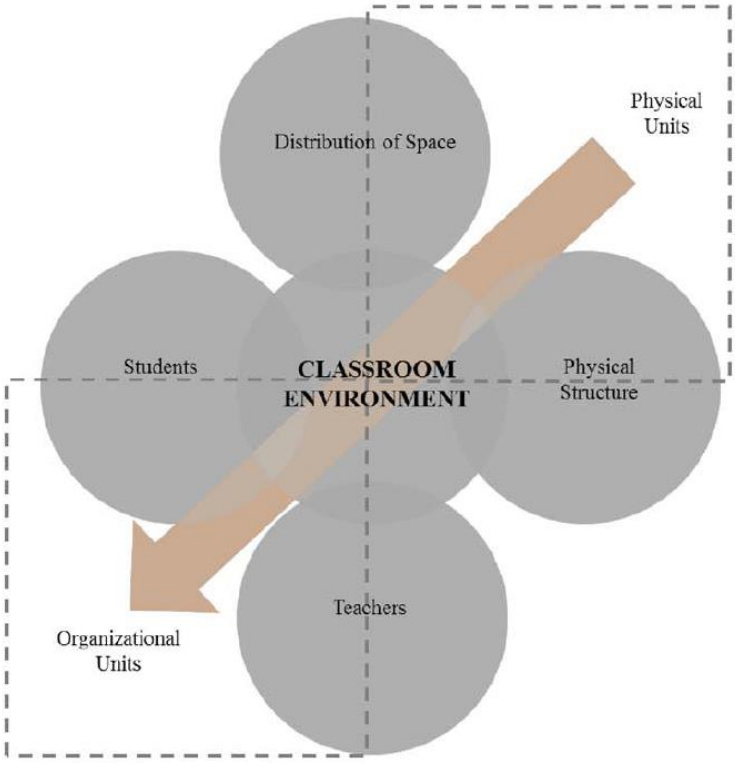


Figure 8. Main Units of the Classroom Environment
(Altinbasak, 2016)

Diverse disciplines are concerned about how users interact with classrooms' physical environments, such as how classroom environments are affected by users and the way users affect these environments (Czarapata & Friskney, 2014). For the past three decades, design, environment-behavior, and education researchers have focused on the impacts of learning spaces on pedagogy and student learning through engagement. According to Czarapata and Friskney (2014), the purpose has been to assess factors that facilitate instructors and students in teaching and learning. They further emphasized that learning spaces should not be ignored as a vital contributor to the education process (Czarapata & Friskney, 2014).

Designing an attractive learning space through the way furniture is arranged and using lighting, and acoustic properties are some factors that have been identified to affect student achievement (Czarapata & Friskney, 2014). Yet, it is still hard to find conclusive research on the

classroom's physical factors that lead to quality teaching and learning. Martin (2006) explained a few reasons for this problem, which are still valid. Some of which are;

1. There is a lack of agreement on the classroom's physical and social environment, teaching strategies, and values.
2. Learning processes and outcomes are still challenging to measure.
3. Inconsistency in the physical characteristics of school environments.
4. Diversity in students and teachers is related to their preferences, educational needs/ goals, and teaching styles.

Therefore, it is vital to understand the different types of higher education classroom spaces in terms of their physical design and how they influence users, especially instructors' instructional methodology.

Traditional classroom

History of Classroom Design. The classroom's physical environment conveys the educational philosophy of teachers' teaching approach and students' learning (Park & Choi, 2014). Since classroom spaces can either obstruct or enable various teaching-learning styles, there has been a change in the classroom design over time to facilitate educational purposes and methods (Park & Choi, 2014).

Back in ancient Greek times, the rhetorical instructional style was followed, where their students surrounded teachers during educational dialogues (Park & Choi, 2014). Instead of a distinct boundary, teachers and students are grouped in a conveniently available space with no regular pattern, as shown in Figure 9 (Park & Choi, 2014). On the other hand, the medieval university first used a more structured educational space. During this time, cathedral schools

used vertical lines of furniture facing each other, which monks and nuns used further on a large scale, as shown in figure 9 (Park & Choi, 2014). Just as the spatial patterns evolved, these dedicated spaces became necessary during the age of medieval universities (Park & Choi, 2014). Instructor lecturing the students was the only mode of information transfer as books and paper use was rare.

During the industrial period, there was an increase in demand for larger lecture rooms to accommodate a rising number of enrollments, as depicted in Figure 9. Till the 19th century, these traditional classroom designs continued to follow the instructional model, "place-bound, role-bound, time-bound, and efficiency-bound" (O'Banion, 1997, p. 9). During this period, a typical lecture hall with a row-and-column seating arrangement faced the instructor, teaching from the front of the room. These types of classrooms represent the philosophy of behaviorism, which focuses on lecture-style teaching and learning where instructors tend to prefer uniform instructional methods using standardized assessments, ensuring students' performance on pre-structured grade levels as mastery of skills and knowledge (Tollefson & Osborn, 2007; Park & Choi, 2014).

To date, this row-and-column seating layout is the most common classroom design in higher education institutions. However, at the advent of the 20th century, the educational emphasis on memorizing facts and knowledge shifted to critical analysis and problem-solving skills development. Students' development of these skills helps them grow professionally, which is often hindered in a traditional row-and-column classroom (Altinbasak, 2016; Hensley-Pipkin, 2015). Therefore, this spatial issue has recently become a challenge for higher education institutions, and universities are striving toward new classroom design development for better teaching and learning outcomes.

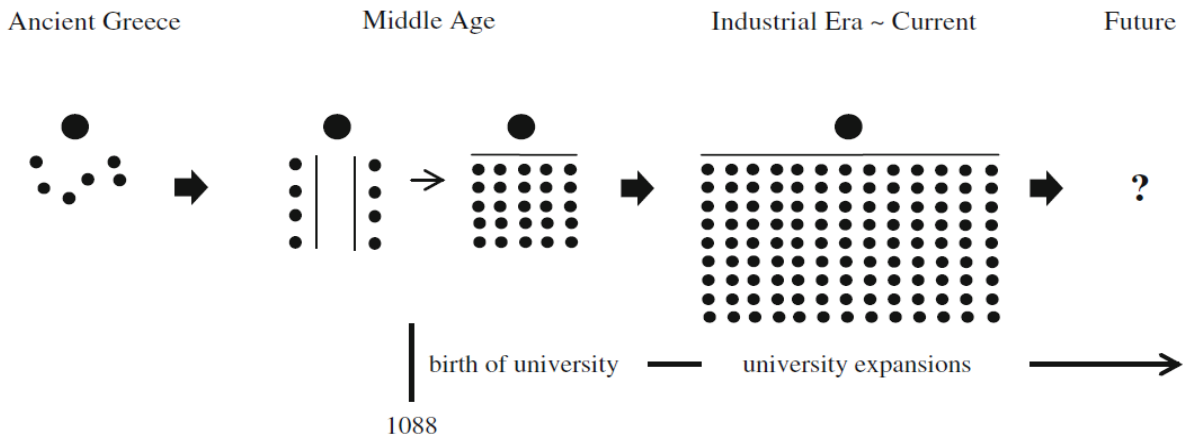


Figure 9. History of Changes in Classroom Design
(Park & Choi, 2014)

Even though the constructivist learning theory evolved around the 20th century, higher education institutions still use traditional classroom designs as a formal learning space. These spaces only support instructor lectures rather than active and collaborative learning. Most commonly, traditional classroom spaces hinder flexibility by limiting the opportunity to interact and collaborate between student-student and student-teacher interaction. Tapscott (1988) described a traditional classroom as "students taking the information they gather through lecture and presentation methods and storming it into memory as they in one direction, facing the instructor" (p.129). According to Dale, lecture-style instruction involves passive student learning (1969). Dale further elaborated that those students retain only 50% of the classroom information after two weeks of lecture-style instructional methods.

According to the philosophy of environmentalism, occupant behaviors are impacted by the physical environment in which it takes place (Strange & Banning, 2001). Therefore, the classroom's physical design can direct individuals on what they can do within that space (Peterson, 2020). For example, a traditional row-and-column classroom design gives students and instructors a message that this is a passive classroom and does not support interaction or

collaboration (Peterson, 2020). Within this traditional classroom setting, the instructor is the primary source of all the knowledge and authority, whereas students are passive recipients of the knowledge (Peterson, 2020). Students may also not feel obligated to collaborate and participate in traditional classroom settings.

Instructors must share power and authority with students for better teaching and learning outcomes (Peterson, 2020). For the past three decades, this shift in knowledge acquisition and authority has been the source of changes in instructors' roles in the classroom (Peterson, 2020). Nowadays, higher education institutions are investing in creative and innovative learning space designs through a change in the physical classroom setting. This change aims to promote active teaching and learning that will help evolve from the industrial economy with passive education to a knowledge-based active education system (Peterson, 2020), for instance, switching from traditional row-and-column to flexible furniture arrangements.

Research suggests that comfortable and flexible furniture arrangement promotes active learning by encouraging interaction and collaboration among students and teachers. Strange and Banning (2001) also emphasized that better teaching and learning outcomes can be expected when the classroom's physical environment supports desired occupant behavior. Currently, designers and researchers are helping higher education administrations design 21st-century classrooms with the idea that a well-designed physical learning space is essential to better teaching and learning, which can be achieved by switching from traditional to active learning classroom layouts. Therefore, there is a need to conduct extensive research on the relationship between the physical space and social interaction for learning, focusing on how classroom design can promote better teaching and learning (Peterson, 2020). Research suggests that change in

traditional classroom layout can promote interactive teaching and learning, so there is a need for more research to assess the impact precisely.

A review of previous research and current experiences in educational settings shows that education and the physical environment have both compound and interactive relationships (Woolner, McCarter, Wall, & Higgins, 2012; Altinbasak, 2016). This interaction occurs both ways, with the users' ability to positively change their environment to improve the teaching and learning experience. Therefore, it is essential to empower teachers to alter classroom settings that suit their teaching (Horne-Martin, 2006). In this area of research, the challenge lies in understanding how the classroom's physical attributes interact with teaching and learning. There has been substantial research investigating students' and teachers' preferences about classroom size. However, there is a need for further research to understand different classroom designs and their role in teaching and learning, as research has shown that the physical settings of a classroom affect students' and teachers' behavior (Altinbasak, 2016; Ge et al., 2015; Weber-Bezich, 2014; Weinstein, 1992).

Instructors and students should feel emotionally attached to the learning spaces. They should feel welcomed and relaxed in the classroom through a furniture layout that does not hinder their educational goals. However, a traditional learning classroom (TLC) with all front-facing furniture signals that students need to sit quietly while listening to the instructor, whose expectation to implement team-based activities would be hindered by the row-and-column furniture setting (Peterson, 2020). The traditional classroom design does not support the constructivist movement for active and collaborative learning. Therefore, it is crucial that the classroom design support 21st-century educational needs.

Active learning classroom

Currently, numerous post-secondary institutions are implementing innovative design classrooms to replace the traditional classroom setting (Altinbasak, 2016; Bezich, 2014; Khamitova, 2022). Some institutions call them active learning classrooms (ALC) (Bezich, 2014). These classroom spaces are mainly designed to promote interaction and collaboration among students. The ALCs are furnished with large tables allowing several students to sit facing each other (Ge et al., 2015). LCD, microphones, and numerous writing surfaces are ALC equipment (Ge et al., 2015). The general classroom's furniture arrangement facilitates group work, promotes student-student interaction, and engages students in problem-solving and critical thinking activities (Ge et al., 2015). The design of ALCs accommodates diverse instructional approaches (Painter et al., 2012).

Similarly, classroom environments that include active learning engage students in their education, encourage 'doing' with understanding, provide them with opportunities to revise and improve their thinking (formative assessment), and help them connect the information from the classroom to practice in the outside world. (Amburgh et al., 2007). The success of any design depends upon the degree to which it creates an interface between users and the environment (Eddidla, 1998). The advantages of active learning are numerous. Integrating active-learning strategies into the classroom results in a strong teaching model because active learning promotes material application while still being presented. Active-learning techniques engage students more deeply in learning course material than the traditional lecture style by encouraging critical thinking and fostering the development of self-directed learning. (Amburgh et al., 2007). Several empirical studies suggest that a classroom's physical attributes can influence not only student learning but also the instructor's instructional methodology (Altinbasak, 2016; Brown &

Long, 2006; Chism, 2006; Chism & Bickford, 2002; Ge et al., 2015; Lomas et al. 2006; Oblinger 2006). ALC spaces and furnishings designs enable students to develop instructional goals through active communication, collaboration, problem-solving, and teamwork (Paul et al., 2014). Active learning classrooms allow instructors to assign students activities to practice these skills for better learning outcomes (Paul et al., 2014).

When instructors are given the freedom to involve in practices considered most effective and valuable, it is best to examine the relationship between the physical classroom's physical design attributes "and its use as a teaching and learning tool" (Hensley-Pipkin, 2015, p. 44). Research suggests that when both classroom design and the instructional methodology promote active learning, it boosts confidence, problem-solving, and team skills among students that are needed professionally (Hensley-Pipkin, 2015). Instructors in higher education institutions must be well trained to implement constructivist instructional approaches while efficiently utilizing physical design attributes of active learning classrooms to promote interaction and engagement among students. Wolf (2002) also highlighted that when the physical classroom design attributes align well with the active instructional approaches, teachers and students feel confident and demonstrate positive academic outcomes.

The idea of active learning classrooms and its benefits may not be new, but the academic administrators still need to know a lot about the significance on ALCs. More than a decade ago, research conducted by Paul (2003) also emphasized that the teaching and learning trends are changing, as are the tools and the physical classroom setting. Paul conducted an experimental study to investigate the impacts of change in teaching methodology by altering the traditional classroom furniture, to increase in-class collaboration and visual display. Paul utilized different layouts with multiple projectors placed for better visual presentation. Findings from the

observations were noteworthy. He found that incorporating user-centered designed furniture in classrooms and changes in classroom layouts significantly affected student interaction and engagement, which led to active student learning. He also found that changes in the classroom's physical environment led to modifications in teaching methodologies. He concluded that it could become a strategic asset for educational institutes if user-centered design furniture is employed.

A few physical environmental modifications have been made to classrooms to increase teaching and learning success. The relationship between the users and the classroom environment must be better understood to promote better academic outcomes. One potential area that needs to be explored even more is the role of classroom furniture layout. The furniture setting in each classroom should facilitate learning while allowing appropriate participation without distractions (Ivory, 2011). Similarly, there still lacks sufficient research on which classroom design aspects impact students and teachers to achieve their educational goals (Ge et al., 2015).

Especially after the pandemic, there has been increasing interest in the relationship between the designed environment and human behavior. The built environment itself also influences human behavior. Both mental and physical stimuli affect behavioral responses (Eddidla, 1998). Researchers have focused on the effects of specific physical features: the absence of windows, temperature density, aesthetic quality, furniture arrangements, and interior design (Ivory, 2011). People respond to their environment based on perception, cognition, and spatial behavior. The designer creates environmental stimuli to direct these psychological stages and the secondary motivation, affect, and development processes. Environmental expectations, another determining element to be considered by the interior designer, are developed over time through experience and interaction with the environment (Eddidla, 1998). For example, the

impact of a classroom's physical environment on instructors' practice, how this impact occurs, and what aspects of the classroom's physical design attributes affect instructional methodology needs to be explored further, as people's perception is influenced by the way furniture is arranged (Heimstra and Macfarling, 1978).

A 1998 PKAL project named *What Does Improved Facilities Make* was conducted on higher education institutions that transformed their teaching environment through great investments toward redesigning the classrooms. The project showed that classroom design improvements positively impacted pedagogy, student learning, and student-teacher interaction, as the new design permitted easy circulation and grouped seating arrangements for student discussions. Gifford (1987) also emphasized that the social interaction of both teachers and students is affected by classroom layout. Crowding should never be ignored regarding easy circulation flow in a classroom setting, as crowding can hinder social interaction. Moore (1979) also highlighted that crowding conditions lead to increased aggression, less social interaction, and hinder classroom involvement.

In the book *Active learning Spaces: New Directions for Teaching and Learning,* Baepler et al. (2014) highlight the empirical studies conducted on technology-enhanced active learning classroom spaces within the Massachusetts Institute of Technology, also known as the TEAL (Technology Enhanced Active learning) project. Researchers found that the new design of classroom spaces and the curriculum contributed to students' higher conceptual understanding and lower rates of failure than in traditional classrooms with lecture-style instructional methods. Baepler et al. (2014) mentioned another example of an active learning classroom project implemented by North Carolina State University researchers, the SCALE-UP (Student-Centered Active learning Environment with Upside-down Pedagogies) initiative. Similar results were

found that the active learning classroom design like the SCALE-UP, along with active instructional approaches, helped reduce failure rates and improved students' understanding, critical skills, retention rates, and student enrollments for that particular course. It can be concluded that the new classroom designs supported instructors' active learning instructional approaches (Baepler et al., 2014).

Baepler et al. (2014) discussed a few more mechanisms in their book regarding the impact of different classroom designs on instructors' instructional methodologies. Analysis of one classroom observation data revealed that even if the instructor's best efforts to use the same instructional approach for each section of the same course in different classrooms "engendered significantly different behaviors and activities" (as cited in Brooks, 2012, p. 15). For instance, the instructor lectured more and stayed at the podium at the front within the traditional classroom compared to the ALC. The ALC design led the instructor to use group activities, and classroom discussion, as according to Amedeo, Golledge, and Stimson, "space exerts situation-related influences on human activities and experiences as they are enacted and felt in [specific] environmental settings" (2009, p. 13). ALCs make it easy to implement active learning (Constructivist) instructional approaches (Baepler et al., 2014).

The University of Minnesota also conducted extensive post-occupancy evaluations on classroom designs. Within the university, a few classroom spaces were designed as active learning classrooms. These spaces were designed to promote flexibility, interaction, and student-centered learning experiences (Whiteside et al., 2010). These active learning classrooms consisted of round tables for group work, a centered instructor's station, multiple projection displays, and 360-degree writing boards. Findings from the classroom evaluation research suggest that instructors modified their instructional methods based on the physical attributes of

the newly designed classrooms (Bezich, 2014). Whiteside et al. (2010) said the same instructors taught quite differently in traditional and active learning classrooms. The instructor lectured more and stayed at the podium at the front of the traditional classroom than the ALC. With the round tables in ALCs, the instructor's circulation became smooth without hindrance (Whiteside et al., 2010). Research suggests that flexible classroom design helps remove obstacles in active learning approaches (Johnson et al., 2019).

Considering the need to develop learning spaces, educational institutions have devotedly started investing in renovating and reconfiguring learning spaces. However, there is insufficient literature on a classroom's physical attributes, such as classroom furniture, that can influence pedagogy. Research on the impact of classroom physical design attributes on instructors' instructional methodology is considered minimal. Extensive data can be found on classroom design on students' engagement and the learning outcome, but limited studies have been conducted on classroom designs from instructors' points of view.

"Teaching is an interactive and human-centered activity" (Johnson, 1990, cited in Altinbasak, 2016, p. 45). Furniture layout plays an integral role in this interaction. Therefore, it is essential to understand what instructors perceive about their classroom's physical environment and how they behave accordingly. The current study investigates the impact of dynamic classroom furniture on instructors' use of the instructional methodology. The information gained from this study will help interior designers, educators, environment-behavior researchers, and school administrators design future classrooms.

Teaching and learning during COVID-19

The sudden transition to remote teaching and learning due to the pandemic and then transitioning back to in-person classes taught many lessons to educational institutions. While the

world was busy dealing with the unprepared circumstances, higher education institutions learned lessons that helped combat the unforeseen and faculty burnout (Kuntz et al., 2022). These lessons included changes in traditional teaching and learning, classroom designs, and optimal technology integration to support educational outcomes. The work of educationists, design professionals, and researchers has become more and more diversified (Kuntz et al., 2022).

Previously mentioned need for a paradigm shift became more dominant as traditional teaching-learning could not be successful during the pandemic. "Learning theories and frameworks became both essential and recognized as important on a large scale" (Kuntz et al., 2022, p. 1). The need for new and changed faculty development programs also increased to train instructors to implement new instructional approaches using technology synchronously or asynchronously, or even in person now. Numerous instructors changed their instructional approach to blended or flipped teaching and learning, which required a lot of before-hand planning and coordination, more instructor availability, and active in-class participation for both students and teachers.

Awareness of the interior design field in designing learning spaces increased tremendously. The need for modular tables, moveable chairs, and flexible classroom arrangements became inevitable. The focus was to design a group seating arrangement to allow for group discussion and better engagement while keeping an optimal social distance. Institutions included classroom design elements such as multiple writing surfaces and screens, projectors, and microphones for the faculty and students to promote more classroom interaction. The use of technology for smooth communication and class coordination was one of the most critical factors during and after COVID-19.

As a result of faculty training, classroom design, and technology addition, instructors and students could shift from traditional to active learning teaching and learning in a faster yet smooth fashion. Even though implementing these changes during the pandemic was extremely challenging for everyone and may have slowed down the performance overall. Still, now that most institutions are back to in-person teaching and learning, institutions have recognized the need for active learning classrooms for better academic outcomes and to deal with future challenges (Khamitova, 2022).

Chapter 3: Method

Research Design

The primary purpose of the current study is to better aid interior designers in creating educational classroom environments. The research was designed to add to empirical knowledge about design and behavior, with the applied aspect influencing future learning spaces' design. In order to achieve this purpose, it was devised to explore the perception of post-secondary institution instructors regarding the role of classrooms' physical design attributes in their choice of instructional methodology, which helped set the study's direction, i.e., mixed-methods study design.

The University of Oklahoma (OU) is one of the institutions where a few traditional learning classrooms (TLC) have been changed to active learning classrooms (ALC) in almost all the colleges/ departments. Therefore, OU is an appropriate location to use instructors as experts for providing vast information on how the physical design of different classroom spaces impacts instructors' perception and use of that classroom type. Therefore, a mixed methods study was used to address the research questions, and quantitative and qualitative data was used to examine design-instructional methods in a triangulated fashion. With the current trends toward altering classroom design and teaching methods from traditional to active learning styles, the present research contributes to developing an enhanced understanding of which learning environment's physical design attributes influence teachers' instructional methods.

Understanding the relationship between the built environment and human behavior is critical to decision-making and problem-solving within the design process. For the present research, the explanatory sequential mixed-methods design was used. The explanatory sequential mixed-methods design is the type of mixed methods design in which the quantitative

data collection is used at the advent of the research with a subsequent qualitative phase to explain the quantitative results further, as shown in figure 10 (DenCuir-Gunby & Schutz, 2017). Therefore, this research method is denoted by 'QUAN → qual' (Liem, 2018). The explanatory sequential mixed-methods design is one of the most frequently used research methods among social science researchers (Liem, 2018), as it allows for a qualitative follow-up phase after the quantitative phase for a rich understanding of the problem under investigation.

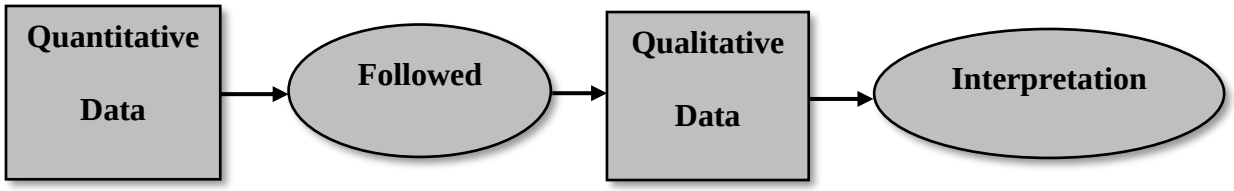


Figure 10. Explanatory Sequential Design

(DeCui-Gunby & Schutz, 2017)

Mixing Rationale

The primary intent of the explanatory sequential mixed-methods design is to clarify the initial results from the quantitative phase. Typically, in this design, only one type of data is collected and analyzed at a time. This research favors a sequential explanatory design because quantitative data is collected first to describe the general statistical results from the sample (DenCuir-Gunby & Schutz, 2017; Liem, 2018). Subsequently, qualitative data collection is used to explore "subjective nuances from participants" individually to "explain the phenomenon behind numbers that cannot be described merely by the quantitative data (Baheiraei et al., 2014; Fries, 2009; Liem, 2018, p. 514). Therefore, it is crucial to tie together the survey results to the follow-up interviews' data collected, as triangulation of results will help describe confusions, contradictions further, or any unusual survey responses "and to explore the results in more

depth" (Creswell & Creswell, 2017, p. 221; Creswell & Clark, 2017; DenCuir-Gunby & Schutz, 2017).

Quantitative and Qualitative Approach

For the quantitative approach, an exploratory research design was developed to explore the association and differences between the four primary constructs: classroom design, pedagogy, perception, and values. Since the present study focuses on understanding instructors' behaviors within the University of Oklahoma classrooms, the survey and follow-up semi-structured interview approach was employed to answer these research questions. The survey questions were used to test the Ecological Model of Man (EMM), User's Environment Interaction Framework (UEIF), and Active learning Ecosystem Framework (ALES) (Altman, 1973; Scott-Webber, 1998; Steelcase, 2011). The present survey was built upon the survey designed by Lennie Scott-Webber's (1997) User's Environment Interaction Framework (UEIF). As per the interview questions, these questions were built upon the interviews conducted during past research studies and after the quantitative analysis based on the findings and basic concepts of the present research's frameworks: EMM, UEIF, and ALES. These instruments helped to assess how the built environment influenced both internal and external behaviors of occupants.

Similarly, the case-study design was the chosen qualitative approach. A case study is the research approach that is used to generate in-depth and contextual knowledge about the problem under investigation. However, the quantitative stance was given importance based on the nature of the research questions. One of the most crucial steps in developing a sequential explanatory interview and interview schedule was developing the interview protocols based on the aspects and questions that were deeply grounded on the most dominant quantitative results (Liem, 2018).

It consists of questions asking the study's participants about their personal experiences concerning built environments.

Survey participants and selection method

The study's participants included instructors at the University of Oklahoma. All instructors were selected, whether teaching as full-time, part-time, adjunct, or graduate teaching assistants within all three University of Oklahoma campuses: Norman, Oklahoma City, and Tulsa. A non-probability purposive total population sampling was done to recruit participants. Participants were contacted via email to complete an electronic survey developed through Qualtrics. The researcher created a survey distribution list by collecting the contact information of all the instructors and graduate teaching assistants at OU from each college/ department's website. College deans and administrative staff were also sent the online survey links to forward to instructors not listed on the college websites. The survey stayed open for two weeks (April 27th, 2020 – May 11th, 2020). A total of 1272 surveys were distributed, and only 83 were returned. Missing data was removed; therefore, the number of participants who fully completed the survey dropped to 60. To better assist in answering research questions, nine faculty members who voluntarily agreed to participate in the follow-up interviews at the time survey were contacted via email.

Data Collection

The study's research question involved:

RQ 1: *Is there an association between the classroom design and the instructors' instructional methodology?*

(Null) Ho: *There is no association between the classroom design and the instructors' instructional methodology.*

(Alternative) H_1***:*** *There is an association between the classroom design and the instructors' instructional methodology.*

RQ 2: *Is there any difference in perception between the traditional and active learning classroom design?*

(Null) Ho: *There is no difference in perception between the traditional and active learning classroom design.*

(Alternative) H_1: *There is a difference in perception between the traditional and active learning classroom design.*

RQ 3: *Is there any difference in values between the traditional and active learning classroom design?*

(Null) Ho: *There is no difference in values between the traditional and active learning classroom design.*

(Alternative) H_1: *There is a difference in values between the traditional and active learning classroom design.*

RQ-4. *How do instructors perceive their current classroom design in relation to their instructional methodology?*

Quantitative Data

To address the proposed research questions, the researcher administered a 23-question online survey to empirically examine the instructors' perceptions concerning the physical attributes of classroom design (Appendix A). The survey used for the current study was built upon the survey developed by (Scott-Webber et al., 1997). The survey was modified after a few phases of experts' review sessions. The five research committee members reviewed all the questionnaire items for better "readability, clarity, and comprehensiveness" (Bolarinwa, 2019, p. 197). The research committee then came to a level of agreement based on survey questions to be included in the final questionnaire. Some of these changes included adding inquiries about physical classroom design and instructional methodology while omitting and rewording a few questions about the classroom's ambient features, such as temperature and lighting controls, noise, etc. Open-ended questions were added at the end of each Likert-scale question set to obtain more information from the participants. The updated survey consisted of a blend of non-

inclusive, multiple-choice, Likert scales, and open-ended questions. The changes in the survey also reduced it size and required lesser survey completion time. Basic demographic information of survey respondents was also collected. The survey required approximately 5-10 minutes to complete.

In the survey, instructors were asked about their current classroom use, either traditional or active learning classroom, questions on perception and values concerning traditional or ALC, and their choice of instructional approach. A figure showing the six most common classroom designs at OU was included in the survey for the instructors who chose their current classroom that most closely matches their classroom layout (Figure 11). This diagram had both traditional and active learning classroom layouts drawn on it.

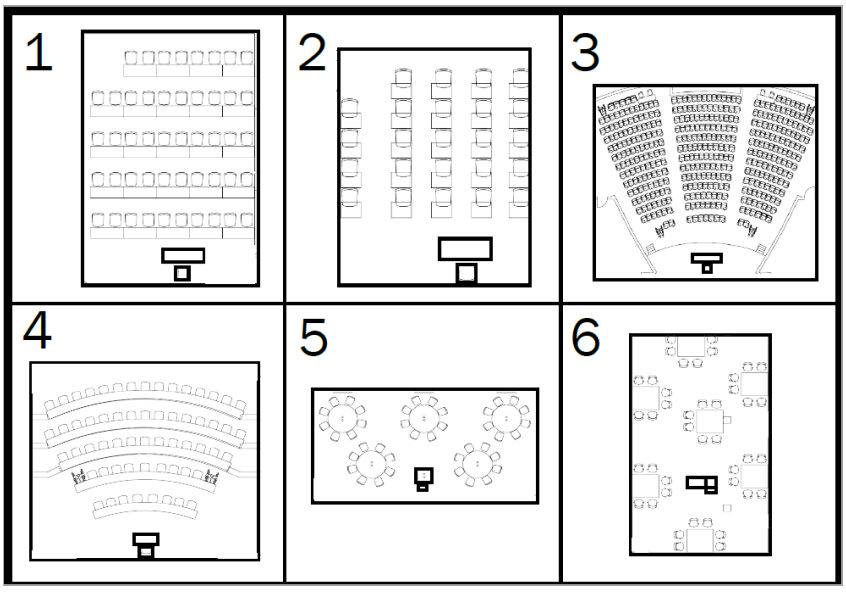


Figure 11. Classroom Designs

The constructs, such as classroom design and instructional methodology, were measured using a non-inclusive question, followed by a multiple-choice question. The perception variable included a six-point Likert scale containing 19 survey items, whereas the values variable also used a six-point Likert scale containing eight survey items. The survey also consisted of seven

open-ended survey questions. After each non-inclusive question and Likert-scale question set, there was an open-ended question option to allow participants to provide any further information.

The survey also had a consent letter for participants to respond to before starting the survey, including information about the survey, researcher, reason and purpose of the study, confidentiality of the results, time duration it would take to complete the survey, IRB approval number, and complete contact information in case of further survey related inquiries or concerns.

Qualitative Data

In order to help validate the findings from quantitative data, follow-up semi-structured interviews of nine faculty members were conducted via Zoom (Appendix B). The key idea is that the qualitative data collection builds directly on the quantitative results, which means that the interview protocol was developed after completing the quantitative data analysis. The findings from the quantitative data set the basis for the follow-up interview questions for this study. Participants were recruited via email. The interviews were conducted for a month, from May 10th,2022 – June 10th, 2022, and were video recorded. The verbal consent was taken from the participants before the start of the interview. The interview questions consisted of eight open-ended questions. A couple of supplementary questions were also asked from the participants to probe based on the interviewee's answers. These interviews lasted for about 35 – 45 minutes each. Participants responded to interview questions based on the type of classroom design they taught and the instructional methodology they used within those classrooms. The interview questions included:

1. Keeping in mind the (traditional or active) classroom design you taught in, could you tell me what instructional method you used (traditional or active learning instructional method)?

2. Did the (TLC/ ALC) design support your choice of instructional method? Yes/no?
3. What physical design elements do you think supported your teaching method? (For example, desks configured in pods/groups, amount of desk space, readily available laptops, flexibility to reconfigure space, lighting & aesthetics (room color), seating, wireless network access, ability to project & annotate onto whiteboard space, amount of whiteboard space, traffic flow, technology, temperature, Other)
4. What physical design elements of the (TL/ AL) classroom best supported your interaction with the students? Please elaborate.
5. Please tell me if this (TL/ AL) classroom design hindered your instructional method.
6. What physical design elements do you think hindered your teaching method?
7. What physical design elements of (TL) classroom design hinder your interaction with the students the most? Please elaborate.
8. Please describe how you feel the design of the TL/ AL classroom affected your ability to teach effectively.
9. Do you feel that OU valued and promoted teaching and learning by providing classrooms that support multiple teaching styles?
10. How has COVID influenced your instructional methodology in your classroom/ lab/ studio (based on whichever classroom they taught in)
11. How are you managing a post-COVID situation in your classroom (both instructional method and classroom design-wise)?

Data Analysis Strategies

Quantitative Data Analysis

The unit of analysis used for the study is instructors. SPSS software was used to conduct all the statistical analyses for quantitative data. The tests were conducted using an alpha level of .01 with a statistical significance of 0.05.

Descriptive Statistics. Descriptive statistics were used to summarize the quantitative data understandably and comprehensively (Sommer & Sommer, 2002). Descriptive statistics of demographic information and frequency distribution of categorical variables such as classroom design and instructional methodology were conducted using software: SPSS and MS EXCEL. Comparisons were made between the two types of classroom designs and instructional methodology based on participants' survey responses. These comparisons were useful to deeply understand the common trends within the data about the difference between the use of different classroom designs' physical design aspects and the type of instructional methodology used within those classrooms. Similarly, descriptive statistics for continuous variables such as perception and values with an independent variable using graphs indicating the frequency of occurrence were used. Additionally, information on demographic variables also helped the researcher understand the participants better in terms of gender, age, years of experience, and major/ area of the field.

The following section discusses different statistical tests applied to answer each research question:

Research Question 1: Is there an association between the classroom design and the instructors' instructional methodology?

Null Hypothesis: There is no association between the classroom design and the instructors' instructional methodology.

Alternative Hypothesis: There is an association between the classroom design and the instructors' instructional methodology.

Chi-Square Test. The present study investigated the association between the classroom's physical design and instructors' instructional methodology. Since the study's first research question aimed to investigate the association between the predictor and outcome variables, the Chi-square test was a suitable method. Another name for this test is enumeration statistics. It compares the various items' frequencies with the expected frequencies, provided the researcher hypothesized the population frequencies. The Chi-square test of association is typically used when both variables are categorical (Lomax & Hahs-Vaughn, 2012). For the null hypothesis, it was assumed that there is no association between the two variables (Tang, He, & Tu, 2012).

Assumptions. The first of two assumptions that apply to the chi-square test of association is that "observations are independent," meaning this assumption is met when the population sample is randomly selected (Lomax & Hahs-Vaughn, 2012, p. 224). The second assumption is that the "expected frequency is at least five per cell" (Lomax & Hahs-Vaughn, 2012, p. 224). Therefore, if the expected frequency values are less than five, the chi-square of association becomes very sensitive. If the expected frequency values are less than five, then the test of goodness-of-fit or Fisher's exact test of independence is used instead. Since, for the

current data, the expected frequency values were not less than five, the Chi-square test of association was the right choice.

Other than finding the statistical level of association among variables, the rationale behind using the chi-square test of association was due to its ease of computation, and it derives detailed information from the test. The chi-square test of the association's data distribution is quite robust, which means "it does not require equality of variances among the study groups or homoscedasticity in the data (McHugh, 2013, p. 1)." The Chi-square test can be used in studies where parametric assumptions cannot be met, and lastly, the chi-square test is quite flexible in data handling ranging from two groups to multiple group projects (McHugh, 2013).

Research Question 2: Is there any difference in perception between the traditional and active learning classroom design?

Null Hypothesis: There is no difference in perception between the traditional and active learning classroom design.

Alternative Hypothesis: There is a difference in perception between the traditional and active learning classroom design.

Research Question 3: Is there any difference in values between the traditional and active learning classroom design?

Null Hypothesis: There is no difference in values between traditional and active learning classroom design.

Alternative Hypothesis: There is a difference in values between traditional and active learning classroom design.

Independent Sample T-Test. The present study's second research question investigated the difference in perception between the traditional and active learning classroom design. However, the third research question investigated the difference in values between the traditional and active learning classroom designs. Independent samples t-test was the preferred method. The inferential test that measures the differences between two independent means is known as the independent *t*-test (Lomax & Hahs-Vaughn, 2012). This test measure means of two different

groups. For the null hypotheses, it was assumed that there is no difference in values between the traditional and active learning classroom design; similarly. It was assumed that there is no difference in values between the traditional and active learning classroom design. "The Independent samples t-test compares the means of two independent groups to determine whether statistical evidence shows that the associated population means are significantly different" (Kent State University, 2021).

Assumptions. For the independent t-test, there should be a random assignment of the sample of data from the population to meet the assumption of independence. The normality assumption means that both independent variable groups should be normally distributed (Lomax & Hahs-Vaughn, 2012). The last assumption for the independent samples t-test is the homogeneity of variances, which is met "when the variances of dependent variables for the two" groups of the independent variables are the same (Lomax & Hahs-Vaughn, 2012, p. 172).

Qualitative Data Analysis

The qualitative data from the survey's open-ended questions and the follow-up interviews helped answer the fourth research question.

Research Question 4: How do instructors perceive their current classroom design in relation to their instructional methodology?

Two different software programs were used to analyze the qualitative data: MS EXCEL and MAXQDA. MS EXCEL was used to analyze the open-ended questions, while MAXQDA was used to analyze the interview data. Out of the 23-question survey instrument, seven questions were open-ended. These questions served as follow-up questions after each Likert-scale question set. Therefore, the content-analysis method was used to analyze the open-ended

questions of the study. Data was organized in MS EXCEL sheets into tables based on each survey question. Then, data were analyzed based on the codes and themes from the data collected based on two groups of independent (classroom design) and dependent variables (instructional method).

The survey data was collected in April 2020 amid an upsurge of COVID-19, which resulted in a relatively small sample size. Another reason for the low response rate was that institutions worldwide shifted from in-person to online classes during data acquisition, while the survey targeted the instructors' perception of physical classroom design elements. This shift from the in-person classroom to the online teaching and learning experience was new and very drastic that the focus of all the instructors within OU also shifted towards managing online teaching and learning correctly and smoothly. These challenges affected data acquisition related to questions # 2 and # 3, that attempt to find differences between two groups' means related to the variables of perception and values. Even though the findings were statistically significant, the small-sized data generated small effect sizes for research questions # 2 and # 3. Therefore, semi-structured interviews were conducted with nine instructors to help rectify any shortcomings of the small sample size and clarify the limitations of quantitative analysis.

As mentioned earlier, the interviews were conducted for a month, from May 10th, 2022 – June 10th, 2022, and were video recorded, and transcriptions generated via Zoom were used for the analysis. The qualitative data from the follow-up interview questions were analyzed using software called MAXQDA. This software generated codes and themes from the survey and interview data which helped with the data analysis. MAXQDA also generated illustrations from the data based on the common themes and their frequencies. These illustrations have been discussed in the next chapter in detail.

Mixed Methods Data Analysis and Integration

In the explanatory sequential mixed methods design, once the quantitative and qualitative data had been analyzed separately, the researcher integrated both databases to connect the quantitative results to the qualitative data collection. According to Creswell & Creswell, the quantitative results direct the nature and formulation of qualitative questions "because one database explains the other and the data collection can be spaced out over time (2017, p. 222)."

The results were interpreted in the discussion section of the study in a stepwise manner. First, the quantitative phase was reported, followed by the qualitative phase. The third critical phase is how "the qualitative results explain and add insight into the quantitative results (Creswell & Clark, p. 78, 2017)." This design approach intends to have a qualitative database to help explore in-depth knowledge of quantitative results. The interpretations should elaborate on the learning points in response to the purpose of the study (Creswell & Creswell, 2017). It is assumed that the interpretations from these results provided enriched, repeated, and different aspects' role of physical classroom design in instructors' instructional methodology (Creswell & Clark, 2017; Creswell & Creswell, 2017; Liem, 2018). Expanding the breadth and range of the problem under investigation using different methods was the third rationale for using an explanatory sequential mixed methods design. In the explanatory sequential research design, qualitative data is used to deeply explore common patterns from the quantitative data to further elaborate patterns conflicting with the research literature (DeCui-Gunby & Schutz, 2017). Therefore, after the data collection and analyses of both sets of data, integration and interpretation of findings takes place (DeCui-Gunby & Schutz, 2017).

Instrument Validity

Since the survey used for the current study was built upon the survey designed by Scott-Webber et al. (2000), which has also been used by furniture manufacturers such as Steelcase, and other researchers to evaluate physical classroom designs and their impact on occupants (Powell, 2015). The findings were consistent throughout their research as well. Thus, the rationale behind adding the open-ended questions in the survey after each Likert-scale question set was to address concurrent validity for the quantitative component and confirmability for the qualitative component through explanatory sequential design and consistent results with previous studies. Content validity and face validity of the survey were also achieved through the reiterated process of experts' assessment and informed opinions in the survey design and execution in the form of a pilot study.

Internal Consistency Reliability

It is significant to measure the consistency of an instrument. Cronbach's alpha for the two constructs, i.e., perception and values, were conducted. For the 19-item perception scale, Cronbach's alpha was found to be .826, indicating good reliability. Similarly, for the eight-item values scale, Cronbach's alpha was found to be .811, indicating a good reliability level.

Trustworthiness

The limitations in the qualitative component were the two threats to validity, which could diminish the trustworthiness of the current study. One could be the researcher's bias towards desired interpretations and conclusions because of the researcher's inclination towards ALC design. Therefore, triangulation with a quantitative data approach, i.e., follow-up interviews, was utilized to enhance the study's trustworthiness. The same applied to the validity of the

quantitative component of the research. Moreover, open-ended surveys and interview questions were coded twice to address credibility and avoid missing significant findings.

Figure 12 shows the conceptual diagram of the current study's variables. Traditional and active learning classroom designs under the classroom physical environment are the independent variables. Instructors' behavioral aspects, such as perception, choice of instructional approach, and values, are the dependent variables, while gender, instructors' major, and teaching experience are the controlled variables. Since the control variables are not the focus of the study, therefore, are not included in the research questions. Table 1 shows the variables and their operational definitions.

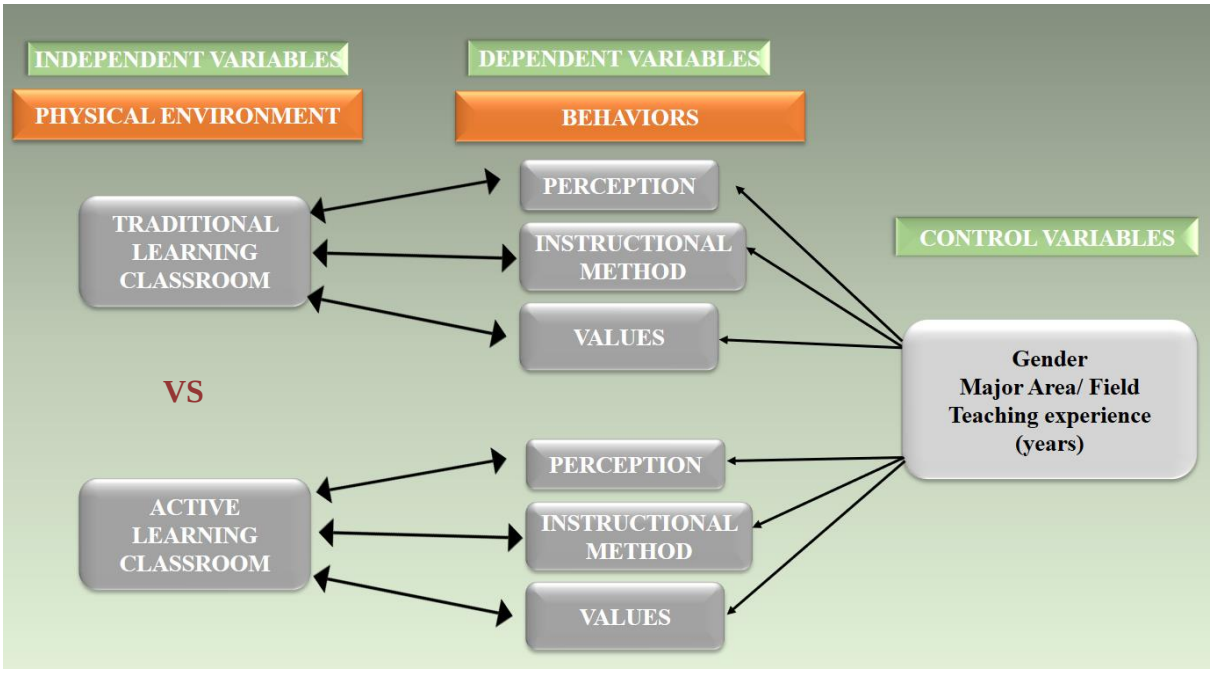


Figure 12. Conceptual Diagram of the Current Study
(Faisal, 2021).

Table 1. Variables and their Operational Definitions

Terms	Definitions	Citation
Classroom Design	**a). Traditional classroom (TC) design:** Traditional classrooms consist of row-and-column seating arrangements with minimal flexibility, where students are seated facing the front of the instructor's podium for minimum interaction.	(Barbash, 2012)
	b). Active learning classroom (ALC) design: ALCs are furnished with large tables allowing several students to sit facing each other and are equipped with LCDs, microphones, and numerous writing surfaces. The general classroom's furniture is comfortable and flexible, while the arrangement facilitates group work, promotes student-student interaction, and engages students in problem-solving and critical thinking activities. ALCs are designed to accommodate diverse instructional methods comfortable and flexible furniture arrangement	(Bezich, 2014; Ge et al., 2015; Painter et al., 2012).
Instructional Methodology	**a). Traditional method:** Teachers use direct, scripted, and step-by-step instruction while students gather that information "through lecture and presentation methods" and storm this passive instruction into their memory, facing the instructor.	(Barbash, 2012; Dewey, 2007; Tapscott, p. 129, 1988).
	b). Active method: Active learning "involves students doing things and thinking about the things they are doing." Integrating active-learning strategies into the classroom results in a strong and efficient teaching model because active learning promotes material application while still being presented. Active-learning techniques engage students more deeply in learning course material than the traditional lecture style by encouraging critical thinking and fostering the development of self-directed learning.	(Amburgh et al., 2007; Bonwell & Eison, p. 3, 1991).
Perception	According to Bitner (1992), "users respond to dimensions of their physical surroundings cognitively, emotionally, and physiologically, and those responses	(Bitner, 1992; Scott-Webber et al., 2000;

	influence their behaviors in any given environment" (as cited in Scott-Webber et al., 2000, p. 21). Similarly, "perception is the organization, identification, and interpretation of sensory information regarding personal experiences" within a classroom environment by the researched population. It evokes these responses that influence their actions/reactions to an environment and social interactions within that environment.	Weber-Bezich, 2014, p. 25).
Values	**a). Personal values:** For the present study, the personal values of instructors, such as autonomy, are also essential to consider for desired teaching and learning outcomes. According to Ryan and Deci, "autonomy refers to the human need to determine, control, and organize your behavior and goals, or to see yourself as having control in your world" (2000, as cited in DeCuir-Gunby & Schutz, 2017, p. 59). Educational researchers believe that human motivation and well-being are closely connected to fulfilling the psychological need for autonomy	(DeCuir-Gunby & Schutz, 2017; Ryan and Deci, 2000).
	b). Corporate values: For the present study, it is considered that as a part of the corporate (institutional) culture that learning institutions should provide a physical environment that reflects their institutional values and importance for teaching and learning and those who encourage and support the teaching and learning process.	(Steele, 1986)

Chapter 4: Results

The previous chapter discussed the research design and methods used to collect data. This chapter reports the data analysis and findings from the survey questionnaire and the follow-up interviews, divided by research questions and relevant variables under investigation. The goal of the present research was to better aid interior designers in creating educational environments, such as higher education classroom settings. Additionally, the goal was to add to the empirical knowledge about design and behavior with an applied aspect of influencing the design of future learning spaces. The chapter starts with a descriptive analysis of overall item-wise survey findings related to instructors' perception of the classroom designs. The chapter analyzes variables and answers research questions for each variable under investigation.

Descriptive Analysis

This section describes the overall item-wise survey findings about the instructors' perception of different classroom designs. There were a total of 60 participants who completed the surveys. Out of 60 participants, 36 instructors taught in Traditional learning classrooms (TLC), whereas only 24 instructors taught in Active learning classrooms (ALC), as shown in Table 2 below.

Table 2. Frequency Distributions for Classroom Design

	Frequency	Percent
TLC	36	60.0
ALC	24	40.0
Total	60	100.0

Figure 13 provides an overview of the survey data on instructors' perception of classrooms' physical attributes based on TRADITIONAL (TLC) and ACTIVE LEARNING CLASSROOM (ALC) designs. The survey findings have been elaborated in Figures 14 – 15.

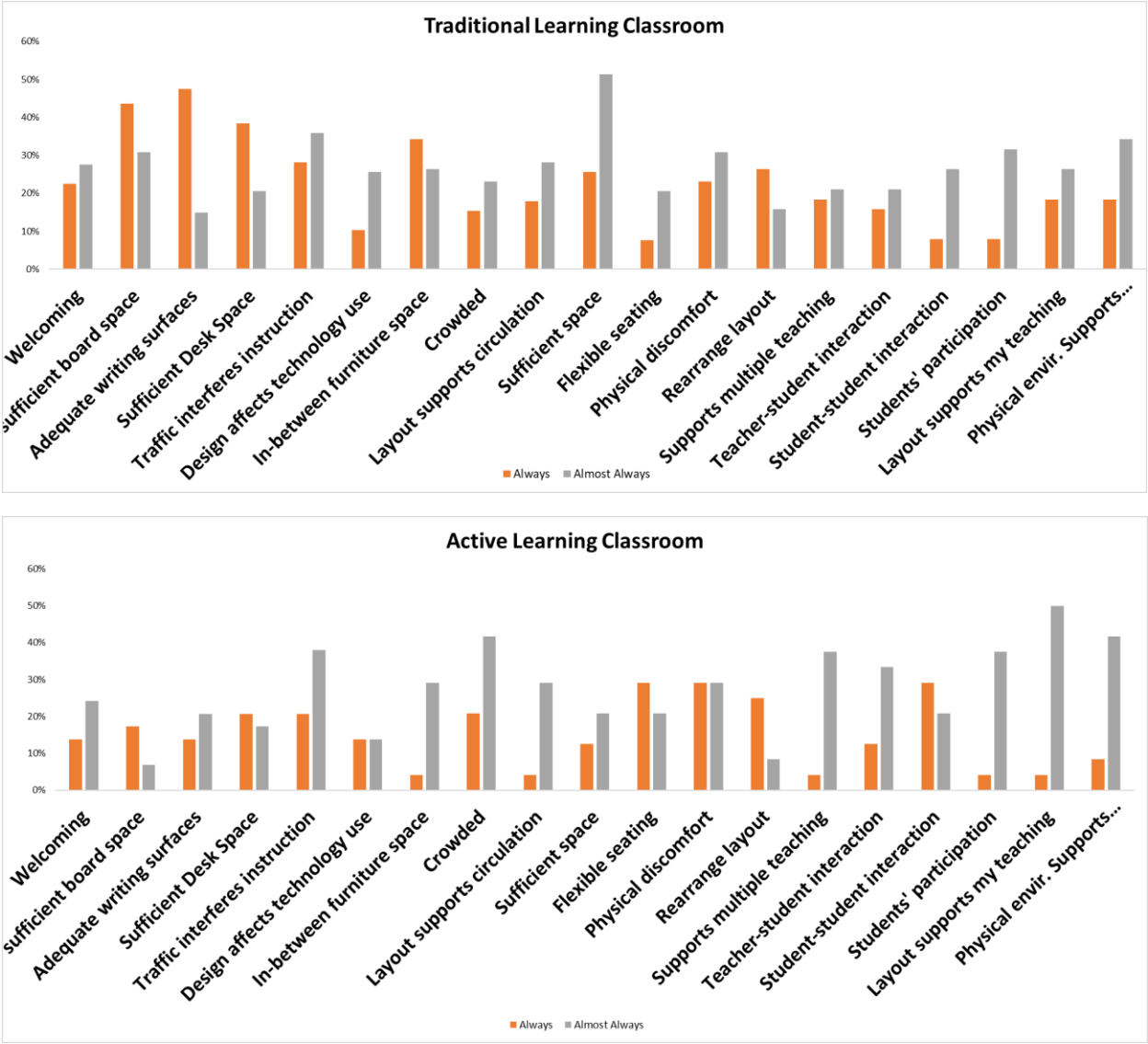


Figure 13. Instructors' Perception of Physical Design Attributes of Classrooms

Figures 14-16 below illustrate a detailed comparison between the instructors' perceptions of traditional and active learning classrooms in three parts. Figure 14 – 16 results are similar to Figure 1 which shows item-wise survey findings comparing the responses on instructors' perception of traditional learning (TL) and active learning (AL) classroom designs.

Based on the survey responses, under the *always* category (Figure 14), TLC instructors have a higher percentage of perception (dependent variable. Operational definition on page 75) as compared to ALC instructors in adequate writing surfaces (48% vs.. 14%), sufficient board space (44% vs.. 17%), and sufficient desk space (38% vs.. 21%). Ali (2017) emphasized that sufficient writing surfaces such as whiteboards and smart boards are an essential physical design aspect of a classroom; thus, these writing surfaces need to be located in such a way to be visible to all students from every direction.

Similarly, under the *almost always* category, TLC instructors have a higher percentage as compared to ALC instructors in perceiving their classroom's physical environment as welcoming (28% vs.. 24%) and that the classroom setting affects their use of technology (26% vs. 14%). Research also revealed that instructors did not perceive the traditional classroom settings as suitable for new technologies, and the technology placement in front only did not support multiple instructional approaches (Ali, 2017). Based on the survey responses, under the *almost always* category, ALC instructors have a higher perception than TLC instructors that their instruction was interfered by the traffic flow in and out of the class (38% vs. 36%). There is a need to plan adequate classroom traffic patterns to facilitate teaching and learning (Altinbasak, 2016).

Therefore, results showed that instructors perceived that TLCs at OU have sufficient board and desk spaces and adequate writing surfaces, which supported their instructional methodology compared to ALCs. However, instructors perceived traffic in and out of the classroom, and the poor design of the TLCs hindered their use of technology and instructional methodology compared to ALCs (Figure 14).

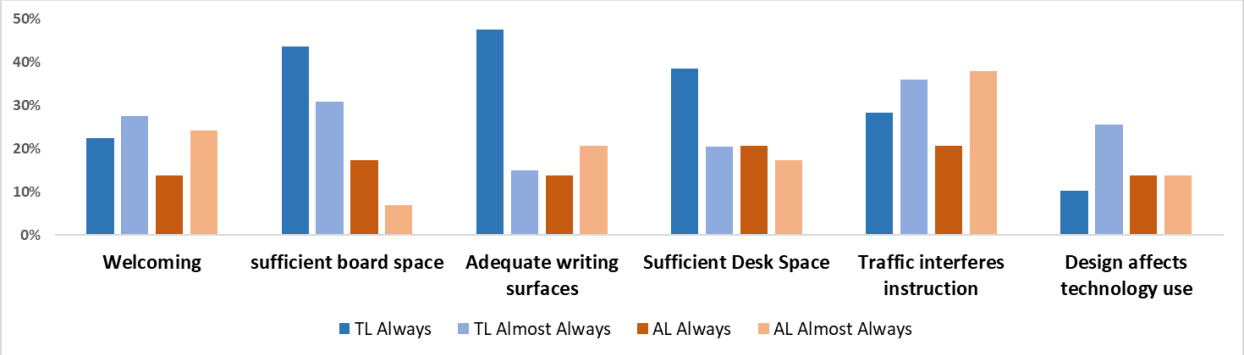


Figure 14. Instructors' Perception of Traditional vs. Active learning classroom Designs (Part 1/3)

Based on the survey responses, under the *almost always* category (Figure 15), TLC instructors have a higher percentage of perception as compared to ALC instructors in classroom space sufficient is enough to carry out their instructions effectively (51% vs. 21%), and the physical discomfort caused by the classroom seating, room layout, and equipment for their instructional approach (31% vs. 29%). However, ALC instructors have a higher percentage of perception as compared to TLC instructors in the crowded classroom setting (42**%** vs. 23%), in-between chair space (39% vs. 26%), furniture layout supports circulation (29% vs. 28%). Literature on classroom layout suggests considering personal and social space to avoid crowding while designing classrooms as it could reduce teaching and learning productivity (Scott-Webber et al., 2000). Moreover, easy circulation during classtime enhances positive teaching and learning behavior (Ali, 2017).

Contrary to previous literature, survey findings under *almost always* category showed that instructors' perception was equal about flexible classroom seating arrangement in both TLC and ALC (21% vs. 21%). Flexible furniture and furnishings align chosen pedagogies well with the classroom spaces (Merrienboer et al., 2017).

Furthermore, under the *always* category, TLC instructors have a higher percentage of perception as compared to ALC instructors in in-between furniture space (34% vs. 4%), furniture layout supports circulation (18% vs. 4%), and sufficient classroom space (26% vs. 13%); however, ALC instructors have a higher percentage of perception as compared to TLC instructors in flexible seating (29% vs. 8%), the physical discomfort caused by the classroom seating, room layout, and equipment for their instructional approach (29% vs. 23%), and in the crowded classroom setting (21% vs. 15%). Overcrowding in learning environments creates confusion and can be sensually overstimulating, which can cause adverse emotional and physiological reactions (Scott-Webber et al., 2000).

According to the results, instructors perceived TLCs' sufficient classroom space, especially in-between furniture space, as supportive of their instructional methodology compared to ALCs. Although instructors perceived ALC designs as crowded, their flexible seating supported their instructional methodology compared to TLC designs (Figure 15).

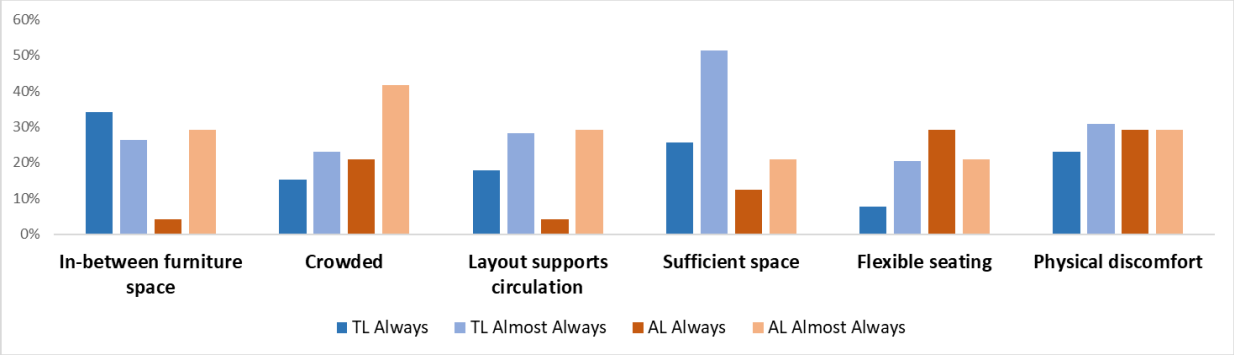


Figure 15. Instructors' Perception of Traditional vs. Active learning classroom Designs (Part 2/3)

Based on the survey responses, under the *almost always* category **(**Figure 16**)**, ALC instructors have a higher percentage of perception as compared to TLC instructors about furniture layout supports their instructional method (50% vs. 26%), the physical environment supports teaching (42% vs. 34%), furniture layout facilitates students' participation (38% vs. 32%), the furniture layout supports multiple teaching methods (38% vs. 21%), and the furniture layout encourages teacher-student interaction (33% vs. 21%); however, TLC instructors have a higher percentage of perception as compared to ALC instructors that they have to rearrange classroom furniture to aid their instructional method (16% vs. 8%), the furniture layout encourages student-student interaction (26% vs. 21%). Active learning classrooms reinforced with ACTIVE instructional methods supported by technology can positively influence teaching and learning, for instance, increased classroom engagement and improvement in motivation and achievements (Nissim, 2016).

Additionally, based on the survey responses, under the *always* category, ALC instructors have a higher percentage of perception as compared to TLC instructors in furniture layout encourages student-student interaction (29% vs. 8%); however, TLC instructors have a higher

percentage of perception as compared to ALC instructors regarding rearranging classroom furniture to aid their instructional method (26% vs. 25%), furniture layout supports multiple teaching methods (18% vs. 4%), furniture layout supports their instructional method (18% vs. 4%), the physical environment supports their teaching (18% vs. 8%), furniture layout supports teacher-student interaction (16% vs. 13%), furniture layout facilitates students' participation during class discussion (8% vs. 4%). Young et al. (2017) found that choice of classroom type impacts education. However, changing the physical classroom design to improve teaching and learning has less impact than changes brought by combining physical design with new teaching methods (Young et al., 2017). Previous research highlighted that the difference between traditional and active learning classrooms is vast, impacting pedagogy, education, and design immensely (Nissim et al., 2016; Scott-Weber et al., 2013).

According to the results, instructors perceived ALCs' furniture layout and overall physical environment supports students' participation, student-student interaction, student-teacher interaction, and multiple instructional methodologies compared to TLC design (Figure 16).

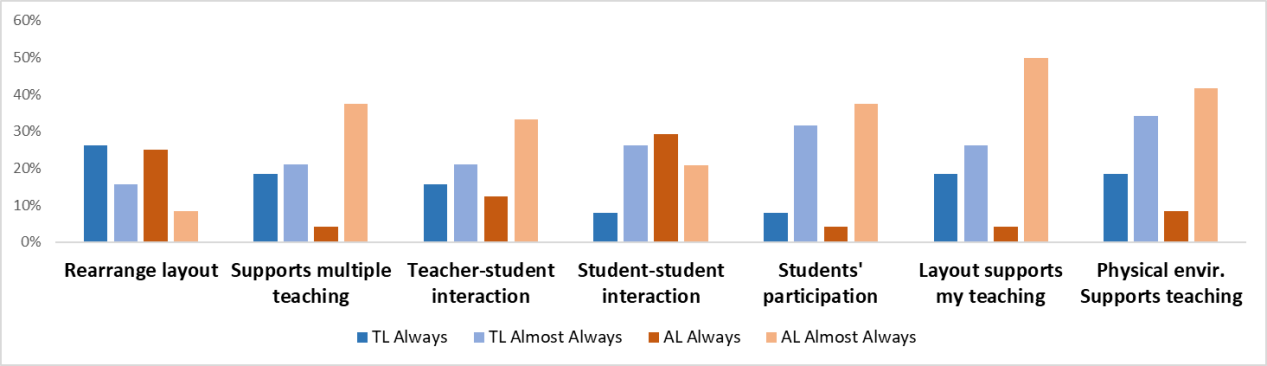


Figure 16. Instructors' Perception of Traditional vs. Active learning classroom Designs (Part 3/3)

Classroom Designs

This section provides a quantitative description of instructors' current classroom designs through frequency distributions to better understand what kind of classroom participant instructors currently teach. Present research divided classrooms into two sub-categories based on their design: traditional learning classroom (TLC) and active learning classroom (ALC). In the survey, as shown in Figure 17, instructors were given six different images to choose from that most closely resembled their current classroom setting.

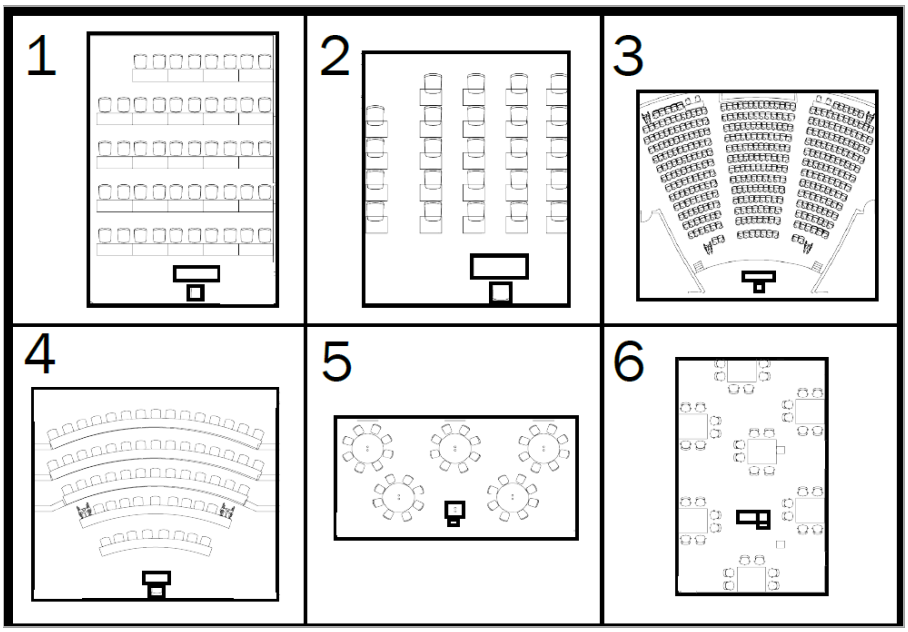


Figure 17. Classroom Designs

Table 3 shows the descriptive statistics of instructors' current classroom arrangements. According to the results, classroom designs consisted of 36 (60.0%) Traditional classrooms, and 24 (40.0%) Active learning classrooms (ALC) (*N = 60*).

Table 3. Frequency Distributions for Classroom Design

	Frequency	Percent
TLC	36	60.0
ALC	24	40.0
Total	60	100.0

Instructional Methodology

In the survey, instructors were given multiple options from a list of instructional methods. These methods were divided into two categories: traditional (TL) and active learning (AL) teaching approaches used in the classroom that they selected from the survey question. Table 4 shows the descriptive statistics of instructors' current choice of instructional method. Among the instructional methodologies used by instructors, 21 (35.0%) instructors used the traditional learning or traditional lecturing approach, and 39 (65.0%) used the active learning approach (*N = 60*).

Table 4. Frequency Distributions for Instructional Methodology

	Frequency	Percent
TL	21	35.0
AL	39	65.0
Total	60	100.0

Perception

Since the perception variable was addressed through a 6-point Likert scale, a new scale gave instructors a total perception score based on the mean score calculation and was treated as a continuous variable. The descriptive statistics for the perception, as shown in Table 5, reveal an overall mean score of 3.16 (*SD = 0.682*).

Table 5. Descriptive Statistics for Perception

	N	Minimum	Maximum	Mean	Std. Deviation
Perception	60	1	4	3.16	.682
N (listwise)	60				

Based on classrooms' overall physical design attributes, 27% of the instructors perceived Active learning classrooms as *frequently supportive* of their instructional methodology. In comparison, 12% of the instructors perceived Active learning classrooms as *occasionally supportive* (Figure 18). Only 2% of instructors perceived ALC as *almost always supportive* of their instructional approach. For the perception of Traditional classrooms' physical design attributes, 30% of the instructors found them *somewhat supportive* of their instructional methods. 18% of instructors perceived Traditional classrooms as *occasionally supportive*. On the other hand, 10% of the participants perceived these classrooms to be *almost always supportive* of their instructional approach, while only 2% perceived traditional classroom arrangements as *always supportive*.

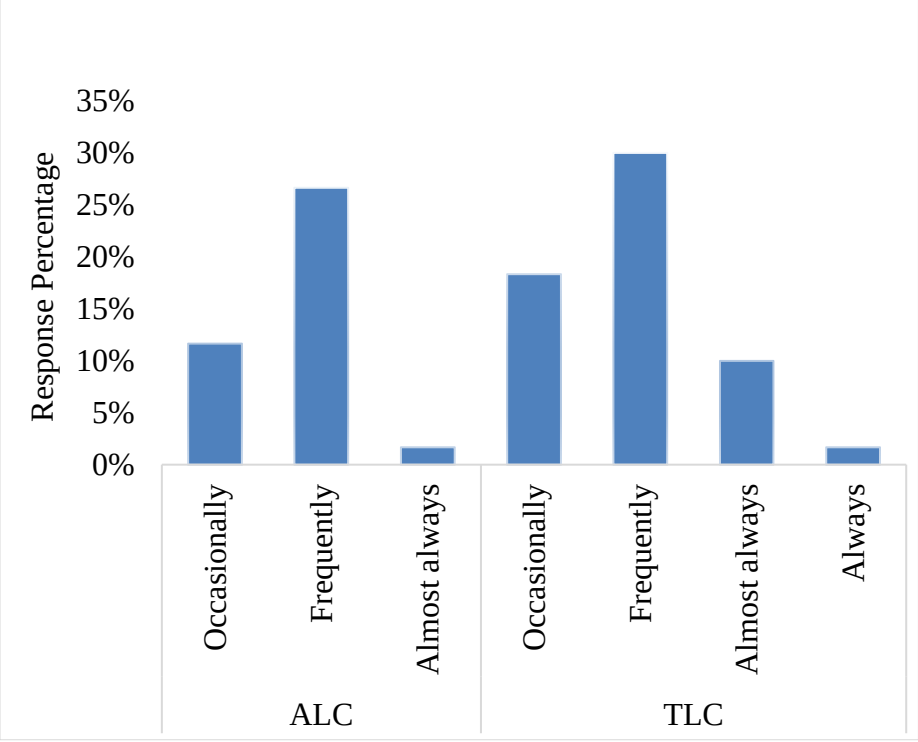


Figure 18. Frequency Distributions of Perception about Classroom Designs

Values

The values variable was also addressed through a 6-point Likert scale; a new scale gave instructors a total values score based on the mean score calculation and was treated as a continuous variable. The descriptive statistics for the values, as shown in Table 6, reveal an overall mean score of 2.64 (*SD = 0.879*).

Table 6. Descriptive Statistics for Values

	N	Minimum	Maximum	Mean	Std. Deviation
Values	60	1	5	2.64	.879
N (listwise)	60				

The purpose of this variable was to understand what instructors value on a personal level regarding work-related autonomy and what the University of Oklahoma values on a corporate level to promote teaching and learning. Figure 19 represents the frequency distributions for value. For the Traditional classrooms, 25% of the participants chose *somewhat agree*, 20% *agreed*, and 10% of the instructors *somewhat disagreed* on the values overall. 3% of the participants *strongly agreed*, and only 2% of the instructors *disagreed* on teaching and learning values for the Traditional classrooms.

On the other hand, for the values regarding the Active learning classrooms, 18% of the participants *agreed*, 13% *somewhat agreed*, and 7% of the instructors *somewhat disagreed.* Only 2% of the participants using the Active learning classrooms *strongly agreed* with teaching and learning values.

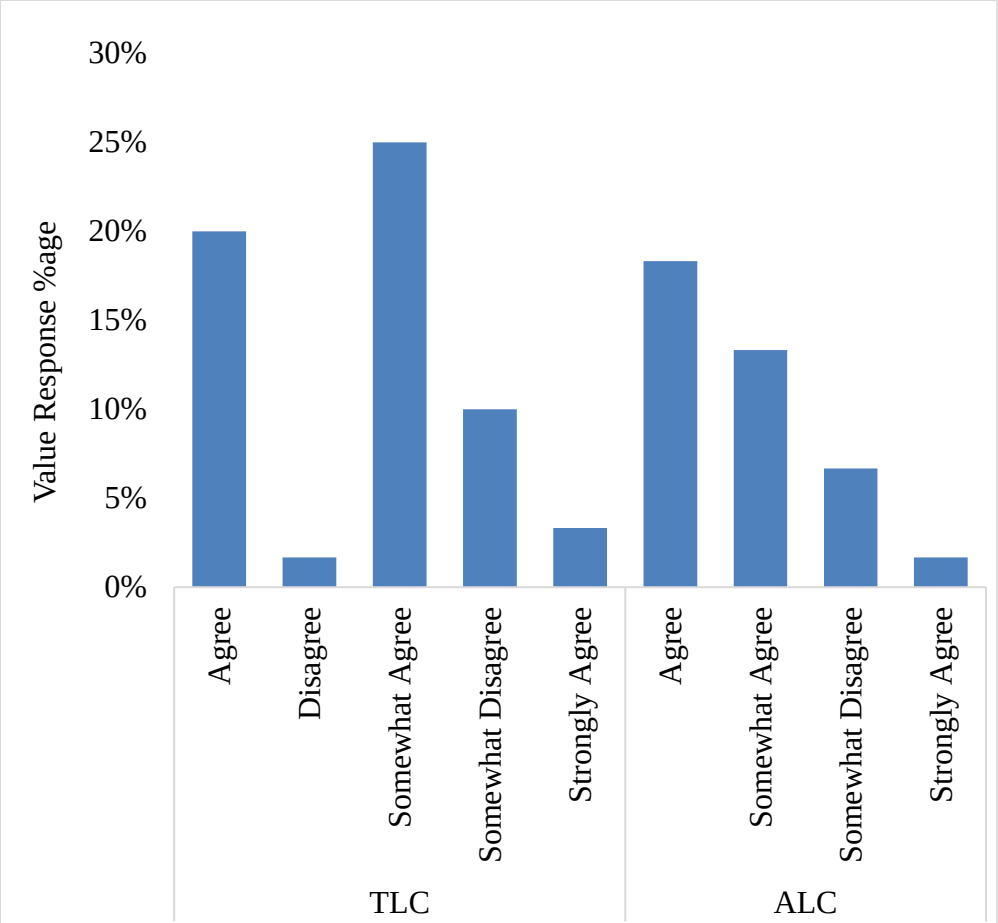


Figure 19. Frequency Distributions of Values Related to Classroom Designs

Chi-Square Test of Association

RQ 1: *Is there an association between the classroom design and the instructors' instructional methodology?*

(Null) Ho: *There is no association between the classroom design and the instructors' instructional methodology.*

(Alternative) H_1: *There is an association between the classroom design and the instructors' instructional methodology.*

A chi-square test of association was conducted to answer the present study's first research question (RQ1). The purpose was to determine if there was a relationship between the classroom design and the teachers' instructional methodology. The test was conducted using an alpha of .01. It was hypothesized that there was an association between the two variables. The assumption of an expected frequency of at least 5 per cell was met. The independence

assumption was not met since the respondents were not randomly selected; thus, there is an increased probability of a Type I error.

The Crosstabulation table (Table 7) shows the row marginals that 65.0% of the teachers overall use Active learning methodology (constructivist method). However, teachers teaching in Traditional classrooms have a much lower percentage (52.8%) of Active learning methodology, while teachers teaching in Active learning classrooms have a much higher percentage (83.3%). Similarly, the teachers who teach in Traditional classrooms have a much higher percentage of using traditional pedagogical methods (47.2%) than those teaching in active learning classrooms, with the lowest percentage of using traditional pedagogical methods (16.7%). The relationship between the classroom design and instructional methodology is subsequently supported significantly from the chi-square test ($X^2 = 5.910$, $df = 1$, $p = 0.015$). Cohen's w, the effect size was computed to be .314, which is interpreted as medium (Cohen, 1988).

Table 7. Instructional Method * Classroom Type Crosstabulation

			CR_DESIGN		
			TLC	ALC	Total
INSTRUC_METHOD	AL	Count	19	20	39
		Expected Count	23.4	15.6	39.0
		% within CR_DESIGN	52.8%	83.3%	65.0%
		Standardized Residual	-.9	1.1	
	TL	Count	17	4	21
		Expected Count	12.6	8.4	21.0
		% within CR_DESIGN	47.2%	16.7%	35.0%
		Standardized Residual	1.2	-1.5	
Total		Count	36	24	60
		Expected Count	36.0	24.0	60.0
		% within CR_DESIGN	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.910[a]	1	.015		
Continuity Correction[b]	4.643	1	.031		
Likelihood Ratio	6.271	1	.012		
Fisher's Exact Test				.026	.014
Linear-by-Linear Association	5.811	1	.016		
N of Valid Cases	60				

Notes. a. 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 8.40.
b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.314	.015
	Cramer's V	.314	.015
	Contingency Coefficient	.299	.015
N of Valid Cases		60	

Independent Sample T-Test Investigation

To answer the second and third research questions, the independent sample t-test was chosen.

RQ 2: *is there any difference in perception between the traditional and active learning classroom design?*

(null) ho: *there is no difference in perception between the traditional and active learning classroom design.*

(alternative) h_1***:*** *there is a difference in perception between the traditional and active learning classroom design.*

difference in perception

an independent samples t-test was conducted to determine if instructors' mean perception of traditional classroom instructors differed from those in Active learning classrooms. The normality assumption was tested and met for Traditional classrooms' distributional shape of the dependent variable (perception). A review of Table 8-9 shows Shapiro-Wilk (S-W) test for normality (*SW = .981, df = 36, p = .781*) and skewness (-.111) and kurtosis (-.218) statistics suggested that the data are a little skewed and kurtotic. Still, it does not differ significantly from normality. Shapiro-Wilk test of normality was relied on since the data set for the current study was less than 100. Thus, we can assume that our normality for traditional classroom perception was a reasonable assumption.

Table 8. Descriptives

	Classroom Design			Statistic	Std. Error
Perception	TLC	Mean		3.07	.124
		95% Confidence Interval for Mean	Lower Bound	2.82	
			Upper Bound	3.32	
		5% Trimmed Mean		3.08	
		Median		2.94	
		Variance		.553	
		Std. Deviation		.744	
		Minimum		1	
		Maximum		4	
		Range		3	
		Interquartile Range		1	
		Skewness		-.111	.393
		Kurtosis		-.218	.768
	ALC	Mean		3.28	.116
		95% Confidence Interval for Mean	Lower Bound	3.05	
			Upper Bound	3.52	
		5% Trimmed Mean		3.26	
		Median		3.12	
		Variance		.321	
		Std. Deviation		.567	
		Minimum		2	
		Maximum		4	
		Range		2	
		Interquartile Range		1	
		Skewness		.726	.472
		Kurtosis		-.395	.918

Table 9. Tests of Normality

	Classroom Design	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Perception	TLC	.096	36	.200*	.981	36	.781
	ALC	.155	24	.142	.927	24	.085

Notes. *. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Similar results were found for the perception of active learning classroom design. review of table 9, s-w test for normality (*s-w = .927, df = 24, p = .085*) and skewness (.726) and kurtosis (-.395) statistics (table 8) suggested that the data are a little skewed and kurtotic. still, it does not differ significantly from normality. thus, we can assume that our normality for the perception of active learning classroom design was a reasonable assumption.

as shown in table 10, data on perception was gathered from 36 traditional and 24 active learning classrooms, with a TLC mean of 3.07 (*SD = .744*) and ALC mean of 3.28 (*SD = .567*).

Table 10. Group Statistics

	Classroom Design	N	Mean	Std. Deviation	Std. Error Mean
Perception	TLC	36	3.07	.744	.124
	ALC	24	3.28	.567	.116

For the independent t-test, the current data set relied on *equal variances assumed* (*t = -1.204, df = 58, p = .234*) as shown in Table 11. According to Levene's test, the homogeneity of variance assumption was satisfied (*F = 1.730, p = .194*). Because there was no random assignment of the individuals to classroom designs, the assumption of independence was not met, creating a potential for an increased probability of Type I or Type II error. The independent t-test indicated that the perception means were not statistically significantly different for Traditional classrooms and Active learning classrooms (*t = -1.204, df = 58, p = .234*). Thus, the null hypothesis that the perception means were the same by classroom design failed to reject at

the .05 level of significance. Cohen's d, the effect size was computed to be .316, which is interpreted as small (Cohen, 1988).

Table 11. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
								95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Perception	Equal variances assumed	1.730	.194	-1.204	58	.234	-.215	.179	-.574	.143
	Equal variances not assumed			-1.271	56.874	.209	-.215	.170	-.555	.124

Difference in Values

RQ 3: *Is there any difference in values between the traditional and active learning classroom design?*

(null) ho: *there is no difference in values between the traditional and active learning classroom design.*

(alternative) h_1: *there is a difference in values between the traditional and active learning classroom design.*

An independent samples t-test was conducted to determine if the mean values of instructors teaching in Traditional classrooms differed from those teaching in Active learning classrooms. The normality assumption was tested and met for Traditional classrooms' distributional shape of the dependent variable (value). A review of Table 12-13 shows Shapiro-Wilk (S-W) test for normality (*SW = .975, df = 36, p = .573*) and skewness (.353) and kurtosis (-

.336) statistics suggested that the data are a little skewed and kurtotic. Still, it does not differ significantly from normality. Thus, we can assume that our normality for traditional classroom perception was a reasonable assumption.

Table 12. Descriptives

	Classroom Design			Statistic	Std. Error
Values	TLC	Mean		2.69	.153
		95% Confidence Interval for Mean	Lower Bound	2.38	
			Upper Bound	3.00	
		5% Trimmed Mean		2.66	
		Median		2.75	
		Variance		.843	
		Std. Deviation		.918	
		Minimum		1	
		Maximum		5	
		Range		4	
		Interquartile Range		1	
		Skewness		.353	.393
		Kurtosis		-.336	.768
	ALC	Mean		2.57	.170
		95% Confidence Interval for Mean	Lower Bound	2.22	
			Upper Bound	2.92	
		5% Trimmed Mean		2.54	
		Median		2.44	
		Variance		.693	
		Std. Deviation		.832	
		Minimum		1	
		Maximum		4	
		Range		3	
		Interquartile Range		1	
		Skewness		.642	.472
		Kurtosis		-.216	.918

Table 13. Tests of Normality

	Classroom	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Design	Statistic	df	Sig.	Statistic	df	Sig.
Values	TLC	.080	36	.200*	.975	36	.573
	ALC	.142	24	.200*	.947	24	.238

Notes. *. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Similar results were found for the values of active learning classroom design. review of table 11, s-w test for normality (*s-w = .947, df = 24, p = .238*) and skewness (.642) and kurtosis (-.216) statistics (table 11) suggested that the data are a little skewed and kurtotic. still, it does not differ significantly from normality. thus, we can assume that our normality for the perception of active learning classroom design was a reasonable assumption.

As shown in Table 14, data on values were gathered from 36 Traditional learning classrooms, 24 Active learning classrooms, with a TLC, mean of 2.69 (SD = .918) and ALC mean of 2.57 (SD = *SD = .832*).

Table 14. Group Statistics

	Classroom Design	N	Mean	Std. Deviation	Std. Error Mean
Value	TLC	36	2.69	.918	.153
	ALC	24	2.57	.832	.170

For the independent t-test, the current data set relied on *equal variances assumed* (*t = .502, df = 58, p = .618*) as shown in Table 15. According to Levene's test, the homogeneity of variance assumption was satisfied (*F = .535, p = .618*). Because there was no random assignment of the individuals to classroom designs, the assumption of independence was not met, creating a potential for an increased probability of Type I or Type II error. The independent t-test indicated that the value means were not statistically significantly different for Traditional classrooms and Active learning classrooms (*t = .502, df = 58, p = .618*). Thus, the null hypothesis that the value means were the same by classroom design was failed to reject at the .05 level of significance. Cohen's d, the effect size was computed to be .131, which is interpreted as small (Cohen, 1988).

Table 15. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Value	Equal variances assumed	.535	.468	.502	58	.618	.117	.233	-.350	.584
	Equal variances not assumed			.512	52.665	.611	.117	.229	-.342	.576

Content Analysis of Open-Ended Questions

In this evaluative case study research design, the researcher tried to deeply understand the role of the physical environment on instructors' instructional methodology for better design approaches in the future. Therefore, attention was given to different classroom settings and their physical design attributes from the instructors' perceptual point of view. Understanding what design aspects instructors find supportive of their instructional methodology is essential because this area still needs to be researched (Altinbasak, 2016; Ge et al., 2015; Hensley-Pipkin, 2015).

The open-ended survey questions helped provide in-depth information to answer the current research questions. The data analysis has identified five themes that speak to recent research questions. It is believed that these themes informed research questions that contributed to the body of knowledge regarding the role of classrooms' physical design attributes on instructors' instructional methodology. Direct quotes were used from the survey to illustrate each respondents' survey response.

Furniture Mobility

The first theme that emerged from the data analysis was *furniture mobility*. Instructors perceived that fixed or immobile furniture most commonly present in traditional classrooms hindered the active learning teaching approach the most. for example, one of the instructors teaching in a traditional classroom commented, "teaching is hindered by fixed arrangement (auditorium or fixed dews/columns) of furniture and positioning of faculty only at the front. i can teach in those types of environments, but they hinder creative teaching." fixed furniture affects not only the active teaching approach but also in-class interactions and discussions. another traditional classroom instructor teaching active pedagogy commented, "the room layout support lectures, discourse with the instructor, and limited discourse with other students, but it is difficult to divide into groups of more than three. you can accomplish a lot with small groups, so i can conduct class effectively within those limitations." a similar comment made by an instructor is that "fixed furniture is a hindrance. most classrooms are set up for lecture delivery. there is little opportunity for effective group work or collaboration between students."

even some active learning classrooms have immobile/ fixed furniture due to technology and electrical system, which also affected active pedagogy for a few instructors. for instance, one of the instructors responded, "… my instructional method is very much impacted because everything in the room is fixed/bolted to the floor." another participant teaching in ALC made a similar comment "… a classroom where the desks cannot be moved, and it makes it difficult for students to work in groups." But most of the instructors believed that ALCs support their active instructional approach. For example, one instructor responded, "Again, the flexible seating does not hinder my teaching style but supports it. I once taught in a room with chairs bolted to the

floor. That hindered my teaching style." Like the previous comment, another participant responded, "the less traditional the classroom, the more flexible it is, the more I can do."

Furniture Layout

A second theme surfacing from this data set is *the role of furniture layout for teaching and learning.* Almost all the instructors mentioned how classroom design impacts their instructional approach through circulation and the level of crowding. Most teachers in Traditional classrooms complained about how poor furniture layout results in poor circulation and overcrowding, leading to effective instructions. For instance, an instructor mentioned that "the room is huge, cramped, hard to walk through or walk around, and students are shoulder to shoulder, so they are easily able to see their neighbor's answers during tests.". Another instructor commented on the poor circulation in the way that there are "no aisles to walk up and down." A similar problem was mentioned by an instructor stating that "the aisles are narrow, so if I'm walking around the room, I'm limited. It's hard to reach some students to answer their questions."

Regarding poor circulation and overcrowding due to classroom furniture that hinders the active teaching approach, most ALCs are no different from Traditional classrooms. Teachers complained that their classrooms have "too many tables/chairs for students and the instructor to be able to flow and move between spaces comfortably and effectively." Inadequate space design can lead to crowding and a lack of personal space for occupants. Another instructor mentioned, "there is not enough room to move about student groups freely." Similarly, one of the respondents commented, "sometimes the classroom does not have enough space to walk around the desks… the desks are difficult to move." Furthermore, instructors also reported hindrances in teaching due to the odd shape and size of the classrooms. One of the instructors highlighted the

issue: “the most common problems I have are: the room is either too wide or too long, so it’s hard to reach and interact with students either at far ends of the room or way in the back….”

Contrary to the afore-mentioned results from the open-ended questions, only a few instructors mentioned that even though the traditional classroom furniture layout hindered their choice of the instructional method, they still managed to use active learning pedagogy. For instance, one of the instructors responded, “there are constraints because no layout is infinitely flexible, but I’m able to work with them.” An instructor made a similar comment was that “I make it work.”

Technology

The third theme related to current research questions is *technology*. Traditional classrooms seemed to have old, non-functional, or mostly out-of-order technology that hinders instructions; as one of the instructors mentioned, “access to working internet is critical.” Another instructor commented that technology hinders teaching and learning, “… the technology is hard to figure out and/or doesn’t completely work.” A similar comment made by an instructor was that “the technology in my classroom is unreliable, clunky, cumbersome and hard to use. I use my laptop rather than the computer in the room because I don’t trust it.” Even some of the ALC lack state-of-the-art technology, as one of the instructors teaching in ALC mentioned that the classroom “needs newer technologies.”

Values

The fourth theme that surfaced from the data analysis was based on *personal and corporate values*. On a personal level, the instructors who teach in Traditional classrooms at OU do not feel autonomous in choosing the instructional method, especially if it’s an Active learning approach. For instance, one of the instructors commented, “I prefer discussion-based courses

and allowing students time to practice the skills we discuss. That's almost impossible to do in this room ..." In contrast, the instructors teaching within the Active learning classrooms feel autonomous in their choice of instructional methodology. For example, one of the instructors teaching in ALC mentioned, "I have the autonomy to choose the type of instructional method that I would like to use in my classroom." But overall, the OU instructors think they lack the autonomy to choose classrooms of their choice to teach autonomously, such as a teacher mentioned that "we are assigned classrooms." It is because only a few ALCs are available on OU campuses.

Moreover, instructors did not find TLCs supportive of their AL instructional methods. For instance, mentioning TLC designs, an instructor commented, "you can be flexible with methods in different environments, but most of the rooms I have taught in at OU do not support team-based learning, instructor circulation, and in-class activities." Therefore, on personal values, instructors did not feel autonomous in choosing classrooms, which eventually affected their instructional methodology.

However, for the values of the University of Oklahoma as a corporate for providing state-of-the-art-classrooms, instructors think that "the room I use… still has a blackboard, not a whiteboard, but I never use the board during this class." Another instructor highlighted the issue by commenting that "our classrooms do not have computers, every building has a different computer connection/input, we should not have blackboards because they are a health hazard, and team-based or problem-based work is difficult in many classrooms on campus. While OU strongly values education, they do not show it in the classrooms I have used." Another instructor made a similar comment complaining that there is "a true lack of congruence between what the university believes and what it demonstrates." Overall, instructors believe that OU does not

provide state-of-the-art classrooms and current classrooms need better physical design attributes for better teaching and learning outcomes.

Design for Future Classrooms

The fifth theme that emerged from the data analysis was *instructors envisioning an ideal design for future classrooms.* In the survey, instructors were asked to suggest physical aspects they envision in an ideal classroom to help future classroom designs. For instance, one of the instructors mentioned, "all classrooms should have flexible, movable seats that allow groups of 3,4,5, or 6 to be made while maintaining sufficient flow space. Greater presentation surfaces are needed; this means digital screens and whiteboards on more than one wall, so all students can easily view, no matter where they are seated… Large whiteboards in every classroom. 4ft by 4ft boards are not sufficient." Instructors suggested additional writing boards for students on each desk. They also suggested designing ample storage for practical classes or studios, "so they could write and erase—ample storage in each classroom for artifacts, manipulatives, tools, or technology used in the class. Smartboards or interactive boards that reliably work." One of the instructors who taught in TLCs suggested the physical attributes of an ideal classroom, "desks that allow for group work. Space between desks to walk... More whiteboard areas to write on." Almost all the respondents mentioned similar design aspects, such as optimal classroom space, the flexibility of furniture layout, whiteboard space, ease of use of technology, etc.

Demographic Characteristics

The descriptive statistics of demographic variables such as gender, age, position, and major field of study, were asked at the end of the survey. The summary of these variables is presented in Table 16. The demographic variables were the individual-level control variables

that were not the focus of the present study; thus, these variables were not part of the research questions.

Sixty participants chose to respond to the age question. Participants varied in their ages between the four indicated categories: 1.7% was between the age of 21-30 years old, 28.3% were between the ages of 31-40 years old, 20.0% were between the ages of 41-50 years old, 23.3% were between the ages of 51 – 60, 25.0% were between the ages of 61-70, and 1.7% chose not to disclose their age. Regarding subjects' teaching positions, there were 49 full-time teachers (81.7%), four part-time faculty members (6.7%), and seven graduate assistants (11.7%) who also participated in the survey research. In terms of subjects' major field of study, the majority of them were from STEM (Science, Technology, Engineering, and Math) (37.3%), followed by social sciences (33.9%), natural and medical sciences (15.3%), and humanities (13.6%).

Table 16. Descriptive Statistics of Demographic Variables

		Count	Column N %
Gender	Male	24	40.7%
	Female	35	59.3%
	Total	59	100.0%
Age	20 - 30	1	1.7%
	30 - 40	17	28.3%
	40 - 50	12	20.0%
	50 - 60	14	23.3%
	61 - 70	15	25.0%
	I do not wish to disclose	1	1.7%
	Total	60	100.0%
Position	Full-time	49	81.7%
	Part-time	4	6.7%
	Graduate Assistant	7	11.7%
	Total	60	100.0%
Major	Humanities	8	13.6%
	Social Sciences	20	33.9%
	Natural and medical sciences	9	15.3%
	STEM	22	37.3%
	Total	59	100.0%

The previous literature found no significant relationship between the demographic and the dependent variables. Thus, for testing inter-relationship among demographic variables, a crosstabulation was conducted to help better understand respondent characteristics and was considered non-solution-related. Tables 17 – 19 show the crosstabulation between gender and instructors' position such as full-time, part-time, and graduate teaching assistant, gender and age, and gender and respondents' major field of study, respectively (implications of the findings are discussed in the Discussion chapter).

Regarding the relationship between the position of instructors and their gender, crosstabulation showed that the percentage of male full-time instructors was the highest (88%) among instructors working in other positions (part-time and graduate assistants). Accordingly, the percentage of full-time female instructors was found to be highest (80%) among instructors working in other positions (part-time and

graduate assistants). Therefore, among all the survey participants, full-time faculty members had the highest response rate (83.3%).

Table 17. Position * Gender Crosstabulation

			Gender		
			Male	Female	Total
Position	Full-time	Count	22	28	50
			88.0%	80.0%	83.3%
	Part-time	Count	3	1	4
			12.0%	2.9%	6.7%
	Graduate Assistant	Count	0	6	6
			0.0%	17.1%	10.0%
Total		Count	25	35	60
			100.0%	100.0%	100.0%

As seen in Table 18, the percentage of male instructors was found to be highest who had an age range between 61-70 (36%) in comparison to the age groups (20-30, 31-40, 41-50, and 51-60). Accordingly, the percentage of female instructors was highest with an age range between 31-40 (31.4%) compared to the age groups (20-30, 41-50, 51-60, and 61-70). Therefore, among all the survey participants, male and female instructors aged 61-70 and 31-40 had the highest response rates (26.7% and 26.7%, respectively).

Table 18. Age * Gender Crosstabulation

			Gender		
			Male	Female	Total
Age	20 - 30	Count	0	1	1
			0.0%	2.9%	1.7%
	31 - 40	Count	5	11	16
			20.0%	31.4%	26.7%
	41 - 50	Count	3	9	12
			12.0%	25.7%	20.0%
	51 - 60	Count	7	7	14
			28.0%	20.0%	23.3%
	61 - 70	Count	9	7	16
			36.0%	20.0%	26.7%
	I do not wish to disclose	Count	1	0	1
			4.0%	0.0%	1.7%
Total		Count	25	35	60
			100.0%	100.0%	100.0%

As seen in Table 19, the percentage of male instructors teaching in STEM majors was the highest (41.7%) compared to the other fields of education (humanities, social sciences, and natural and medical sciences). Accordingly, the percentage of female instructors teaching in social sciences majors was the highest (37.1%) compared to the other fields of education (humanities, natural and medical sciences, STEM). Therefore, among all the survey participants, male instructors teaching in STEM and female instructors teaching in social sciences had the highest response rates (41.7% and 37.1%, respectively).

Table 19. Major * Gender Crosstabulation

			Gender		
			Male	Female	Total
Major	Humanities	Count	2	6	8
			8.3%	17.1%	13.6%
	Social Sciences	Count	6	13	19
			25.0%	37.1%	32.2%
	Natural and medical sciences	Count	6	4	10
			25.0%	11.4%	16.9%
	STEM	Count	10	12	22
			41.7%	34.3%	37.3%
Total		Count	24	35	59
			100.0%	100.0%	100.0%

Qualitative Data Analysis

For the explanatory sequential mixed methods design, the results section first reported the quantitative survey findings, followed by qualitative results from the semi-structured interviews. One of the qualitative analysis' strengths involves its ability to illustrate the aspects of a shared human phenomenon (Ayres, Kavanaugh, & Knafl, 2003).

RQ-4. *How do instructors perceive their current classroom design in relation to their instructional methodology?*

Therefore, to answer the qualitative research question, nine semi-structured interviews were recorded via Zoom and later transcribed using Otter.ai and Zoom's transcription feature. The transcribed data was then imported into MAXQDA for coding and data analysis. The content analysis technique was utilized to code the textual data systematically. The coding process consists of combining text into small categories of information to synthesize evidence for each code from the study's databases and later assigning those codes with the labels (Creswell, 2013). Figure 20 below shows the single-case model of the themes generated from

the interview data sets using MAXQDA, based on their frequencies. These aspects were discussed the most by the instructors during the interviews and have been explained in detail below.

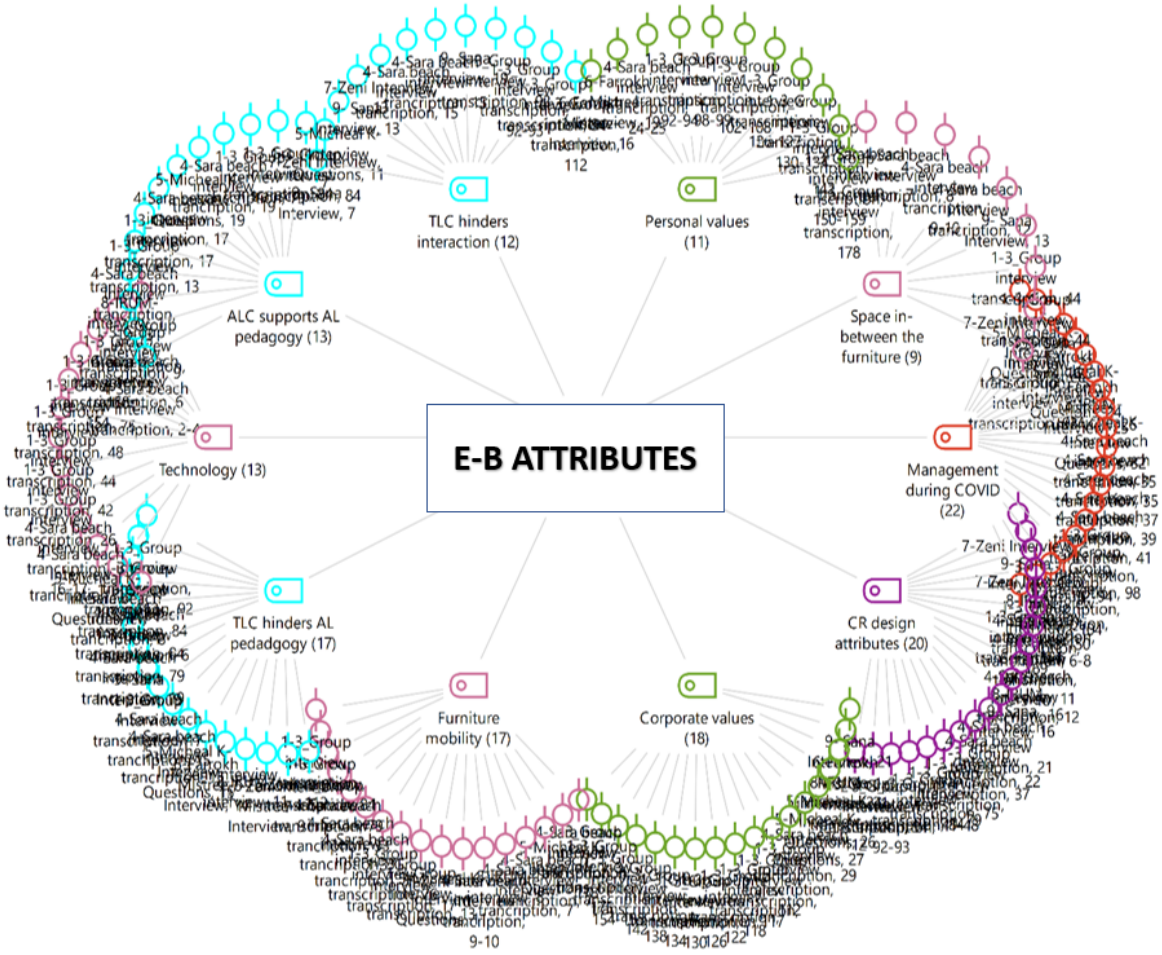


Figure 20. Single-Case Model of the Study Interviews

Five major themes and a few related sub-themes emerged from the data analysis. According to Creswell (2013), these themes and categories are synonyms in qualitative research. They are also considered broad information units composed of several codes combined to form one unanimous concept. As can be seen in Figure 21, five major themes and related sub-themes that emerged from this qualitative research consisted of 1) Classroom design attributes, 2) Technology, 3) Instructional method, 4) Corporate and personal values, 5) management during

COVID-19. These themes speak to the research questions in ways that contribute to the body of knowledge regarding the role of classroom design attributes towards instructors' instructional methodology. The faculty's teaching experiences in active and Traditional learning classrooms that were gathered from the data have provided valuable insights about classroom design elements. Interpretations of these themes generated the findings below.

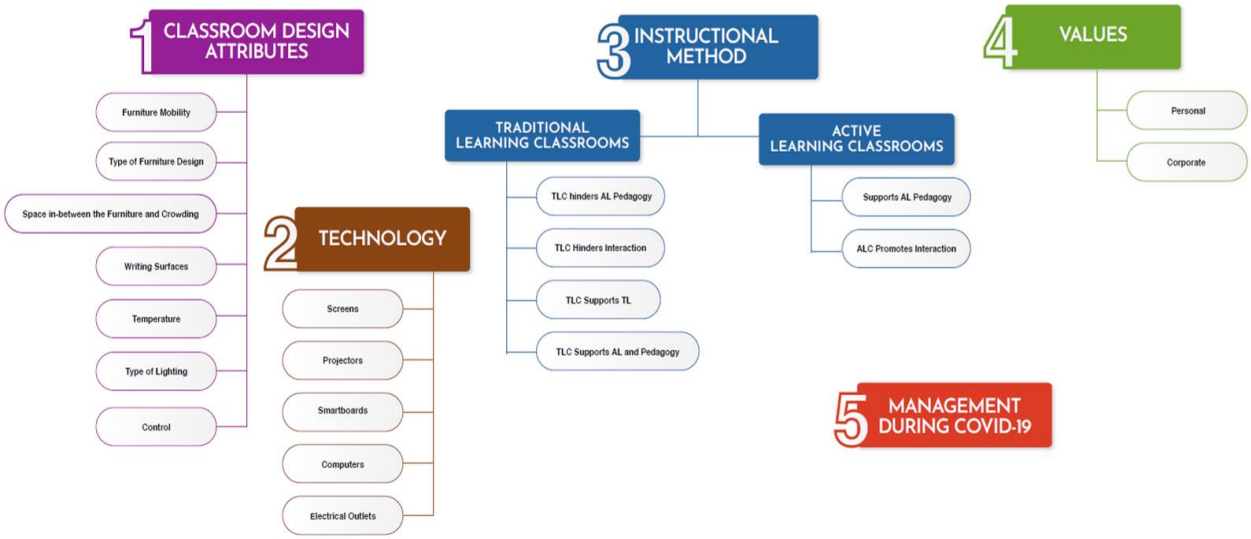


Figure 21. Themes and Sub-themes that Emerged from the Interviews

Classroom Design Attributes

The first theme, *classroom design attributes,* highlighted the role of a classroom's physical elements in an instructor's choice of an instructional method, such as furniture mobility, type of furniture design, space in-between the furniture and crowding, writing surfaces, temperature and lighting control, and noise as its sub-themes. Faculty interviews revealed that furniture mobility and classroom layout are the most affecting physical design attributes in any classroom. Research suggests that classroom size, furniture flexibility, and layout are some of the most important factors for better teaching and learning outcomes (Altinbasak,2016; Brooks, 2012; Merrienboer et al., 2017; Scott-Weber et al., 2000). Classroom layouts with grouped

seating encourage interaction among students and teachers, while moveable/ flexible furniture facilitates multiple pedagogies and supports instructors' instructional methodology. The interview findings are consistent with the survey results and previous literature

Moreover, instructors who taught in Active learning classrooms mentioned that "the way the tables are set, they're set so they have to talk to each other, and they don't look at a centered person… so that students look at each other and talk to each other. And there's room to move around…." Flexible furniture with grouped seating also encourages instructors and students to comfortably move within each student group and from place to place within the classroom to discuss among groups and the teacher to interact with every student group. Since there are multiple screens in ALCs, different forms of documents are presented on the screens so that different students or groups can present their work and make comparisons at the same time, depending upon the activity that is going on during the class. Instructors use grouped and flexible seating along with multiple screens and writing surfaces in many different ways. Similarly, another instructor emphasized that "The table supports interaction. If you have people around a table, then they can talk to each other much more easily, especially if the table is not that huge."

Furniture Layout/ Design. Classroom space design has been given significantly less importance, hindering teaching and learning. Even though the grouped seating in Active learning classrooms supports instructors' instructional methodology, it negatively affects circulation and occupants within the classroom in some cases when it gets crowded. An instructor shared her experience: "It's harder for me to get between the desks to see what groups are doing… groups are closer together, which makes it a little difficult to interact. Sometimes I send people out into the hallway so that they're not disturbing each other as they have conversations to problem-solve whatever the task at hand is. Poor spacing hinders my instructional method." Crowding within classroom spaces can also violate

individuals' personal space. Another instructor mentioned that "space is really important because students have personal space. Sometimes if they're too clustered, they feel extra awkward." Not only are TLCs typically considered crowded, but some ALCs can also get crowded when grouped seating layout is planned in a small space to facilitate active learning. Findings from the survey also support these findings.

Writing Surfaces. Another important classroom design element that instructors believed facilitated their instructional method within the classrooms were the whiteboards or glass writing surfaces. according to an instructor teaching in an active learning classroom, "whiteboards for students to be able to work are necessary." A similar comment from an instructor was that "the whiteboard was actually a very entity in my classroom. The glass surrounding was often very good because the students had to present." Availability of writing surfaces, however, was not the case with the instructors who taught in Traditional learning classrooms, as they avoided using the chalkboards in Traditional learning classrooms due to their health-affecting concerns. One of the interviewees said that "the room had a chalkboard, not a whiteboard. I used it sparingly during the semester." Another instructor showed a similar concern saying, "I had chalkboards, which as a public health person aggravates me to no end because I know their asthma and allergy triggers." instructors also mentioned that there are insufficient writing surfaces to support teaching and learning within the Traditional learning classrooms. Instructors believe limited access to whiteboard space may hinder interaction among students and between teachers and students.

Temperature and Lighting Control. Regardless of the type of classroom design, one common thing in active and traditional learning classrooms was the lack of instructors' ability to control classroom temperature and lighting. An instructor mentioned, "another big issue is

indoor temperature control, and it's an assault with 67 degrees with tiled floors and fluorescent lighting. It's so unpleasant. Teaching in icepacks does not foster active learning ha-ha." Another instructor commented that "the lack of temperature control is ridiculous and it is crazy… it is miserable in wintertime in particular. It was a frustration for everybody."

Optimal lighting and lighting fixtures are essential to support teaching and learning and prevent glare. Expressing their concerns about the lack of optimal lighting, instructors said, "Fluorescent lighting in the traditional classroom is such a drag. It wears people out. And then, when you or students are sharing slides, it's nice to have ambient lighting." It is good to have control over natural and artificial lighting sources within the classroom to facilitate teaching and learning. Another instructor mentioned that "if I'm using one class, I want the sunlight in there… But I need to have enough power to overcome that. Why? Because I think we need it, we don't need a constant fluorescent glow." Sometimes natural light can be too bright, which can cause glare. Lighting should support teaching and learning processes so students and teachers feel at ease and in control (Scott-Webber et al., 2000).

Noise Control. One last classroom design attribute that instructors perceived as a hindrance in their choice of instructional methodology is the noise level in Traditional learning classrooms. With the traditional classroom layout and furniture without wheels, instructors who use active instructional methods mostly have to change the furniture layout, thus wasting class time and increasing noise levels. For example, an instructor mentioned that "unfortunately, an activity calls for a room transformation each time. This adjustment leads to unwanted furniture dragging noises." Another instructor mentioned, "The seating arrangement in rows hinders instruction whenever group discussions/activities are part of the lesson plan." Having to

rearrange the physical features of the room not only hinders instruction but also is a waste of limited class time and gets noisy. This further leads to incomplete tasks.

Technology

Screens. Technology is the second theme that emerged from the data set correlating to the classroom design. Especially those instructors who identify as using *active pedagogy* expressed the need for technology in detail as, according to them, there is a lack of sufficient technological elements in many classrooms. One of the instructors said, "what's really helpful are electrical outlets… lighting and the screens, multiple screens… I have had technology go down, so it's been very frustrating for me and students." As mentioned, ALCs are enhanced digital learning spaces with multiple screens and grouped seating layouts to support group work. Still, not all ALCs have a smart board, which is essential to promote more interaction. Another instructor highlighted the need for classroom design and technology to support an active instructional approach. According to the instructor, "I would prefer using an interactive smartboard where I can post an assignment up, and students can look at it… I think the lack of multiple screens has the potential to hinder in-class interaction. Because it's setup only to look at one thing in the front." Technology has a significant role in supporting teaching and learning for better educational outcomes.

Projectors. Projectors and screens had been extremely helpful for instructors during COVID-19, especially within the studios and labs for design-built courses. Referring to their experiences, one of the instructors mentioned that "I love the ability for them to hook up and then project if they're working on a computer, to be able to project and share if they're creating those things. I enjoy that built-in infrastructure for projectors, and to be able to, you know, highlight specific things."

Contrary to ALCs instructors' experiences, the instructors who taught active pedagogy in Traditional learning classrooms with limited technology access devised ways to be less dependent on it. One of the instructors commented, "I was a low-tech-high interaction with students professor, and so most of what you list (ALC attributes) was not important to my teaching. There were a couple of times each semester when I allowed students to take out their cell phones and search the web for information so that we could compare it with the textbook... I was pleased with the wireless internet, so I think I adapted to whatever I had at my disposal." Open-ended survey responses also highlight similar technology-related issues with which instructors had to deal during their instruction, such as non-functional or out-of-order screens and projectors, limited access to the internet, non-user-friendly technology, and outdated devices installed within the classrooms.

Electrical Outlets. Electrical outlets for students' devices and in-class instructors' computers support teaching and learning. One of the instructors also said, "what's really helpful are electrical outlets and every (in-class) computer that depends on a network so that you won't have to bring your laptop." I also asked instructors about their perception of the tables in Active learning classrooms hooked with electrical outlets and some additional wiring that makes those tables immobile. Instructors found perceived electrical outlets and technology supportive of their instructional approach. As one of the instructors responded, "the tables are hooked in so that you have to have groups… and the groups can work together… they're facing each other and basing screens that can have my description on... I mean, the tables are, yes, they're immovable, but they're intended to be small group discussions faces." Therefore, the extent to which instructors use technology in instruction can significantly depend upon its availability within a classroom, both for teachers and students. Instructors who use active instructional

methodology use different forms of technology to support their instruction for better teaching and learning.

Instructional Method

The third theme related to the research questions is the instructional methodology.

Active Pedagogy in Active Learning Classrooms. Instructors who use active pedagogy and teach in active learning classrooms find multiple screens and cluster furniture layouts that facilitate smooth circulation within the classroom, supportive of their instructional approach. instructors mentioned that active learning classrooms promote interaction, as according to her, "the elements that best support instruction and interaction with the students is the amount of desk space available that leads to unobstructed learning and access to technology for most students." Instructors who had the opportunity to teach in ALCs with grouped seating found it helpful for their instructional approach.

Active Pedagogy in Traditional Learning Classrooms. On the contrary, teachers who identify as using active instructional methods but are placed in Traditional classrooms did not find those classrooms supportive of their instructional approach. An instructor mentioned, "I have that stadium seating in some of these classes; it's much harder to get the students to get together and interact and have those kinds of activities going on." Another instructor mentioned that Traditional classrooms do not support active teaching and learning but a lecture. According to him, "Traditional classrooms with whiteboard and screen at one end, where students sit at desks in rows, and the instructor projects their slides on the screen. It does not support my instructional method."

TLCs do not provide students the opportunity to participate in group discussions and, in return, affect the teaching and learning process. However, one of the instructors commented,

"we'd still need some of the large lecture halls. There's still a purpose for those. I still believe in a solid lecture that can get people thinking quietly." Instructors who use AL pedagogies found teaching challenging in TLCs as the physical design attributes did not support their instructional approach. These findings were consistent with the survey results.

Traditional Pedagogy. Teachers using the traditional instructional method consider student-student and student-teacher interaction distractions. These instructors prefer passive learning with minimal student engagement, mainly with the course content and the teacher. Typical TLCs are the spaces where students sit facing one direction, which supports traditional instructors in their teacher-centered pedagogies. One of the instructors mentioned, "my traditional teaching has been supported by the TLCs with the ease of class engagement that it offers. It helps me stay focused in the lesson and avoids unnecessary distractions." Teachers who solely use lecture-style find traditional learning classroom supportive of their pedagogical approach, one of the instructors mentioned that "it (TLC) never hinders my teaching."

Values

Values were the fourth theme that emerged from the interviews. Values theme was divided further into sub-themes such as corporate and personal values. This discussion helped to address the third research question.

RQ 3: *Is there any difference in values between the traditional and active learning classroom design?*

Most instructors at the University of Oklahoma feel that OU needs to value/ promote teaching and learning more while providing them with state-of-the-art classrooms. Moreover, instructors believe that the University of Oklahoma need to make even more rational decisions regarding active learning classroom budget allotment. According to one of the instructors,

"these Active learning classrooms are not well distributed across campus." Instructors feel that OU's decision to place new ALCs on the South campus is not practical because it is far away from the rest of the campus departments.

Teaching during the pandemic was also one of the biggest challenges for higher education institutions worldwide. Educators and the university administrations tried their best to deal with this problem for smooth lecture delivery and student learning while keeping attendance the same as before the pandemic. Since there was a drastic change in typical teaching and learning during the pandemic from in-person to online classes, there needed to be a change in classroom design attributes to keep up with the change smoothly. For instance, projectors show instructors the online students via Zoom, but they should also be able to see students' chats on the screens so that the instructors do not have to move in-between the screens or stop their instruction just to keep up with the students who tired participating in the discussion if it's a full discussion going on. Additional screens/ projectors and microphones are among the technological design attributes needed for instructors to teach without feeling tethered.

Although there are ALCs in almost all the college buildings at OU, the number of ALCs is minimal compared to the number of TLCs. Again, the distribution of the number of ALCs in each college is inconsistent throughout campuses. Some colleges have a couple of ALCs, while others may have one or two. Due to this uneven distribution of ALCs within each college, not all the instructors who use active pedagogies get to teach in the ALCs to support their teaching and learning methods. One of the instructors from the College of Education also mentioned this problem of uneven distribution of ALCs and commented, "I would say at least in our building, yes. In other buildings, maybe not so much."

Classrooms allotted to instructors most of the time did not align well with their instructional approach, or the course taught at that time. For instance, instructors who taught in Active learning classrooms did not complain about the abovementioned issues. However, as can

be seen from the afore-mentioned interviewees' responses, instructors who identified as using AL pedagogies but had to teach in Traditional learning classrooms did not find traditional classroom design attributes supportive of their instructional methodology. if they had a choice, they would have chosen a different classroom from what they had at that time. one of the instructors highlighted how the traditional classroom allotted for his practical course hindered teaching and learning, "Students cannot use this as a studio. This is limiting if students have to design and build a project. Else, it works."

Teaching online due to pandemics with limited resources in traditional learning classrooms also hindered teaching and learning. Instructors teaching in TLCs feel that they lack the autonomy to implement their choice of instructional methodology. An instructor mentioned, "I can't walk around as much because the room is too large. You get more than 35-40 feet from the computer, even with the microphones. The range is problematic." Stadium seating is also a form of TLC setting that does not support easy circulation and interaction among occupants. During the pandemic, instructors had to simultaneously use microphones while teaching online and in-person students, which became a problem for most: "I'm spaced out spatially constrained. I feel tethered, and it drives me nuts because then there's a whole lot of students who I never get to make eye contact with and make that point like, yeah, I know, and we can do these things."

Another instructor mentioned a similar technology issue related to teaching in Traditional learning classrooms during the pandemic. Due to the lack of multiple screens within the TLCs, it became difficult for instructors to interact with students. For instance, one instructor mentioned, "it was really frustrating when we were doing the weird hybrid model where students were out because if you walk around, they can't hear you. If other students are participating, they can't hear them. And if you're monitoring the students who are with you, you can't see who's online.

And if you're monitoring who's online, you can't see who is with you. It's it was a mess." Yet, one of the instructors who had more than 50 students in his design, build, and test course and was placed in a traditional learning classroom found it better to teach online than in-person. According to him, "I am very comfortable offering courses via Zoom. For my undergraduate design, build and test course, I would like a studio. But we have over 100 students in this course." Instructors who taught a larger number of students, but had limited classroom resources, found it more productive to teach online than in-person, as the physical design attributes of TLCs did not support their instructional method.

Management during COVID-19

This leads to my fifth and last theme, *management during COVID-19*, contributing to the new body of knowledge. From the interviewee responses, I found that either teaching in an active learning classroom or a traditional learning classroom, overall, became quite difficult for instructors to use their choice of instructional approach both online and in-person during COVID-19. During the interviews, instructors shared their struggles and experiences managing that stressful time. One of the instructors explained,

> "So as an epidemiologist, I'll say the pandemic is not over, but we certainly have decided it is… During the time of the pandemic, I did discussion sections; my big class was broken into multiple discussion sections, but by the end of the semester, there were only out of 45 students per section, two or three showed up. So, when they have this option, and they know that almost everything's online, a lot of students just go, I'm not going to come. So, it does take away from that. Now, I understand I didn't at that point, I was kind of like, well, should we be in person any at all anyway,

but it's hard to do a really good discussion online. It's better than trying to do the hybrid, but it's difficult."

As mentioned earlier in this chapter, instructors felt the need for multiple screens even more during the pandemic to simultaneously see online students and their chats or discussions.

Instructors shared exciting ways of keeping up with their active instructional methodology during the pandemic. One of the instructors elaborated, "teaching in pandemic made things difficult… for a Zoom class, you had to rethink how you did small group instruction and thank goodness for the breakout rooms, that it also forced me to include a link to a Google folder for each one of my classes, where I could send students and say, I want you to start a Google file. And here's the task that you have." Instructors devised ways to engage students online by assigning different tasks and holding them accountable through progress checks. For instance, an instructor mentioned, "it (pandemic) forced me to send the students an outline what all the tasks we're going to be… a lot of times. It's like, here's your task, and then we're going to come together and share the outcomes of your task. And I'm going to put it in here so that you have the notes for what we all decided, which is a little more difficult. But since I gave the students access to a Google folder for the entire semester, it encouraged them to become more collaborative and talk to each other as they were across space and time... And then, we would create it together." Instructors worked hard to learn how to teach differently during COVID-19 because it's not the same as just converting face-to-face to online. Although many people seem to think it is, but it's not. Additionally, instructors had to reconsider the kinds of projects to give students, "so many of my students blog instead of writing traditional academic papers."

While teaching during a pandemic was a difficult task for everyone, it also negatively affected both instructors' and students' performances compared to in-person sessions. There was

a sudden and unplanned change from the regular teaching routine. This change involved a temporary shift from face-to-face teaching to online or remote teaching and learning mode (Iglesias-Pradas, 2021). "The pandemic has shaken up the landscape of higher education worldwide (Iglesias-Pradas, 2021, p . 1)." However, after conducting the interviews, I found that the pandemic had its advantages too. It helped some instructors to improve their evaluation scores. Like one of the instructors mentioned that "when I taught in Zoom, I figured out how to use the breakout rooms to accomplish my goals, i.e., team-based learning. I also figured out how to use the chat, in some ways, to create more participation… I will add that my teaching evaluation scores during the semester that ended in Zoom actually were slightly higher than my average without Zoom. So, I feel like I was equally effective during COVID." Even though going online from in-person was fruitful for some instructors, they still missed interacting with students in-person. For instance, the instructor commented, "I did not enjoy it as much because I didn't get to have the personal interactions before and after class or casual conversations in the hallway."

On the other hand, not only did instructors learn to teach differently during COVID-19, but students also experienced new learning techniques. One of the interviewees that identified as teaching in a STEM discipline also found teaching online more practical than in-person sessions, as, according to him,

> "COVID has been a blessing in disguise. I am able to offer my lecture courses remotely. The students are learning how to learn and collaborate in a remote environment. When they graduate, they are going to work with people remotely. This was already the case with tech companies like Google and Apple. This was not the case at universities. At universities, faculty stress the value of face-to-face teaching. This position, I suggest, is no

> longer tenable. The value of face-to-face teaching is substantial when one has a small class (typically under 20) when the instructors and students can form a learning community for the class. Our class sizes in engineering at OU range from 30 to 100+ and are not conducive to forming learning communities. Of late, I have heard faculty (who offer lecture courses using MS PPT and or "chalk and talk" complain of not being able to interact with students during the COVID times. I interacted far more with my students in the COVID years than before and last year. What is my point? There is a need for culture change in the faculty and students… We changed the manner in which we offered the lectures to students in my design, build, and test course. We taped the lectures. Had the students listen to them and then hosted tutorials to bring alive the information embodied in the lectures. I made myself available to meet with individuals via Zoom from 9:00 AM to 9:00 PM seven days a week. The quality of work turned in by students during the COVID times was superior to the work turned in by the students who we taught face-to-face."

Instructors from STEM also found that students' projects' quality improved during online class sessions compared to in-person ones. Although COVID brought some advantages for some fully remote instructors, including increased student engagement and collaboration, improved quality of projects, increased attendance, higher teaching evaluation scores, etc. The pandemic made things more challenging for instructors who taught in-person, with half online and half in-person students during class sessions. For this kind of class session, the demand for upgraded and better physical design attributes, especially technology increased for better teaching and learning outcomes. Now that the classes have returned to the normal in-person sessions, it is crucial to increase the number of ALCs at OU so it can provide more and more instructors the opportunity to practice instructional methods adequately.

Chapter 5: Discussions

Summary of Study's Purpose

Schools are educational facilities that play an essential role in community building and education; therefore, immediate attention is needed to improve classroom spaces. Unfortunately, schools have not facilitated changing educational standards and still follow old philosophies (Altinbasak, 2016; Baker, 2012; Hensley-Pipkin, 2015; Penrod, 2021). According to research, the built environment impacts the occupants positively and negatively (Altman, 1970; Rapoport, 1973). Therefore, it is crucial to understand how classroom physical environments affect its primary users, teachers, and students and what design aspects impact their teaching and learning experience**s**. The primary purpose of the current study is to aid interior designers in higher education classroom designs for better teaching and learning and to add to empirical knowledge about design and behavior, with the applied aspect influencing future learning spaces' design. Therefore, the goal was to evaluate the existing higher education learning spaces from the perspective of one of the primary users. As teaching is perhaps the most essential variable for the "improvement in the quality of education," an instructor's perspective could give valuable insights for improvement (Manville, 2004, p. 2). This research is expected to add to the existing knowledge of Environment-Behavior and build on similar studies. This study is also expected to provide the practical aim of improving classroom design, which can be achieved by reducing uncertainty in designing educational environments and helping design professionals in crucial design decisions. In short, the presentation of the present study's findings and their application in the design process are expected to lead designers to make better design decisions.

Summary of Study Design and Method

The explanatory sequential mixed-methods research study focused on evaluating classroom spaces within the post-secondary institution from the way occupants perceive these spaces. Educational settings' Post-Occupancy Evaluation (POE) has significantly contributed to the informed design and pedagogical practices throughout the evaluation process (Scott-Webber et al., 2018; Tookaloo & Smith, 2015).

The study is composed of four significant steps (Figure 22). First, quantitative data was collected through Qualtrics^{XM} online surveys and analyzed using the software IBM SPSS and MS EXCEL. The quantitative data analyses used for this study included: 1) Chi-square test of association to study the association between classroom design and instructors' instructional methodologies, 2) Independent samples t-test to investigate the difference in perception and values between traditional and active learning classroom design, and 3) Cronbach's alpha (a) to measure reliability or internal consistency.

Since the data was collected during the surge of COVID-19, the survey response rate was not enough to rely solely on the quantitative data collected. Thus, "based on a need to further understand quantitative results," the researcher developed a subsequent follow-up semi-structured interview protocol (Creswell & Clark, 2018, p. 82). Based on quantitative findings, the follow-up interview helped get a better insight into how occupants perceived their physical classroom designs impacted their instructional methodologies. The qualitative data analysis involved coding and theme development. Software MAXQDA was used for the qualitative data analysis. After collecting and analyzing both quantitative and qualitative data, the researcher then integrated both quantitative and qualitative results and made interpretations. During this

merging process, comparing and contrasting both data types helped the researcher understand participants' perceptions of their classroom designs. This mixed-methods research primarily aimed to deeply understand different types of classroom design parameters that instructors perceive to positively and negatively impact their instructional approach. It further explored what must be done to improve the quality of teaching and learning experience within these classroom environments (Scott-Webber et al., 2000).

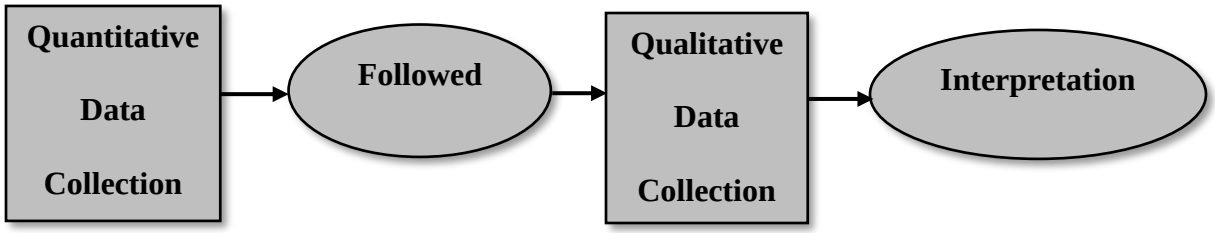


Figure 22. Explanatory Sequential Design
(DeCui-Gunby & Schutz, 2017).

Summary of Findings and Conclusions

This mixed-methods study's quantitative and qualitative data suggest that classroom designs influence instructors' instructional methodology. Responses from the online survey revealed that instructors perceive that a classroom's physical design attributes can facilitate or hinder their choice of instructional methodology. The open-ended questions and the follow-up interviews provided additional insight regarding instructors' perceptions of their instructional methodology in a traditional and active learning classroom. Through extensive data analysis, the researcher found that a classroom's physical design influences how an instructor teaches within that space. The research information gathered through online surveys and follow-up interviews supported the researchers' hypothesis that instructors perceive and value traditional and active learning classrooms differently. Additionally, the findings consistently supported the literature

review that well-designed classroom spaces positively influence teaching and learning. The present study findings revealed that instructors perceive active learning classrooms as more supportive of their instructional approach than traditional learning classrooms.

First Research Question

Is there an association between the classroom design and the instructors' instructional methodology?

This research question aimed to explore the association between different classrooms and instructional methodologies. The survey findings revealed a significant association between classroom design and instructors' instructional methodology. Survey questions (SQ) 2 to 5 inquired about the classroom design and instructors' instructional methodologies. Chi-square test results indicated that the instructors who teach in traditional learning classrooms (TLC) are less likely to use active instructional methodology than instructors who teach in active learning classrooms (ALC), who are more likely to use active pedagogy. Similarly, instructors who teach in TLCs are more likely to use traditional pedagogy, whereas instructors in ALCs are less likely to use traditional instructional methodology. Results from the open-ended questions also confirmed the close-ended or quantitative data analysis findings that instructors' instructional methodology was most likely influenced by the classroom design. Ecologists believe that "what people do is markedly influenced by where they are" (Kounin & Sherman, 1979, p. 145). These results are framed by Altman's ecological model of man (1973), "environment and behavior are closely intertwined," meaning that this concept is more than the famous dictum 'environment affects behavior' (Altman, 1973, p. 108).

The findings of the first research question are consistent with the studies mentioned in the literature review. Research suggests that the classroom design affects the overall teaching and

learning because the physical environment influences the behavior and actions of the users (Altinbasak, 2016; Bezich, 2014; Castilla, Llinares, Bravo, & Blanca, 2017; Ge et al., 2015; Guardino & Antia, 2012; Martin, 2002; Scott-Webber Strickland, & Kapitula, 2013). Physical design elements of a space can promote or suppress occupant motivation and perception about that space. Studies highlight that classroom arrangement can potentially help prevent student behavioral problems before occurring by controlling their attention during in-class instruction (Wannarka & Ruhl, 2008). This control of behavior problems is because the classroom setting can directly influence occupant performance, concentration, attention, and comfort (Scott-Webber et al., 2000; Sommer. 1969). Design professionals and environment-behavior (E-B) researchers consider that man and the environment cannot be separated and should be considered one unit for design and research purposes. Thus, it is essential that classroom arrangement suit instructors' instructional methodology, as classroom arrangement lacks due attention from educational research (Wannarka & Ruhl, 2008). This alignment of classroom arrangement with teaching styles can generate positive teaching and learning outcomes because different classroom "furniture configurations can influence the nature and extent of" teacher-student interaction (Wannarka & Ruhl, 2008). Careful attention to classroom arrangement, technology, and ambient factors (noise, light, temperature, air quality, odor, etc.) can support instructors' instructional methodology and create a better teaching and learning environment.

Second Research Question

Is there any difference in perception between the traditional and active learning classroom design?

The purpose of this research question was to understand instructors' perception of their current classroom design, either traditional or active learning classroom, and to see if there is a

difference in their perception of the instructional approach. Survey questions 6, 8, and 10 with six Likert scale sub-questions each, intended to measure instructors' perception of their current classroom physical design attributes relating to their instructional approach. Each survey question set (6,8, and 10) had a follow-up open-ended question encouraging participants to fill in any additional information regarding their classroom teaching experiences.

Independent samples t-test indicated a difference in perception between the traditional and active learning classroom design, but the difference is not statistically significant. There is no significant difference in instructors' perceptions between traditional and active learning classrooms. This non-significant difference was due to a low survey response rate. However, the majority of findings from the qualitative data revealed a significant difference in perception between the traditional and active learning classroom design.

Findings from this quantitative data analysis are consistent with most previous research studies, except for the one already mentioned in the literature review chapter. Altinbasak (2016) also found slightly different findings for one of her research questions. It did not make a significant difference for teachers whether they teach in traditional or active learning classrooms. In other words, these results suggested that the way instructors comprehended and used TLC or ALC physical environment did not differ (Altinbasak, 2016). However, further analyses of the same research indicated that teachers preferred active learning classrooms over traditional classrooms because ALCs supported "group studies, independent student activities, and technology use" (Altinbasak, 2016, p. 241).

Although the quantitative data findings supported the present study's theoretical position, they were insignificant due to the low survey response rate. According to the study's theoretical framework, perceptions about a space evoke both emotional and physiological responses within

the users; these also impact their thoughts, actions, and reactions regarding that space (Scott-Webber et al., 2000). Moreover, according to Bitner (1992), our perceptions regarding space's ambient factors can influence our actions within that space.

Despite not a significant difference in instructors' perception of traditional and active learning classrooms, quantitative findings still indicated some difference in perception. Moreover, findings from the open-ended responses indicated a significant difference in instructors' perceptions of TLC and ALC. Except for a few participants, most qualitative data responses also revealed that teachers perceive that traditional classrooms' physical design attributes hinder their active learning instructional approach, contrary to those teaching in ALCs. Only traditional pedagogy teachers perceived that teaching in TLCs did not hinder their instructional approach.

Instructors that use active pedagogy and teach in ALCs found their classroom arrangement supportive of their instructional approach as classrooms provided enough writing surfaces, multiple screens, and projectors compared to TLCs. These survey findings tie back to one of the present study's theoretical frameworks: Active learning Ecosystem (ALES). The spatial and technological dimensions of the Active learning Ecosystem (ALES) cover the environmental dimensions of the User Environment Interaction Framework (UEIF), which highlights space as a critical factor influencing user behaviors (Scott-Webber 1998). For the current study, the absence or presence of supportive classroom spatial and technological aspects and ambient factors are expected to influence instructors' choice of instructional methods, use of technology, interaction with students, etc. Furthermore, findings reveal that these active learning classrooms were provided with grouped furniture layouts and flexible furniture, which supported teacher-student and student-student interaction and encouraged student participation. However,

the survey findings indicated that instructors perceived ALCs as crowded due to classroom size limitations.

Crowding is one of the common factors in active learning classrooms, which can interfere with occupants' privacy and personal space. The proxemics, territoriality, and privacy concepts are woven into the UEIF framework model and are the psychological aspects that individuals seek within any environment (Ellis, 2015). However, if the occupants do not perceive these aspects as well aligned within an environment, it results in crowding (Ellis, 2015; Kaplan & Kaplan, 1982). Survey findings reveal that crowding in ALCs interferes with instructional methods, hinders smooth circulation, and disrupts student interaction. There is a crucial need to design ALCs that have ample space between the furniture and optimal technology to reduce privacy and personal space interference issues to support optimal teaching and learning.

Third Research Question

Is there any difference in values between the traditional and active learning classroom design?

This research question aimed to understand the difference between the values (personal and corporate level) relating to traditional and active learning classrooms. Survey questions (SQ) 12 to 15 inquired instructors on what they value personally and what they think the University of Oklahoma values on a corporate level to support teaching and learning. An independent samples t-test was conducted to understand the difference in values between traditional and active learning classrooms.

The quantitative data results supported the conclusion that there is not a significant difference in values between traditional and active learning classroom designs. Again, this slight difference can connect back to the low survey response. However, like perception, the majority

of the findings from the qualitative data revealed a significant difference in the values between the traditional and active learning classroom design. More specifically, instructors personally valued active learning classrooms more, yet also believed that OU needs to improve classroom designs on a corporate level as not all classroom designs can be considered state-of-the-art classrooms at OU.

Instructors who taught in TLCs and preferred active pedagogy mostly felt forced to choose traditional pedagogy because the row-and-columned classroom layout did not support group activities, interaction, and collaboration. However, teachers who taught in ALCs felt autonomous in their choice of instructional methodology. Similarly, instructors who use traditional pedagogy felt autonomous in their instructional approach when teaching in traditional classrooms. From an ecologist's perspective, it can be concluded that "what people do is markedly influenced by where they are" (Kounin & Sherman, 1979, p. 145).

Findings from the qualitative data are consistent with the theoretical perspectives of the present study and support the findings from the previous studies that instructors understand and value the physical classroom environment as a tool for teaching and learning, preferencing active learning classroom designs (Altinbasak, 2016; Bezich, 2014; Hensley-Pipkin, 2015; Ge et al., 2015; Martin, 2002; Scott-Webber Strickland, & Kapitula, 2013). Research suggests that instructors prefer to use ALC and its technology, primarily for group work and collaborative activities (Altinbasak, 2016; Ge et al., 2015). Based on the Users' Environment Interaction Framework (UEIF), the personal values of the instructors, such as autonomy for the choice of instructional methodology, are essential to consider for better teaching and learning outcomes (Ryan & Deci, 2000). Educational researchers believe that human motivation and well-being are

closely connected to fulfilling the psychological need for autonomy (DeCuir-Gunby & Schutz, 2017).

Another conclusion that can be inferred from the analysis is that higher education classrooms should provide ample space for flexible furniture and grouped seating arrangement with academically supportive physical design elements, such as technology, writing surfaces, and controlled ambient factors. Based on the study findings, the ample space for flexible furniture and grouped seating align well with multiple instructional approaches. These survey results are consistent with the previous literature that classroom size and furniture flexibility are the most important aspects of classroom design (Altinbasak, 2016). Similarly, with research and informed decisions, classroom arrangement can effectively regulate optimal behaviors, such as student interaction and collaboration among students and teachers, while supporting teaching and learning (Altinbasak, 2016).

Fourth Research Question

How do instructors perceive their current classroom design in relation to their instructional methodology?

The purpose of this qualitative research question was to incorporate a qualitative follow-up approach after conducting the quantitative phase of the present study, to take advantage of the qualitative strand to deeply elaborate initial quantitative results (Creswell & Clark, 2018; Tashakkori & Teddlie, 1998). In order to accomplish this purpose, a follow-up semi-structured interview protocol was developed using quantitative analysis. A semi-structured interview is a popular and flexible data collection tools that provides a rich understanding of the phenomenon under investigation. It allows for individual and group interview methods (Kallio et al., 2016).

Semi-structured interviews "contribute to the objectivity and trustworthiness of studies" by making the results even "more plausible (Kallio et al., 2016, p. 2954)."

Furniture Mobility and Classroom Size. The open-ended survey and follow-up interviews helped answer the fourth research question. According to the open-ended questions of this study's survey, the two most crucial physical design attributes of a classroom were flexibility and mobility of furniture and the size of classroom space (Ali, 2017; Altinbasak, 2016; Moore et al., 2003). Follow-up interview findings identified five major themes and related sub-themes, which added to the open-ended survey findings. As mentioned in the previous results chapter, these classroom design attributes that impact the instructional approach are: furniture flexibility, type of furniture design (mobile or immobile), space in-between the furniture and crowding, number of writing surfaces, temperature, and the type of lighting and to be able to control it. These findings are consistent with previous literature, demonstrating how student density, measurements of the classroom space available, and a reduced space impact educational outcomes (Kariippanon et al., 2021, Woolner et al., 2007; Woolner & Hall, 2010).

Studies indicate that crowded settings are noisier, hinder circulation or better instructor movement, cause distraction and interfere with teaching and learning (Kariippanon et al., 2021, Woolner et al., 2007; Woolner & Hall, 2010). According to Altinbasak (2016), furniture mobility is a significant design factor and a necessity that facilitates instructors' instructional methodology. Therefore, it becomes vital to design classrooms considering this classroom size and furniture mobility factors because it should lead to better teaching and learning outcomes for teachers and students.

The post-occupancy evaluations of the present study revealed that traditional learning classrooms' row-and-column designs lack flexible furniture arrangement and do not support easy

circulation, hindering instructors' instructional methodology and in-class communication and collaboration. Historically, instructional methodologies and classrooms' physical design attributes were designed to suit direct information while limiting students' ability to interact, communicate, and collaborate around the space (Kariippanon et al., 2021). Research suggests that flexible furniture and a physical classroom environment combined with appropriate size and layout can lead to better teaching and interactions and plays a significant role in occupants' attitudes and behavior (Frith, 2011). Contrary to TLCs, ALC designs consist of flexible and grouped seating arrangements that facilitate in-class group discussions, student-student and student-teacher interactions, and easy circulation, supporting an active instructional approach. However, these ALC design features have been found to hinder pedagogy if the classroom size is small, creating crowding and poor circulation.

Therefore, the conclusion inferred from the analysis is that the classroom shape and size can psychologically impact occupants (Moore et al., 2003). For instance, poorly arranged and small-sized classrooms that do not align well with teaching and learning could lead to aggressive behavior and low interaction among occupants (Moore et al., 2003). Qualitative findings also suggested that larger classrooms, if arranged in various shapes to support multiple teaching and learning approaches, can enhance students' abilities and learning performance (Long et al., 2011). "This confirms that the potential gains from these spaces lie in both their form and function or how learning spaces are designed and how they are used. (Kariippanon et al., p. 143, 2021)."

Technology. The present study's survey and follow-up interview findings consistently showed that instructors believe technology is a crucial classroom design aspect that facilitates teaching and learning. These findings support previous studies that technology plays an essential

role in education as it enhances teaching efficiently and improves students' interaction and motivation in the learning process (Altinbasak, 2016; Czarapata, 2014; Kariippanon et al., 2021; Loundas, 2001; Michel, Cater, & Varela, 2009; Schultz, 2012; Scott-Webber et al., 2000; Van Merrienboer et al., 2017; Weber-Bezich, 2014). The follow-up interview findings also confirm the study's survey results that the essential classroom technology features that aid teaching and learning are computers, projectors, multiple screens, the internet, and networks (Cotterill, 2013). However, interview findings provided deeper insight that traditional learning classrooms are not equipped with optimal technology compared to active learning classrooms (ALC) at the University of Oklahoma (OU). Unfortunately, widespread higher education administration lacks the awareness and is neither flexible nor interested in bringing this change that technology needs to be applied within teaching and learning (Kariippanon et al., 2021). Consistent with the study's framework: Active learning Ecosystem (ALES) that pedagogy, technology, and the physical space are interrelated, it is concluded from the findings that classrooms designed well equipped with technology-related interactive facilities for quality teaching and learning and has positive influences on teacher and student's performance and academic outcomes, such as efficient teaching, improved student interaction, collaboration, and motivation for learning (Ali, 2017). Thus, higher education classrooms should be designed with optimal technology, regardless of classroom type (traditional or active learning).

Instructional Methodology. Instructional methodology emerged as a third theme from the present study's findings. It was found that the instructors perceived that traditional learning classrooms only support traditional teacher-centered pedagogical approaches. However, the instructors who used active pedagogy or student-centered instructional methodology found teaching challenging in TLCs. They believed that TLCs hinder their instructional approach and

do not support student interaction and collaboration. Consistent with the survey findings, interviewees mentioned that they did not find TLC supportive of their instructional approach. Unfortunately, some instructors just came to terms with what they had at their disposal and devise solutions such as rearranging the seating arrangement, etc., which wasted their precious class time. These study's findings also aligned well with the previous literature that "the quality of education suffers when pedagogies are not aligned with physical learning spaces" as it makes it more challenging to implement a student-centered instructional approach in traditional classrooms (Altinbasak, 2016; Van Merrienboer et al., p. 253, 2017; Weber-Bezich, 2014).

The present study's findings also support the conclusion that successful educational implementation depends on the instructors' instructional approach and the learning space's arrangement where the instructions and learning occur (Van Merrienboer et al., 2017). Furthermore, previous literature indicates that classroom arrangement should support instructors' preferences and align with the instructional approach and activities implemented within the classroom (Ali, 2017). As mentioned in the previous theme, the study's findings are consistent with its theoretical frameworks, i.e., Users' Environment Interaction Framework (UEIF) and Active learning Ecosystem (ALES). Therefore, it can be inferred from the analysis that the physical environment influences student learning and teaching directly (Ali, 2017; Scott-Webber et al., 2000; Van Merrienboer et al., 2017).

Personal and Corporate Values. Personal and corporate values are also essential to the educational system, as found in the present study's data (both survey results and the results from interviews). While teaching in TLCs, instructors who use a student-centered approach did not feel autonomous in their instructional approach. Due to the lack of sufficient classroom design attributes such as seating arrangement, furniture flexibility, and optimal technological resources

such as multiple screens, and microphones, especially during the pandemic, the instructors felt *tethered,* as mentioned by one of the faculty. Instructors who use active pedagogy were not comfortable using their choice of instructional methodology because they were placed in TLCs due to the limited number of ALCs available within the institution building.

Moreover, instructors perceived that the University of Oklahoma claims its support student-centered pedagogy but lacks practical implementation itself. Therefore, instructors did not feel motivated and autonomous as they perceived that most classrooms at the University of Oklahoma are not equipped with state-of-the-art technology and do not support multiple teaching styles. A review of previous studies highlighted a similar concept that classroom affordances of flexible learning spaces paired with the student-centered instructional approach provided occupants autonomy to choose however they wanted to work within that space (Ali, 2017; Altinbasak, 2016; Van Merrienboer et al., p. 253, 2017; Weber-Bezich, 2014). The study's theoretical frameworks also align well with the conclusion that the flexible classroom arrangement and active instructional approach consequently help teachers and students to collaborate and interact more which appeared in their improved educational outcomes (Kariippanon et al., 2021). The conclusion from the study's findings also encourages higher education administration and classroom management to allocate and utilize academic funds after discussion with the primary stakeholders, such as instructors, students, design professionals, and E-B researchers, for efficient and informed design solutions.

Classroom management during COVID-19. Classroom management during COVID-19 brought many challenges and massive disruption to traditional higher education institutions (Iglesias-Pradas et al., 2021). These challenges included: teaching both in-person and online students at the same time, switching from in-person to fully online studios and lab courses,

devising ways to continue to promote student-student and student-teacher interaction and collaboration, and working towards improved or at least keeping up with the same level of teaching and learning outcomes, maintaining student retention, and much more. The pressure to cope with the unplanned crisis was suddenly tough on students, and the instructors were also under immense stress (Iglesias-Pradas et al., 2021).

The data collected for the present study was done from the start of the pandemic until the post-pandemic situation, which helped reveal critical academic findings on how COVID-19 changed in-person teaching and learning in physical classroom environments. As mentioned in the previous chapter, these findings revealed what problems they faced, how instructors struggled during the pandemic, and how they devised solutions to those problems. Instructors used readily available technology and tools that helped them cope with the sudden change and implemented different solutions that suited their course nature and teaching approach. These sudden yet temporary changes in teaching forced instructors to rely on technology and some digital tools that supported their instructional approach (Iglesias-Pradas et al., 2021).

Even before the pandemic, some schools at OU already practiced synchronous/ blended/ hybrid whole or part of the semester for their theoretical courses. However, teaching create/ design/ build studios for the Architecture, Engineering, and Construction (AEC) courses were typically done in person. The present study's findings contributed to the knowledge on teaching in studios during the pandemic, which is in its infancy. According to these findings, studio instructors used a blended approach by recording and uploading their lectures beforehand. At the same time, students came prepared with readings and lectures to work online during class/ studio time. Instructors also made themselves available to the students throughout the day. Instructors at OU mentioned that this teaching approach significantly improved students' quality

of design projects, and the average grade number increased as they were able to communicate better during online class sessions. Like the present study's findings mentioned above, this finding also aligned with the previous literature that a blended approach should be considered to enhance the learning experience of online students (Nubani & Lee, 2022).

One emerging phenomenon of Virtual Design Studio (VDS) also gained instructors' attention during the global pandemic. Schon introduced the idea of reflective learning in formulating architectural and design pedagogy (Iranmanesh & Onur, 2021). VDS helps enhance self-dependence and the student-oriented teaching and learning process (Iranmanesh & Onur, 2021). The present study revealed that most STEM instructors already use the Virtual Design Studio for their lab and practical design/build courses, as mentioned above. However, implementing VDS is convenient for third and fourth-year students compared to first and second-year students who are not "well-versed in digital communication" and need one-on-one hands-on guidance in building their digital communication skills (Iranmanesh & Onur, 2021, p. 263).

Findings from the present study aligned well with the previous research findings that empowering instructors with optimal technology and tools, technical support, and academic training from the institute's teaching and learning center had a positive effect during the pandemic (Iglesias-Pradas et al., 2021; Schlesselman, 2020). Research also suggested organizational readiness for higher education institutions in terms of technical support to empower instructors in decision making, rapid adaptation of new digital and teaching skills during the crisis, and sustaining high-quality education delivery (Iglesias-Pradas et al., 2021).

The present study's findings concluded that among all the physical design attributes, technology, classroom size, and flexible furniture arrangement were the main aspects that played

a significant role in successful teaching and learning during the pandemic. These aspects played an essential role, especially when the students were attending studio classes both online and in-person. Flexible seating facilitated social distancing and peer and teacher interaction, while the optimal classroom size helps avoid crowding. Technology helped with interaction and collaboration within the online learning environment. Instructors also mentioned a need for an increased number of ALCs with flexible seating arrangements, multiple screens, writing surfaces, good network connection, and microphones so that both online and in-person students can hear the instructor simultaneously.

In conclusion, classrooms should have optimal space for better furniture layout, grouped furniture arrangements with easy circulation, flexible enough to support multi-purpose in-class activities, and multiple instructional methodologies (Ali, 2017; Bezich, 2014; Hensley-Pipkin, 2015). Therefore, it is crucial to consider these primary design factors when designing learning spaces for post-secondary institutions. Literature suggests that how people perceive and relate to their environment can impact their experience within that environment (Altman, 1973; Bitner, 1992; Friedow, 2012). Therefore, becoming knowledgeable about evidence-based design and research applications can be challenging yet beneficial for designers. Post-occupancy evaluations provide clarity for design professionals and researchers about how different individuals perceive their environments differently (Friedow, 2012). Thus, "the better designers and researchers understand how" people perceive their environments, "the better they can create design environments" that facilitate their functions, contributing to people's quality of life and experience within those spaces (Friedow, 2012, p. 53). All stakeholders, such as higher education administration, instructors, and students, must collaborate with architects and designers to develop classroom design solutions for better educational outcomes (Van

Merrienboer et al., 2017). As design researchers discover how environments affect human behavior and wellness, they should document and record their findings to contribute to the growing body of environment-behavior literature. Designing higher education learning spaces that align effectively with pedagogy and physical environment is a creative yet daunting process. However, a participatory design process that includes students, teachers, school administration, design professionals, and researchers' output can yield rewarding academic outcomes if painstakingly planned and executed (Van Merrienboer et al., 2017).

Contributions

The applied findings from this study make considerable contributions to the current body of knowledge related to the role of classroom physical design attributes in academic success. This study's findings divulge that:

1. This study supports previous literature and confirms that the physical classroom environment can impact the users positively and negatively; it significantly influences teachers' pedagogy, behavior, and academic outcomes. The study findings that an association between classroom design and instructors' instructional methodology validates the knowledge that the built environment impacts occupants, thus making an additional contribution to design practice, E-B, and education.
2. The present study's findings validate the previous literature that active learning classrooms promote active pedagogy. In contrast, traditional classroom designs do not support active pedagogy for its group activities and discussion, student engagement, collaboration, etc., which add to the body of knowledge on the need for active learning classrooms within post-secondary institutions.

3. This study's findings agree with the previous research that traditional classroom design attributes merely support traditional instructional approaches. These findings also call for an urgent need to change passive to active teaching and learning by implementing student-centered classroom design elements and pedagogy for better teaching and learning outcomes.
4. This study's finding that the classroom size, furniture mobility, and optimal technology resources are the most critical aspects of a classroom design is a noteworthy interdisciplinary contribution to the field of design and education and E-B research. These findings confirm previous literature on higher education classroom design, built environment and human behavior, and faculty perceptions.
5. One significant finding from this study is the significance of classroom arrangement. Instructors perceived classroom arrangement as a valuable tool in positively impacting teaching and controlling behaviors while supporting interaction and student engagement between students and teachers, which can play a significant role in optimal academic outcomes. These findings are consistent with the previous literature, highlighting the importance of active learning classroom implementation in post-secondary institutions.
6. The present study findings make considerable contributions from the methodological standpoint by integrating and mixing quantitative and qualitative research approaches to evaluate higher education classroom environments and their relation to the users' experience, behavior, and academic outcomes. This approach will encourage future researchers to implement multiple data collection approaches to get rich insights into user experiences in a built environment.

7. Another contribution of the study's methodological strategy is that it is easily replicable by other researchers for future studies in other higher education institutions.
8. Another contribution of this research will be connecting design professionals and researchers with the study's theoretical framework/ background to encourage evidence-based design practices. Although there has been a growing trend towards evidence-based design (EBD), there still needs to be done relating to classroom design and human behavior in the design field. This research will help fill in some gaps in the present literature evaluating classroom-built environments.
9. One central message for higher education administration and policymakers from this study's findings is that designing classrooms that support multiple instructional approaches and facilitate optimal teaching and learning outcomes is a very complicated, open, and creative process (Van Merrienboer et al., 2017). There is a need to give special attention to future classroom design projects by conducting extensive research. Most importantly, higher education administration and policymakers should bring together the point of view of all the stakeholders (teachers, students, design professionals, E-B researchers, classroom management, and administration personnel) for successful and informed design decisions.

Ultimately, designing learning spaces like active learning classrooms that promote active pedagogy contributes to addressing occupant behaviors for better learning outcomes, such as efficient teaching and learning, better grades, and increased student retention rates.

Limitations

While researching a post-secondary institution, difficulties and possible flaws occurred, especially amid the pandemic. As with any research, a few limitations also affected the present research. Following are the present research's limitations:

Sampling Strategy Limitation

Since the study was conducted during the pandemic's peak, purposive total population sampling was done to get the maximum number of responses. However, the survey response rate did not meet the sample size estimation of 200, using Cohen's (1992) 95% confidence level. One of the biggest reasons for the low response rate could be that institutions all over the US have started to shift from in-person to online classes. Another possible reason for limited response could be the technical issue with several participants who tried opening the survey with an internet browser other than Mozilla Firefox. Qualtrics surveys can face technical issues with Google Chrome and Internet explorer.

Statistical Limitation

Researching with a large sample size provides more accurate results. However, a discrepancy between the quantitative and qualitative findings occurred due to the small sample size of the present research.

Methodological Limitation

Another limitation of the present research is gathering data by asking participants about their opinions and behavioral outcomes relating to the classroom's physical design attributes through the survey. In order to find the association between the variables of interest, a survey was preferred to collect data due to its convenience for implementation within the given time, cost, and anticipated larger sample size. However, respondent bias is one of the most significant

issues associated with surveys gathering data on participants' attitudes and behavior. Respondents may not give honest responses, while observational studies would.

Recommendations for Future Research

1. Future researchers can conduct the same research on students' perceptions instead of instructors within those classroom spaces. Those responses can be compared to understand better classroom physical characteristics' role in teaching and learning.
2. Additionally, conducting the same research using observations and behavioral mapping could provide more accurate data.
3. Next time, there could be more close-ended questions regarding classroom technology in the survey instrument.
4. A future study can expand data collection to other universities to see any difference between participants' responses.

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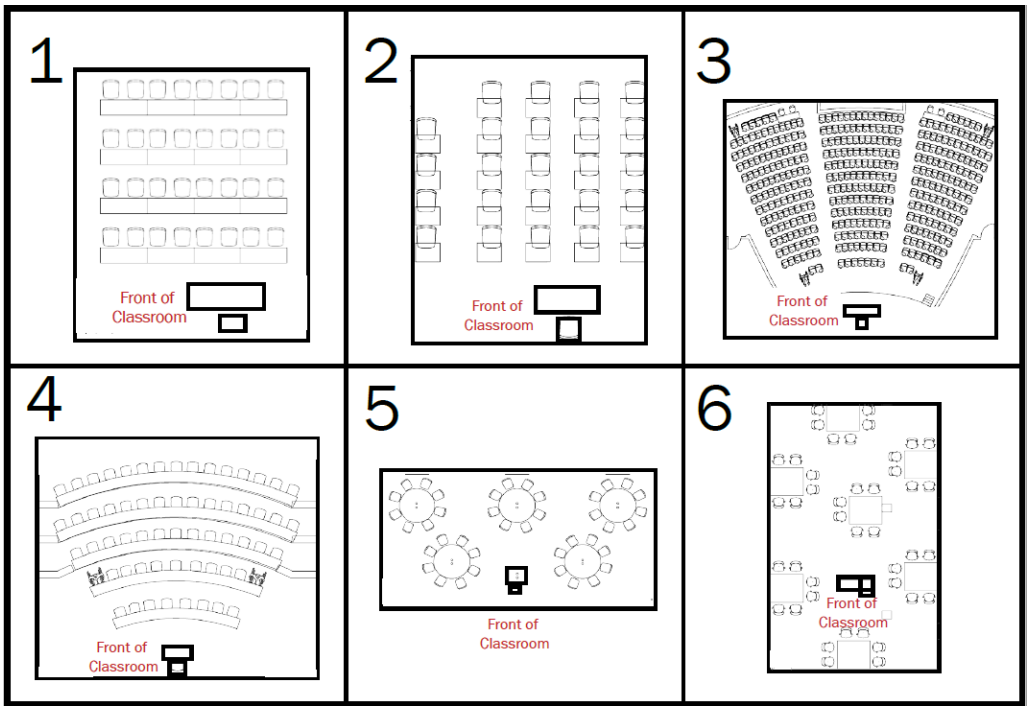
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Appendix A: Online Consent and Survey

Q1 Online Consent to Participate in Research You are invited to take part in a research survey about investigating the role of environment-behavior (e-b) attributes upon faculty's (instructor) instructional methods in higher education. Your participation will require approximately 5 - 10 minutes and is completed online at your computer. There are no known risks or benefits associated with this survey. The present study will contribute towards developing an enhanced understanding of learning environment's physical design attributes that influence teachers' preferences of instructional methods. By completing this survey, you will also be given an opportunity to win one of two $10 Visa gift cards. Taking part in this study is completely voluntary. If you choose to be in the study you can withdraw at any time without adversely affecting your relationship with anyone at the University of Oklahoma. Your responses will be kept strictly confidential, and digital data will be stored in secure computer files. Any report of this research that is made available to the public will not include your name or any other individual information by which you could be identified. If you have questions or want a copy or summary of this study's results, you can contact the researcher at the email address above. If you have any questions, please feel free to contact researcher **Ammara Faisal** (**ammaraarshad@ou.edu**). You can also contact my faculty advisor, **Natalie Ellis**, at **nellis@ou.edu or 573-289-1739.** You can also contact the University of Oklahoma – Norman Campus Institutional Review Board **at 405-325-8110 or irb@ou.edu** with questions, concerns or complaints about your rights as a research participant, or if you don't want to talk to me. **(IRB Number: 8751)**

o I agree to participate

o I do not agree to participate



Q2 Which of the following six (6) classroom types most closely represent the classroom arrangements in which you teach most frequently? (You can select more than one if you teach in several classroom types) Please respond based on the Spring 2020 on-campus classroom(s) in which you taught.

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ Other (Please describe your classroom): _____

Q3 Even if you teach in different classroom types, select a classroom from your selection above that mostly impacts your teaching method. This selection will be the basis of your remaining responses.

- o 1
- o 2
- o 3
- o 4
- o 5
- o 6
- o Other: _____

Q4 Please select from the following instructional methods that you most frequently use (you can select more than one if you teach in several classroom types). Please respond based on the Spring 2020 on-campus classroom(s) in which you taught.

- ▢ Lecture
- ▢ Tutorials
- ▢ Problem-based learning
- ▢ Project-based learning
- ▢ Inquiry-based learning
- ▢ Team-based learning
- ▢ Other: _____

Q5 Even if you use different teaching methods in different classroom types, select a teaching method from your selection above that is mostly impacted by your chosen Spring 2020 classroom. This selection will be the basis of your remaining responses

- o Lecture
- o Tutorials
- o Problem-based learning
- o Project-based learning
- o Inquiry-based learning
- o Team-based learning
- o Other: _____

Q6 This section relates to our perceptions about the physical aspects of the classroom, that are often affected by our environment. Please complete the following with the room type that you have identified in the first question.

	Always (1)	Almost always (2)	Frequently (3)	Occasionally (4)	Almost never (5)	Never (6)
The classroom's physical environment is welcoming for me (1)	○	○	○	○	○	○
The classroom has enough usable (black/ white) board space for my teaching style (2)	○	○	○	○	○	○
This classroom has adequate writing surface for me (3)	○	○	○	○	○	○
The current furniture has enough desk space for me to work (4)	○	○	○	○	○	○
My classroom instruction is interfered by the traffic flow in and out of the room (5)	○	○	○	○	○	○
The current classroom setting affects my use of technology for instructional purposes (6)	○	○	○	○	○	○

Q7 If you think the above responses do not fit your practice, please type your response below:

_____

Q8 This section relates to our perceptions about the physical aspects of the classroom, that are often affected by our environment. Please complete the following with the room type that you have identified in the first question.

	Always (1)	Almost always (2)	Frequently (3)	Occasionally (4)	Almost never (5)	Never (6)
The in-between chair space is suitable for test taking within my current classroom (1)	○	○	○	○	○	○
I feel that the current classroom setting is too crowded for my current teaching style (2)	○	○	○	○	○	○
The current furniture layout supports circulation within classroom for my teaching style (3)	○	○	○	○	○	○
The space in my current classroom is sufficient enough to carry out my everyday instruction effectively (4)	○	○	○	○	○	○
My instructional method is impacted by flexible furniture seating within the classroom (5)	○	○	○	○	○	○
The seating, room layout, equipment in this classroom causes physical discomfort for my teaching style (8)	○	○	○	○	○	○

Q9 If you think the above responses do not fit your practice, please type your response below: _____

Q10 This section relates to our perceptions about the physical aspects of the classroom, that are often affected by our environment. Please complete the following with the room type that you have identified in the first question.

	Always (1)	Almost always (2)	Frequently (3)	Occasionally (4)	Almost never (5)	Never (6)
I re-arrange classroom furniture to aid my teaching method (1)	○	○	○	○	○	○
The classroom furniture layout supports multiple teaching methods (2)	○	○	○	○	○	○
The furniture layout encourages teacher-student interaction (3)	○	○	○	○	○	○
The furniture layout encourages student-student interaction (4)	○	○	○	○	○	○
The furniture layout facilitates students' participation during class discussion (5)	○	○	○	○	○	○
The current furniture layout supports my instructional method (8)	○	○	○	○	○	○
The overall physical environment within the classroom supports my instructional method (9)	○	○	○	○	○	○

Q11 If you think the above responses do not fit your practice, please type your response below:

_____

Q12 This section relates to the University of Oklahoma's values as corporate, along with instructors' personal value such as work-related autonomy. Answer the following based on your current classroom setting, do you feel:

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Somewhat disagree (4)	Disagree (5)	Strongly disagree (6)
If I could, I would choose a different instructional method (1)	○	○	○	○	○	○
My current teaching method reflects my choice of instructional methodology (2)	○	○	○	○	○	○
I feel free to choose my teaching method the way I think it could best be done (3)	○	○	○	○	○	○
In my current classroom, I feel forced to choose teaching method I do not want to use (4)	○	○	○	○	○	○

Q13 If you think the above responses do not fit your practice, please type your response below:

_____

Q14 This section relates to the University of Oklahoma's values as corporate, along with instructors' personal value such as work-related autonomy. Answer the following based on your current classroom setting, do you feel:

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Somewhat disagree (4)	Disagree (5)	Strongly disagree (6)
I feel that the University of Oklahoma (OU) values and promotes teaching and learning (1)	○	○	○	○	○	○
I think that OU provides state-of-the-art-classrooms (2)	○	○	○	○	○	○
I think that OU classrooms are equipped with the state-of-the-art-technology (3)	○	○	○	○	○	○
I think that the classrooms at OU facilitate multiple teaching styles (4)	○	○	○	○	○	○

Q15 If you think the above responses do not fit your practice, please type your response below:

_____

Q16 **Please describe what you envision being the ideal classroom for the 21st century. Please respond to the following. Describe what hinders your teaching methodology the most with regards to the physical environment.**

_____

Q17 What the planners/ designers should consider for future classroom designs with respect to the physical characteristics? Please explain.

_____

Q18 SECTION SIX: DEMOGRAPHICS
Gender:

- Male
- Female

Q19 Age:

- 20 - 30
- 31 - 40
- 41 - 50
- 51 – 60
- 61 – 70
- Do not wish to disclose

Q20 Teaching position:

- Full-time
- Part-time/ Adjunct
- Graduate Assistant

Q21 What is your major area/ field of study?

- Humanities
- Social Sciences
- Natural and medical sciences
- STEM (Science, Technology, Engineering, and Math)

Q22 Voluntary Response: Please provide your email address below if you give the researcher permission to contact you to invite you to participate in future research. If no, please proceed to next page.

_____

Thank you!

Appendix B: Interview Protocol and Consent

Verbal Consent to Participate in Research

Dear Professor,

I am an interior design Ph.D. candidate and in the middle of collecting data. I collected my research data through a survey in April 2020 but couldn't get enough responses due to COVID-19. I am inviting you to take part in a 20-30 min follow-up interview in May via zoom because you showed interest in the follow-up interview by providing your email address in response to one of the survey questions. Your participation will help me improve the quality of data collection.

There are no known risks or benefits associated with this study. The present study will contribute toward developing an enhanced understanding of the learning environment's physical design attributes that influence teachers' preferences of instructional methods. Taking part in this study is completely voluntary. If you choose to be in the study, you can withdraw at any time without adversely affecting your relationship with anyone at the University of Oklahoma. Your responses will be kept strictly confidential, and digital data will be stored in secure computer files. After removing all identifiers, we might share your data with other researchers or use it in future research without obtaining additional consent from you. Any report of this research that is made available to the public will not include your name or any other individual information by which you could be identified. Data are collected via Zoom which has its own privacy and security policies for keeping your information confidential. No assurance can be made as to their use of the data you provide.

To preserve your responses, I would like to record our discussion.

Do you agree for your interview to be audio recorded? (note response) Yes No

Do you agree for your interview to be video recorded? (note response) Yes No

If you have questions or want a copy or summary of this study's results, you can contact the researcher at the email address above. If you have any questions please feel free to contact researcher **Ammara Faisal** (**ammaraarshad@ou.edu**). You can also contact my faculty advisor, **Dr. Charles Warnken**, at cwarnken**@ou.edu** or 573-289-1739.

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board at **405-325-2444** or **irb@ou.edu** with questions, concerns or complaints about your rights as a research participant, or if you don't want to talk to me. (**IRB Number: 8751**)

Thank you for your time and willingness to participate. As you know, I am interested in understanding the role of the classroom's physical design attributes on instructors' instructional methodology. Particularly, I am (or we are) trying to investigate how these classroom's physical design aspects impact instructors' instructional methodology. My research questions include Is there an association between the classroom design and the instructors' instructional methodology? Is there any difference in perception between the traditional and active learning classroom design? Is there any difference in values between the traditional and active learning classroom design? And how do instructors perceive their current classroom design in relation to their instructional methodology? You also have the option of declining to answer – passing on – any of the questions. Do you have any questions before we start?

Interview Questions

12. As per the survey responses you chose _____ classroom design (active learning (AL) or traditional learning (TL)) and _____ (AL/ TL) instructional approach. Could you explain if this (AL/ TL) classroom design supports your choice of instructional method?
    a. If so, what aspect/ design elements do you think support your teaching method?
    b. What design elements of (AL/ TL) classroom design best support your interaction with the students? (For example, desks configured in pods/groups, amount of desk space, readily available laptops, flexibility to reconfigure space, lighting & aesthetics (room color), seating, wireless network access, ability to project & annotate onto whiteboard space, amount of whiteboard space, traffic flow, technology, Other)
13. Please explain if this (AL/ TL) classroom design hinders your instructional method.
    a. If so, what aspect/ design elements do you think to hinder your teaching method?
    b. What design elements of (AL/ TL) classroom design hinder your interaction with the students the most? (For example, desks configured in pods/groups, amount of desk space, readily available laptops, flexibility to reconfigure space, lighting & aesthetics (room color), seating, wireless network access, ability to project & annotate onto whiteboard space, amount of whiteboard space, traffic flow, technology, Other)
14. Please describe how you feel the design of the (AL/ TL) classroom design affected your ability to teach effectively.
15. Do you feel that the University of Oklahoma (OU) values and promotes teaching and learning by providing classrooms that support multiple teaching styles?
16. How do the design elements of an (AL/ TL) classroom design contribute to increased engagement of students with (a) you, the instructor, (b) fellow students, and (c) content material?
17. For those items that you liked least, how could they be improved?
18. How has COVID influenced your instructional methodology in your classroom?
19. How do you manage a post-COVID situation in your classroom?

Closing

Now that we are done, do you have any questions you'd like to ask me about this research project? If you want to contact me later, here is my contact information… Also, I may need to contact you later for additional questions or clarification.