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Facility Matters: The Perception Of Academic Deans Regarding The Role Of Facilities in Higher Education

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FACILITY MATTERS: THE PERCEPTION OF ACADEMIC DEANS REGARDING THE ROLE OF FACILITIES IN HIGHER EDUCATION

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Abstract

FACILITY MATTERS: THE PERCEPTION OF ACADEMIC DEANS REGARDING THE ROLE OF FACILITIES IN HIGHER EDUCATION

A Q method Study

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The purpose of this study was to examine how academic deans perceived the characteristics of facility built environment and its impact on learning in higher education. Q methodology was used as the means to explore the subjective opinions of academic deans within the State of Florida regarding the facility built environment's impact on learning in higher education. For this Q study, the concourse statements were the result of communications taken from the subject literature and participant responses to this study's online concourse questionnaire. The resulting 32 item Q sample was sorted online by 43 academic deans, associate and assistant deans. In completing the survey, the participants ranked statements representative of the characteristics of facility built environment according to their own beliefs and subjective opinions. From the resulting data and subsequent analysis, three distinct factors emerged that represented the collective opinions of this study's participants. The emergent factors for this study were named Traditionalist – Focused on Functionality and Universal

Rationality; Modernist – Technology Conscious Seeking Innovation and Flexibility; and Abstractionist – Contextual and Expressive.

Chapter 1

Introduction

This study examined the relationship of the facility built environment to the complex endeavor to provide a quality education in institutions of higher learning. Although a number of studies have been conducted in K-12 that sought to link facility variables to a wide array of educational outcomes (Schneider, 2002; Simons, Hwang, Fitzgerald, Kielb, & Lin, 2010; Uline, Tschannen-Moran, & Wolsey, 2009), few such studies have been conducted in higher education. Therefore, this study sought to expand the body of knowledge in the area of college facilities and its perceived impact on learning in higher education.

This chapter identified the rationale, the need for the inquiry and made a contextual argument on how subject research in K-12 was applicable in higher education. Following sections identified the conceptual underpinnings for the perceived relationship between learning and space and provided a detailed analysis of the status of facilities in America's school systems. The last sections provided a framework for interpreting language nuances encountered in this study, a brief overview of the study's design and concluded with definition of terms and a summary of the chapter.

Rationale for the Study

The rationale for conducting this study on the impact of facilities on learning in higher education was rooted in the awareness that students learning in physical campus facilities, commonly referred to as the brick and mortar institutions, spend a significant amount time in the facility built environment ("Campus life back in session," 2012). Accordingly, the United States Government Accountability Office (GAO) reported that full time enrollment in America's postsecondary institutions increased by 37% and part time enrollment by 23% from 1998-2009

(*GAO-12-179*, 2012). With an increase in enrollment, aging building infrastructure, and the understanding that postsecondary learners were spending appreciable amounts of time in postsecondary facility built environments ("Campus life back in session," 2012), the rationale to conduct an inquiry to identify variables perceived to affect student learning in higher education appeared to be warranted. In support of this assertion, a national marketing firm, re:fuel College Explorer, issued a press release in 2012 detailing the results of a national survey of college students. The firm surveyed 1528 college students between the age of 18-34 that attended conventional brick and mortar institutions. In the survey, respondents indicated that they spent, on average, 66.7 hours per calendar week within the communal college campus consisting of classrooms, lecture halls, libraries and other built facilities on campus ("Campus life back in session," 2012). To that end, Lackney states that "if the physical environment is more influential than realized by significant findings on student attitudes and behavior , therefore it is incumbent upon educators to take a look at factors upon which a student's learning depends" (Lackney, 1994, p. 17).

Arguably, there are similarities between the facility built environments in K-12 (Schneider, 2002) and postsecondary institutions. This fact, when coupled with the amount of time students spend in both environments (Schneider, 2002; "Campus life back in session," 2012), raises the probability that variables readily identified in K-12 research would also exist in higher education. Although this researcher failed to locate an abundance of research that had been conducted on the relationship between learning and space in higher education, the literature and subsequent research did identify several characteristics/variables consistent with findings reported in K-12 research. The characteristics identified included seating capacity, lighting, technology, furnishings, noise, and temperature (Banning, 1990; Hill & Epps, 2009; Veltri, Banning & Davis, 2006). Similarly, research conducted by Veltri et al. (2006) at a community college concluded that students could articulate negative and positive factors of their classroom's physical environment and its perceived impact on their learning. In another study, Hill and Epps (2009) concluded that the “physical environment of the college classroom could impact student learning” by providing a catalyst for “desirable instructional behavior and communicating a level of formality that is expected in classroom interaction” (p.16).

Although this research failed to find a definitive or substantive explanation for the lack of research on facilities and learning in higher education, speculatively, the lack of research could be caused by the lack of consistent variables. Where standardized tests in K-12 provide a stable dependent variable to research the relationship between educational outcomes and independent variables associated with the facilities, other factors may be present within postsecondary institutions that may explain the lack of research. Arguably, the absence of standardized tests, varied degree offerings and a more migratory population within higher education facilities makes researching student outcomes more challenging. Therefore, this study concentrated on the impact that facilities have on the perception of academic officers, namely deans, that reside within the perspective facilities as a means to explore the relationship between facilities and education in the collegiate environment.

Likewise, Lackey, when commenting upon the lack of empirical evidence establishing a definitive link between learning and facilities in K-12, asserts that it is clear that “the physical environment has been unappreciated for its supportive role in student learning” and that “the relationship between the physical environment, pedagogical, psychological and social variables have yet to be explored to any great extent by educational researchers” (Lackney, 1994, p. 17). He concludes by postulating “if the physical environment is more influential than realized by significant findings on student attitudes and behavior, therefore it is incumbent upon educators to take a look at factors upon which a student's learning depends" (Lackney, 1994, p. 17). For this study, the importance of the dean's point of view on the matter of facilities, although subjective, provided a self-referent viewpoint into facility operations from a "me" standpoint (Watts & Stenner, 2012) and therefore provided a means for this researcher to explore the relationship between facility and learning at the collegiate level.

With the perception of academic deans toward facilities being the primary focus of this inquiry, a consideration had to be made regarding the appropriateness of the methodology and method required to garner the relevant data needed to complete this study. Similar considerations had to be made regarding the viability and feasibility of the proposed study given the highly subjective nature of the inquiry. Given that this study relied solely on qualitative data gathered from educational leaders whose primary training and education typically reside in functional areas other than facilities management, a near textbook rationale was created for using Q methodology as the means to evaluate the participant's highly subjective, opinionated responses in a reliable, scientific and experimental manner (Watts & Stenner, 2012).

The Different World of Facilities and Education

The facility built environment that comprises the learning space for postsecondary education is built with the intent to support the education process (Beynon, 1997; Kennedy, 2011). For the most part, this relationship is understood by its stakeholders yet its unique characteristics are often expressed from different viewpoints and in different vernaculars due to training and education of its individual stakeholders. Invariably, how those issues were subjectively expressed in this study became a central issue that had to be addressed. In part, this was accomplished by recognizing that the participants of this study were less likely to be versed in the language common to facility and design professionals who plan, build and maintain the built environments for higher education institutions. As the researcher, an attempt was made to bridge the language difference by anticipating the language nuances and providing a framework that allowed the participants (deans) to articulate subjective statements in a manner that they saw fit. As a result, the participants were able to provide statements whose meanings could easily be associated with variables (language) expressed and acknowledged within facility management disciplines. Therefore, Table 1 was created by this researcher to provide a framework in which both facility and educational professionals in higher education could easily associate key terms and phrases with themes and concepts put forth in this research.

Table 1

Expressed Mediating Variable Table by Discipline (Facility Professionals and Academic Deans)

Facility-expressed Mediating Variable	Educator-expressed Mediating Variable
Thermal Comfort (Quality)/Ventilation	Too hot, too cold, uncomfortable, drafty, humid, adequate, comfortable
Indoor Air Quality (IAQ)	Stuffy air, stale air, moldy, smelly, clean, crisp
Noise/Acoustics	Loud talking, noisy equipment, echo
Lighting	Dimly lit, dark, too bright, need blinds, bulbs out, glare, shadows, reflection, natural
Size	Cramped, cavernous, overcrowded, confined, large, spacious
Maintenance Quality	Dirty, smelly, nasty, foul, excellent, outstanding, well maintained, quality, up-to-date
Facility Age/Quality	Broken, in shambles, disrepair, rickety, new, old, renovated, antiquated
Aesthetics	“not pleasing to look at,” dingy, unpleasant, view, beautiful, vibrant, pleasant
Technology	“technology equipped,” “smart,” connected, digitally enhanced

Although much of the research identified for this paper was conducted in a K-12 setting, the preponderance of the research conclusions drawn in K-12 appeared to be supported in this higher education study. Foremost, mediating variables that were identified in previous K-12 studies as affecting student outcomes were also identified within this study. Although identified in this study, there was no attempt by this researcher to draw a correlation between learning outcomes and characteristics of the facility built environment, or for that matter any variables readily identified in this subject area. Instead, 43 participants' sorts of 32 statements regarding the facility built environment in higher education were the variables analyzed by this study and all inferences drawn were only generalized to the participants of this study.

Current Challenges of the Facility Built Environment

The facility built environment arguably provides the learning space for both K-12 and higher education institutions in which learning and teaching can occur regardless of the age or socioeconomic status of the occupants (Beynon, 2007). The common facility challenges that exist between higher education and K-12 institutions include large deferred maintenance backlogs, reduced budgets and inadequate aged facilities (Kennedy, 2011). The "United States is full of schools built in the 1950s and 60s" and another large contingent of "schools built in the 1980s and 90s" (Ericson, 2011, p.24).

In the current national discussion, there is broad recognition that the cost to repair and modernize America's existing schools will continually grow (Ericson, 2011). In higher education, research conducted by the Organisation for Economic Co-operation and Development (OECD) found that an increasing number of higher education leaders identified the challenges associated with "aging and expanding facilities" as one of the top reasons for change in the field. The challenges within facilities were only "exceeded by insufficient financial resources, technological change and changing student demographics" (Marmolejo, 2007, p. 1). In the same OECD report, insufficient facilities were also listed as one of the top threats to the success of higher education. The report concluded with a call to action for leaders in higher education to recognize that leadership in the facilities arena was a "key ingredient to higher education success and a means to mitigate threats to its future survival" (Marmolejo, 2007, p. 1).

The Association of Plant Professional Administrators (APPA) estimated in 1994 that there was a $26.5 billion dollar backlog of deferred maintenance in America's higher education institutions with $5.7 billion defined as urgent (Kaiser, 2009), (Most current data available). The range of deferred maintenance needs reported in higher education institutions included extensive renovation and maintenance of Heating, Ventilation and Air Conditioning (HVAC); plumbing, roof, window, and door repairs; fire code and other safety upgrades; interior and exterior painting; sidewalk and parking lot repaving; electrical and lighting upgrades; locker and boiler replacements; kitchen upgrades; bus-depot repairs; masonry repairs; security systems; and updated technology (Caserly, Hache, & Naik, 2011).

Unfortunately, as a result of the 2008 economic downturn, the public funding for education in America has continued to decline (Hurley, McBain, Harnisch, & Russell, 2010). The decline has resulted in the majority of state colleges and universities performing "budget triage in the wake of major reductions in state appropriations" (Hurley et al., 2010, p. 1). With a prolonged period of budget cuts and funding restrictions, educational institutions are stretched to cover the major deferred maintenance required to extend the useful life of structures built in the 1950s/60s, let alone the buildings built in the 1980s and 90s (Ericson, 2011)**.** The resulting effect is that an already aging infrastructure will continue to degrade, and an extensive deferred maintenance backlog will continue to grow, which undoubtedly will affect learning and outcomes at all levels of education.

Deferred Maintenance

There are numerous definitions for the concept and idea of deferred maintenance. A simple definition that has been put forth for years is the idea of putting off needed repairs until a later date. However, for this study, three disparate definitions were offered to define the problem of deferred maintenance. From the three definitions, a list of key elements was put forth as the components of the term that have relevance to this study. The Association of Professional Plant Administrators (APPA) defines deferred maintenance as the total dollar amount of existing major maintenance repairs and replacements, identified by a comprehensive facilities condition audit of buildings, grounds, fixed equipment, and infrastructure needs (APPA, 2012). In the APPA definition, there is a specific exclusion of projected maintenance and replacements or other types of work that include program improvements or new capital needs and planned construction (APPA, 2012). Whitfield (2010) in the January/February issue of the *Facilities Manager Magazine* defines deferred maintenance as the capital funding required to replace equipment that is no longer adequate to meet the needs of the facility.

Where APPA and Whitfield's definition specifically excludes new construction and planned renovations resulting from academic program needs, a definition put forth in an issue brief on the status of Clemson University's maintenance needs defines deferred maintenance as the "upkeep of buildings and equipment postponed from an entity's normal operating budget cycle due to a lack of funds" (Cato, 1989, p. 1). In this definition, there was no specific exclusion of new construction or renovation required to support educational program changes. Although different in scope, it could easily be argued that all three definitions shared basic components that could easily be discerned and that are of some importance to this study. The components included: (1) the recognition that an asset/major/system repair was required but postponed due to financial limitations; (2) an inference that repair costs would continue to grow in magnitude over time; (3) a recognition that a condition exists in which a facility may encounter unforeseen system failures and incur increased risk for interruptions to key utility services; (4) the possibility that catastrophic equipment failures may occur that have the potential to shut down planned events and programs (Whitfield 2010), and a fifth component proposed by this researcher, (5) the possibility that the facility built environment and its learning spaces no longer contain the required characteristics to support the learning function for which they were designed or utilized.

Why the Alarm?

The alarm is arguably centered on an expansive body of research that reports a link between mediating facility variables, student achievement and educational outcomes in K-12 (Duyar, 2010; Earthman & Lemasters, 2011; Schneider, 2002; Uline & Tschannen-Moran, 2008) and shown by this study to have plausible implications in higher education. To that end, Schneider lists multiple studies that link student achievement and performance to six key facility variables that were expanded on by his research and acknowledged by participants of this study. The variables identified by Schneider, others and referred to within this study include indoor air quality (IAQ), thermal quality and ventilation; lighting; acoustics; building age and quality; and school and class size (Earthman, Cash & Vanberkum, 1995; Earthman & Lemasters, 2011; Schneider, 2002; Uline & Tschannen-Moran, 2008). In research conducted in K-12, Schneider concluded that school facilities do affect learning because of the implicit understanding that "students and teachers require quality facilities in order to perform the essential tasks of teaching and learning" (Schneider 2002, p. 1). Similarly, in this study, participant responses and sorts indicated that there was a subjective belief that characteristics of the facility built environment does matter and that the quality of facility extends beyond the mere physical components of the learning environment.

The inferred link between deferred maintenance, the literature and the findings of this study seemingly imply that a direct connection exists between the quality of the facility built environment and the amount and type of needed deferred maintenance. Simply, as indicated specifically in this study, the perceived suitability of space by its users was viewed as a primary contributing factor that limited an educational leader's ability to provide learning space conducive to learning. This became highly important when viewed from the perspective of a practitioner in the field of facility maintenance or of an educational leader, because the costs required to address inadequacies of the facility built environment tend to be costly from three separate perspectives, the first being the capital replacement cost of key building systems; the second being the direct maintenance cost of operating equipment past its normal life expectancy, which routinely results in operational cost increases and unplanned equipment downtime (Thorne & Nadel, 1993); and the third being a transactional cost that has the potential to limit the efficacy of learning space due to users perceiving the space as inadequate or unsuitable for learning activities.

Conceptual Underpinnings of Study

Learning Space

The Organisation for Economic Co-operation and Development (OECD) defines an educational space as a physical space that supports multiple and diverse teaching and learning programs and pedagogies (Kuuskorpi & Gonzalez, 2011, p. 2). In this definition, the concept of the physical learning environment related to space, equipment and tools within an educational facility. Unexpectedly, the OECD definition did not differentiate between “learning space” in brick and mortar facilities and virtual space. Instead, the organization concluded that all spaces created by teaching equipment and sources of information created and defined learning space (Kuuskorpi & Gonzalez, 2011), thus establishing a plausible connection between the characteristics of the facility (space) and its ability to provide a healthy, comfortable, safe, secure and stimulating setting for the building occupants (Kuuskorpi & Gonzalez, 2011).

The Theory of Learning Space

Kolb and Kolb put forth the concept of learning space as an expansion of the Experiential Learning Theory (ELT), which defines learning as “the process whereby knowledge is created through the transformation of experience” (Kolb & Kolb, 2005, p. 194). In ELT, Kolb drew upon other constructivist theories to develop a holistic model of the experiential learning process (Kolb & Kolb, 2005) and introduced the concept of learning space to further elaborate on the “dynamic nature of learning and its formation through transactions between the person and environment” (Kolb & Kolb, 2005, p. 199). Their synthesis of principles from other theorists that sought to explain the relationship between learning, environment and space contributed greatly to the development of their theoretical concept for learning space. Likewise, Bennett (2007) citing Brown (n.d.) argued that learning occurred as a result of a social framework fostered by the facility built environment.

Primarily drawing from Kurt Lewin’s Field Theory and his concept of life space (Lewin, 1939), the Kolbs incorporated Lewin’s idea that a person and environment are independent variables. They put forth the idea that a person’s behavior is a function of the environment, which provided a theoretical construct to integrate learning space and social environment. In doing so, Lewin drew heavily from Urie Bronfenbrenner's work on the ecology of human development that defined the ecology of learning/development space as a "topologically nested arrangement of structures, each contained within the next"; Llave and Wenger's situated learning theory that considered "learning as a transaction between the person and the social environment"; and finally Nonaka and Konno's theory of knowledge creation that considers shared "space as the foundation for knowledge creation" "to inform the ELT concept of learning space" (Kolb & Kolb, 2005, p. 199).

Lewin's theory and the works of other prominent 20th century constructivist scholars such as John Dewey, Jean Piaget, William James, Carl Jung, Paulo Freire, Carl Rogers and others (Kolb & Kolb, 2005, p. 194) contributed heavily to Kolb's ELT theory and the concept of learning space. Like other theorist and constructivist scholars previously listed, Kolb's ELT adheres to six universally accepted and shared propositions: (1) Learning is best conceived as a process, not in terms of outcomes; (2) all learning is relearning; (3) learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world; (4) learning is a holistic process of adaptation to the world; (5) learning results from synergetic transactions between the person and the environment; and (6) learning is the process of creating knowledge (Kolb & Kolb, 2005, p. 194). Of the six key constructionist propositions accepted by the aforementioned scholars and Kolb, the two key propositions that became highly relevant to this study were the propositions that learning is a holistic process of adapting to the world (Kuuskorpi & Gonzalez, 2011) and that learning resulted from the synergetic transactions between the person and the environment (Kolb & Kolb, 2005; Dugdale, 2009). With a key proposition of constructionist theory being that learning and knowledge is constructed and affected by the space and environment, Kolb's ELT arguably provided a theoretical basis to explain the link between the facility, its created environment and learning.

Constructivism and the Learning Environment

Although there are various accepted and shared constructivist propositions (Kolb & Kolb, 2005), a number of researchers ultimately distill the varied propositions into four major encompassing themes that explain learning and instruction (Eggen & Kauchak, 2010). The themes conceptually define learning as a process by which knowledge is constructed in order to make sense of the real world; the knowledge constructed depends upon what the learner already knows; continued learning is predicated on social interaction; and the primary reason for knowledge acquisition is for it to be applied to the real world (Eggen & Kauchak, 2010, p. 226-227).

The link between the facility built environment and learning space is supported by a number of researchers (Beynon 1997; Duran-Narucki, 2011; Kolb & Kolb, 2005; Mcfarlane, 2011). As an example, Beynon, reporting on planning for educational facilities for member states of the United Nations, states that, "the essence of education is learning and teachers, textbooks, educational technology, physical facilities and administration are all means to expand and accelerate learning" (Beynon, 1997, p. 18). In the context of learning, Beynon and others conclude that the facility and its man-made environment provide a catalyst for learning to occur through a process of social interaction. To that end, Lackey asserted that "many educators who work in school settings on a daily basis accept almost axiomatically that the physical setting of the school has an effect on the teaching and learning which takes place within a school" (Lackney, 1994, p. 15). Similarly, Duran-Narucki found that the "physical environment of a school was an integral part of any activity that occurred in the building and its quality" (Duran-

Narucki, 2011, p. 115). Thus, reason suggests and the literature supports the idea that the facility built environment provides a nexus for social interaction to occur and learning to be constructed. It provides a link between learning outcomes (Duran-Narucki, 2011) and functions as a transactional mechanism in that all planned or unplanned features of a school's built environment are constantly interacting with school users and therefore create and recreate meaning (Duran-Narucki, 2011).

Purpose of the Study

The purpose of this study was to investigate an academic dean's perspective on characteristics of the facility built environment perceived to impact student learning in higher education. The importance of the inquiry was based on the precept that an academic dean's perception would be representative of their individual operant subjectivity (Watts & Stenner, 2012) and thus could be identified and studied. It was also based on the proposition that academic deans, due to their unique skillset and experience, have developed the ability to connect facility variables to learning instinctively without a "need for special training, artificial induction or any form of external causation" (Watts & Stenner, 2012, p. 25). Finally, it was based on the notion that an academic dean's perception of the subject matter was made meaningful by the nature of their role and impact upon the relationship between the facilities environment and learning (Watts & Stenner, 2012). Therefore, the perception of academic deans regarding facilities, their overall mission and their participant role in individual student outcomes (Hyun, 2009) invariably became the primary focus of inquiry in this higher education study.

Research Design

The research design for this study was non-experimental. The participants in the study were identified via a purposive convenient sample based on the uniqueness of their profession, title and function within an institution of higher learning (Gmelch, 2009). The decision to limit the study's potential participants to academic deans did not meet a basic premise of a true experimental design given that random selection of the participants was neither desired nor required to establish a representative sample of a population. Given the features of this proposed study, a Q methodological study using descriptive analysis was employed to collect data from a sample population of college deans employed within the State of Florida and therefore not intended to be generalized to the population of academic deans' nationality.

In Q methodology, the research question is not stated as a hypothesis (McKeown & Thomas, 1988). Instead, in Q methodology, the researcher shapes a research question or statement to elicit subjective views or opinions from the study's participants for empirical evaluation. For this study, the statement sought to identify "the flow of communicability surrounding the topic" (Brown, 1993, p. 94) of facilities and its perceived effect on student outcomes. In order to elicit the widest response from the participants of this study, the Q statement for this research was expressed in a past and present form in order to solicit information on a participant's view of current and past institution's facility conditions. The present and past tense of the Q statement is stated below:

Q-1: What characteristics of your current institution's facility do you perceive as having the greatest impact on student learning?

Q-2: From a general perspective, what characteristics of the facility do academic deans perceive as having the greatest impact on student learning in higher education?

The selection of the potential participant pool by geographical location and classification by accrediting body was an intentional delimitation of this study. Namely, the potential participants sought for this study were from among colleges and universities located in the State of Florida and accredited by the Southern Association of Colleges and Schools (SACS). Currently there are 78 SACs accredited institutions of higher learning in the State of Florida. However for this study, only those academic deans employed at institutions classified by SACS in Florida as Level II to VI and categorized as public or private not-for- profit institution were included. Excluded were purely associate degree granting, for profit and community colleges accredited by SACS within the state. The primary rationale for this delimitation was based on the desire to gather data from sources whose facilities shared a common geographical climate; shared similar funding sources to include public allocation, private gifts, student fees and investment; and provided a course of instruction geared toward the granting of a bachelor's degree.

Definition of Terms

In order for the reader to understand this research, the following terms and acronyms are herein defined or purpose explained:

APPA:

The Association of Professional Plant Administrators is a 501(c)(3) nonprofit organization formed to promote leadership in educational facilities by supporting educational excellence with quality leadership and professional management through education, research, and recognition. The organization has over 5200 members who are facilities professionals, institutional members, education related organizations and corporate based business partners.

ASHRAE:

The American Society of Heating, Refrigeration, and Air Conditioning Engineers is a nonprofit building technology society formed in 1894 to advance the arts and sciences of heating, ventilation, air conditioning and refrigeration. The society and its over 50,000 members worldwide focus on building systems, energy efficiency, indoor air quality and sustainability within the industry through research, standards writing, publishing and continuing education.

Retro-commissioning (RCX):

Retro-commissioning is a process that seeks to improve how building equipment and systems function together in order to reduce operational costs, increase efficiencies and improve the functionality of existing building systems (Thorne & Nadel, 1993, p. ii).

LEED:

Leadership in Energy and Environmental Design is a voluntary, consensus-based, market-driven program that provides third-party verification of green buildings with a primary goal to transform the way built environments are designed, constructed, and operated through the entire lifecycle of a building.

Sustainability/Green Building:

Sustainability (green building) is defined by The Office of the Federal Environmental Executive as "the practice of increasing the efficiency with which buildings and their sites use energy, water, and materials, and the reduction of a building's impact on human health and the environment through better siting, design, construction, operation, maintenance, through the complete building life cycle" (Building Construction and Design Sustainability, 2003, p. 1).

Facility Built Environment:

The facility built environment is any man-made environment that provides structure for human activity (*USGBC*, n.d.)

Deferred Maintenance:

(1) The upkeep of buildings and equipment postponed from an entity's normal operating budget cycle due to a lack of funds (Cato, 1989); (2) the total dollar amount of existing major maintenance repairs and replacements, identified by a comprehensive facilities condition audit of buildings, grounds, fixed equipment, and infrastructure needs (APPA, 2012); (3) the capital funding required to replace equipment that is no longer adequate to meet the needs of the facility (Whitfield, 2010).

Facilities Planning:

Facility planning is defined as a "process of determining the purposes of facilities and the means (activities, procedures, resources, etc.) for attaining them" (International Facility Management Association [IFMA], 2009, p. 9).

Physical Facilities:

Physical Plant/Physical Facilities for education consist of all or any portion of buildings, structures, site improvements, complexes, equipment, roads, walks, passageways, parking lots, or other real or personal property located on a site (Beynon, 1997).

Facility Management:

Facility Management is defined as "the practice of coordinating the physical workplace with the people and work of the organization integrating the principles of business administration, architecture and the behavioral sciences" and "encompasses multiple disciplines that ensure functionality of the built environment by integrating people, place, processes and technology" (International Facility Management Association [IFMA], 2009, p. 9).

Indoor Air Quality (IAQ):

IAQ is the nature of air inside the space that affects the health and wellbeing of building occupants in which there are no known contaminants in the air at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction (ASHRAE 62.1, 2004).

Thermal Comfort:

Thermal comfort is defined as the combinations of indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space (ASHRAE Standard 55, 2004).

Learning Space:

Learning space is defined as a "process whereby knowledge is created through the transformation of experience through transactions between the person and environment" (Kolb & Kolb, 2005, p. 199).

Distance Learning:

Distance learning is defined as all forms of learning that occur between two parties (learner and instructor), held at different times and/or places and using varying forms of technology assisted instructional learning (Moore, Dickerson-Dean, & Gaylen, 2011; Valentine, 2002).

Building Envelope

The building envelope are those elements of the building (floor, walls, roof, window, etc.) that form the boundary between the indoor environment of a building and the external environment in which it is located (Duru & Torcellini, 2005).

Heating Ventilation and Air Conditioning (HVAC):

HVAC is an acronym for heating, ventilation and air conditioning. It refers to the different systems, machines and technologies used in indoor settings in built facilities and transportation systems that need environmental regulation to improve comfort (American Society of Heating Refrigeration and Air Conditioning Engineers [ASHRAE], 2007).

Maintenance & Operations (M&O):

All activities associated with the routine, day to day use, support and maintenance of a building or physical asset; inclusive of administration, management fees, normal/routine maintenance, custodial services and cleaning, fire protection services, pest control, snow removal, grounds care, landscaping, environmental operations and record keeping, trash-recycle removal, security services, service contracts, utility charges (electric, gas/oil, water), insurance (fire, liability, operating equipment) and taxes. It does not include capital improvements. This category may include expenditures for service contracts and other third-party costs. Operational activities may involve some routine maintenance and minor repair work that are incidental to operations but they do not include any significant amount of maintenance or repair work that would be included as a separate budget item (APPA, n.d.).

Conclusion

This chapter served as a catalyst for the chapters to follow by briefly detailing issues within facilities and introduced the constructs of learning space and constructivism as essential theoretical components of this study. A brief discussion was presented on the methodology and the choice of the participants for this study. Definitions of key terms were addressed and a discussion presented on the impact of learning space at postsecondary institutions. Finally the chapter made a contextual argument as to why this study was needed by referencing literature that indicated that there were more than 60 years of research on the relationship between building quality and student achievement (Cash & Twiford, 2009) in education. Therefore, with an abundance of research spanning numerous decades, coupled with the amount of time students spend in the educational facility built environment, dwindling resources and an ever growing deferred maintenance backlog, this research sought to identify the perception of academic deans toward their respective facilities and their perception of facility characteristics that they believed to impact their students' ability to learn.

Chapter 2

REVIEW OF LITERATURE

This chapter identified relevant literature that had previously explored the role and relationship that exist between facilities and education. At the onset, the initial paragraphs linked the study's subject matter to variables identified in K-12 and postsecondary school research to affect learning. Ensuing sections outlined findings derived from research spanning over six decades that examined the complex relationship between facilities and learning. The chapter concluded with an investigation of the role that educational leaders, namely academic deans, play in the relationship between facilities and learning; their decision making in regard to facility expenditures and the crafting of facility building templates to meet the future needs of higher education inclusive of distance learning and dwindling economic resources.

Variables Linked to Learning and Educational Outcomes

A statement to be addressed while conducting an inquiry into a relationship between facilities and education was the premise that learning can take place in any environment. With the assertion, the question then became why facility funding required the second largest expenditure of education dollars trailing only the compensation for educators (Beynon, 1997**.** Beynon addressed this issue by simply stating that "all learning cannot and will not take place in pristine environments that, without modification or enhancements, will contribute to learning" (Beynon, 1997, p. 19)**.** Similarly, Earthman asserted that "when students are surrounded by a safe, modern and environmentally controlled environment, the facility will have a positive effect on their learning climate" (Earthman, 2002, p. 1). The implication is that the facility built environment could account for a "5-17 percent variation in achievement between students in poor buildings and those students in modern buildings, when the socioeconomic status of students is controlled" (Earthman, 2002, p. 1). This invariably led to the reasonable inference that facilities not only affect learning but promote and enhance effective teaching in K-12 (Schneider, 2002, 2003, 2005) and could have similar implications in higher education (Earthman & Lemasters, 2011).

Roberts, Edgerton, & Peter (2008) put forth the idea that facility and key variables associated with educational outcomes are inexorably linked; linked not through an independent/dependent relationship but through facilities mediated effects on other variables that affect student learning outcomes. Numerous studies over the past six decades have linked the facility built environment to educational achievement and satisfaction in both K-12 and higher education (Earthman et al., 1995; Earthman, 2002; Hill & Epps, 2009; & Reynolds, 2007; Roberts et al., 2008; Veltri et al., 2006). Earthman asserts that K-12 students who attend schools with substandard facilities are "definitely handicapped in their academic achievement" (Earthman, 2002, p. 1).

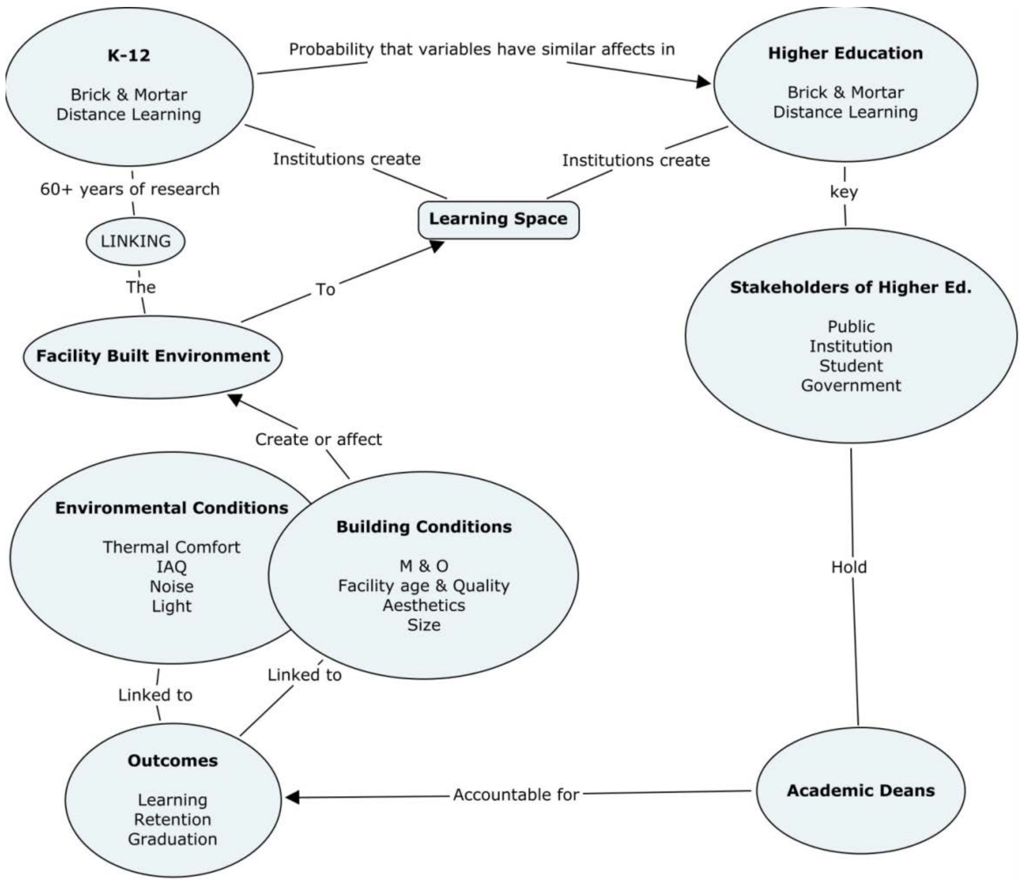
Common mediating variables such as thermal comfort, safety, aesthetics, building lighting, maintenance quality, building condition, noise, facility age, size, environment and indoor air quality (IAQ) were routine themes that emerged in various research articles and studies linked to learning outcomes in K-12 institutions. As a result, the research appeared to conclusively show a correlation between the facility condition and learning in K-12 (Earthman, 2002; Earthman & Lemasters, 1998; Roberts et al., 2008; Uline, Tschannen-Moran; Wolsey, 2009) and that the environment fashioned by the facility condition could impact student performance either negatively or positively (Earthman, 2002 ; Hill & Epps, 2009). Furthermore, qualitative variables such as amenities, external environment and facility upkeep, maintenance quality and technology could all be inferred to be or identified as additional variables to be included with the aforementioned list.

The Emergent Path: Environmental and Physical Conditions

In the sections to follow, key variables identified within the research were expanded upon. Along with the presentation of the variables, a discussion ensued regarding the connectivity of the various components of the research subject. In Figure 1, the key variables and concepts identified within the literature were linked via a concept map. As stated previously within the document, the majority of the research on this topic had been conducted in K-12. However, as Figure 1 depicts, similar dynamics and trends were presumed to exist in both higher education and K-12. The similarities appear to be pronounced and therefore provided a viable starting point to conduct research in this area of higher education.

Where Figure 1 sought to map the key concepts of the research topic, Table 2 presented the core/common variables that continually emerged from the research and identified key researchers that examined variables and their relationship to educational outcomes. Table 2 was also created by this researcher to provide a simple guide to assist readers of this document and for future researchers. Generally, findings in the research identified facility variables that appeared to cluster in two very distinct yet complementary areas. The two distinct areas were related to environmental conditions within a facility resulting from the built environment and the physical condition of the facility resulting from age, maintenance or operations (M&O), or physical properties. The other key finding alluded to by the prevailing research was the notion that a symbiotic relationship existed between the variables in both clusters and that a cause and effect relationship could be intuitively drawn through logic but may not be or yet to be proven empirically.

Figure 1: Probability of K-12 Variables Having Similar Effects in Higher Education



Therefore, Table 2 listed the emergent themes in the context where both condition types were independent variables, the factors of the condition were shown to be mediating and the dependent variables were shown to be the measurable outcomes such as retention, test scores, occupant health, satisfaction, and dropout rate.

Table 2

Listing of K-12/Higher Education Variables and Researchers

Mediating Variable (Facility Environment)	Dependent Variable	Researcher
Thermal Comfort	Teacher/Student retention and satisfaction; occupant health; absenteeism; dropout rate; test scores	de Dear & Brager, 2002; Earthman, 2002, Uline & Tschannen- Moran, 2008; Veltri et al., 2006
Indoor Air Quality (IAQ)	Occupant health; absenteeism; dropout rate; test scores	Bosch, 2003; Buckley, Schneider & Shang, 2004; Schneider, 1995, 2002; Uline & Tschannen-Moran, 2008
Noise/Acoustics	Teacher/Student retention and satisfaction	Bosch, 2003; Buckley et al., 2004; Earthman & Lemasters, 1998; Lyons, 1999; Schneider, 2002, 2003; Veltri et al., 2006
Lighting	Teacher/Student retention and satisfaction	Bosch, 2003; Duyar, 2010; Hill & Epps, 2009; Jago & Turner, 1999; Schneider, 2002; Veltri et al., 2006
Size	Test scores	Bosch, 2003; Duyar, 2010; Earthman, 2002; Earthman & Lemasters, 1998, 2011; Schneider, 2002; Veltri et al., 2006

(table continues)

Table 2 (continued)

Listing of K-12/Higher Education Variables and Researchers

Mediating Variable (Facility Condition)	Dependent Variable	Researcher
Maintenance quality	Teacher/Student retention and satisfaction	Earthman et al, 1995; Earthman & Lemasters, 2008, 2011
Facility Age/ Quality	Teacher/Student retention and satisfaction; Occupant health; absenteeism; dropout rate; test scores	Duran-Narucki, 2011; Earthman & Lemasters, 2011; Hill & Epps, 2009; Uline & Tschannen-Moran, 2008
Aesthetics	Teacher/Student retention and satisfaction	Cash & Twiford, 2009; Duran-Narucki, 2011; Hill & Epps, 2009
Technology	Student Satisfaction	Hill & Epps, 2009; Veltri et al., 2006

Environmental Conditions

Environmental conditions within a facility were defined contextually in that no single concept or definition clearly and succinctly covered the breadth of the subject. The framework for assessing the existing research on the relationship between environmental conditions and educational outcomes rested on the idea that the physical and psychological needs of a learner needed to be met in order for learning to occur (Beynon 1997; Uline & Tschannen-Moran, 2008). This understanding has led to a growing body of research that established linkages between discrete physical features of school facilities and student achievement (Uline & Tschannen-Moran). The US Green Building Council (USGBC) defined Indoor Environmental Quality (IEQ) as the condition inside a building and its impact on occupants (USGBC, n.d.). This definition provided a framework in which key variables listed in Table 2, under environmental conditions, were conceptualized and linked. With this notion, the factors were addressed independently but with an understanding that the variables were interrelated and shared a synergistic relationship.

Thermal Quality and Ventilation

Thermal comfort has been shown to be one of the most critical variables as it relates to education (Uline & Tschannen-Moran, 2008). It is a variable that the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) defines as the combinations of indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space, with acceptable being synonymous with satisfaction (de Dear & Brager, 2002). Earthman, citing a 1974 study by Harner concluded that temperatures above 74 °F (23 ºC) adversely affected reading and mathematics skills; that a significant reduction in reading speed and comprehension occurred between 73.4 ºF (23 ºC) and 80.6 ºF (27 ºC) and indicated that temperatures between 68 ºF (20 ºC) and 74 ºF (23.3 ºC) to be an ideal temperature range for effective learning to occur in reading and mathematics (Earthman, 2002). With the acceptance that thermal comfort having a significant contributory role in the attainment of acceptable educational outcomes (Earthman 2002; Uline, Tschannen-Moran 2008), a link could easily be established between the variable and the amount of time people spend in the facility built environment. In America, on any given day 20% of Americans spend time in educational facilities (Schneider, 2002). Intuitively when expanded to include an additional four to six years of post K-12 education, Earthman concluded that other than the "socioeconomic status of the students, thermal comfort (air conditioning) proved to be the most influential building condition variable that influenced student achievement" (Earthman 2002, p.3).

Indoor Air Quality (IAQ)

ASHRAE defines IAQ as a condition within a building in which there are no known contaminants in the air at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction (ASHRAE 62.1, 2004). Indoor pollutants most often measured in schools are formaldehyde, volatile organic compounds (VOC), carbon dioxide, and aerosolized micro-organisms (bio-aerosols) (Bosch 2003). Although to date, there have been few empirical studies that have directly investigated the relationship between IAQ and educational outcomes (Bosch, 2003), there appears to be widespread consensus within the educational community that IAQ is an important aspect of the facility and mediates its impact on learning outcomes (Schneider, 1995). Therefore, most discussion linking IAQ to student performance depends on a simple logical link: "poor IAQ make students sick and sick students can't work or study as well as healthy ones" (Schneider 1995, p.27). Like thermal comfort, numerous studies have associated IAQ as a mediated variable for educational outcomes (Bosch 2003; Buckley et al., 2004; Schneider, 1995, 2002; Uline & Tschannen-Moran 2008).

As detailed in Chapter one of this study, school buildings within America have a wide range of needed deferred maintenance repair needs (Caserly, Hache, & Naik, 2011). Many old buildings simply do not have the features required to control the thermal environment or have adequate roofing or building envelope systems to prevent water intrusion within the facility (Earthman, 2002; Hunter, 2009). To that end, major buildings systems in need of repair or replacement have been shown to contribute to poor IAQ within educational facilities (Earthman, 2002). Often systems that have the largest deferred maintenance cost implications, such as HVAC, roofing and envelope systems, are the very systems that impact IAQ quality most directly. Examples include leaking roofs and envelopes that allow water intrusion within a facility and poorly maintained or broken HVAC systems that are incapable of maintaining acceptable temperature or humidity ranges within a facility. The inadequacy of the systems arguably contributes to IAQ issues by providing space and surfaces conducive to the growth of biological contaminants (mold and allergens) (Schneider 1995) which have been linked to student and teacher absenteeism and reported health problems (Bosch, 2003). The problem appears to be pervasive and widespread. Bosch, citing a 1996 US GAO report, provided data that showed that one in five school buildings in America have reported IAQ problems.

Another link to be explored was the relation between IAQ, faculty retention and satisfaction. In a survey of public school teachers in Washington DC and Chicago, survey findings indicated that a majority of the teachers surveyed believed that they taught in facilities that had inadequate IAQ. In the same study, participants also attributed some personal health issues to poor IAQ within the facility (Schneider, 1995). In the aforementioned study, Schneider provided a logical link between teacher productivity and student achievement by looking at the amount of time teachers were not in the classroom due to illness attributed to IAQ issues.

Acoustics/Noise

Lyons argues that good acoustics are important in any learning situation in that noise in classrooms often makes students struggle to hear and concentrate and therefore the learning process is defeated at the outset (Lyons 1999). The noise comes from many different sources that can be placed into three categories: (1) noise from outdoors, (2) mechanical noise generated between rooms or between corridors and rooms, and (3) noise generated within the classroom from building MEP systems. Taken all together, the noise can stifle a student's ability to learn (Lyons, 1999). Earthman & Lemasters further expand upon the importance of noise/acoustics as an important mediating variable in the learning process. To that end, Earthman and Lemasters report findings that associate higher student achievement in schools that have less external noise. They found that outside noise caused increased student dissatisfaction with their classrooms and that excessive noise caused stress in students (Earthman & Lemasters 1998). The overarching research in regard to noise/acoustics and its association with learning appears to be consequential. Research conducted by Schneider showed that 44% of Chicago and 68% of Washington DC teachers indicated noise as one of the factors that affected their health and their students' academic achievement (Schneider, 2003). Likewise, Buckley, Schneider and Shang reported that almost 70% of teachers in Washington, DC indicated that hallway and classroom noise affected their ability to teach (Buckley et al., 2004). Therefore the implications cannot be any clearer that classroom "acoustics matter." In a review of literature conducted by Schneider in 2002, he cites numerous studies that link acoustical conditions to a number of educational or health factors to include spelling, reading ability, behavior, attention, concentration, blood pressure, feelings of helplessness, and a lack of persistence on task (Schneider, 2002).

Lighting

A number of studies identified the quality and amounts of both natural and artificial lighting as a key mediating variable that affected student's ability to learn and for teachers to instruct (Bosch, 2003; Duyar 2010; Schneider, 2002). The synthesis of their research indicated that lighting contributed to the emotional and social wellbeing of the facility occupants and provided aesthetics that promoted a sense of pride and ownership. Buckley et al. (2004), citing research conducted by Jago and Tanner in 1999, expanded upon results of seventeen studies from the mid-1930s to 1997 that indicated that adequate lighting improved test scores, improved behavior and played a significant role in student achievement. When taken in the context that the visual environment affects a learner's ability to perceive visual stimuli and affects his/her mental attitude, and thus, performance (Jago & Tanner, 1999), a logical step was to conclude that lighting was an important mediating variable of learning outcomes. Similarly, in 2010, Duyar expanded the research by exploring the perception of school principals regarding specific facility variables and learning. The research findings indicated that lighting levels in the schools garnered the lowest satisfaction rate of all variables identified within the research study (Duyar, 2010).

Building (Facility) Conditions

The condition of facility serves as an overarching concept for mediating variables that were addressed in the following paragraphs. In the discussion that follows, the facility condition was outlined using two yet distinctive conduits for the facility condition framework. The distinct categories that emerged conceptualized the idea that a facility must be both functional and provide elements that promote the psychological and physical wellbeing of its occupants. Essentially, does the facility serve the needs and purpose of its occupants? Do the basic fundamental building systems (plumbing, HVAC, electrical, envelope and interior furnishings) operate as designed and does the building provide an environment that is conducive to learning? Mediating variables that were discussed in the context of functionality included building size, maintenance quality and facility age. Where functionality provided the quantifiable aspect for the concept of facility condition, the psychological aspect of the facility was characterized by the mediating variables of aesthetics and safety. Even though the aforementioned variables were arguably more difficult to measure (Earthman & Lemasters, 2011), researchers have found that these variables have a negative impact upon student performance in buildings where deficiencies in these variables exist. In addition, research findings also link overcrowded school buildings and classrooms to poor student performance, especially for minority/poverty students (Earthman, 2002).

Building Age and Quality

Research conducted by Earthman and Lemasters concluded that the age of the facility was a contributing factor when assessing the condition of the building (Earthman & Lemasters 2001) and has been shown to affect learning in that it provides both a psychological and physical aspect to the relationship between learning and facilities (Duran-Narucki, 2011). The clearest example of this concept and premise is that the facility built environment provides the place to shelter human activity (Beynon, 1997), thus learning. Therefore, when the age of the facility was connected to the concept of maintenance quality, a clear connection could be made between a number of facility variables and their potential to affect learning. Variables such as IAQ, noise, aesthetics and safety have a greater potential to affect learning in that a strong correlation exists between the aforementioned variables, facility age, the required levels of M&O and deferred maintenance (Earthman & Lemasters, 2011). The relationships are intuitively linked by the rationale that key building systems in aged facilities are more likely to be inadequate or poorly maintained (Earthman & Lemasters, 2011). Earthman & Lemasters concluded that the age of the building was not the primary determining factor in the reported link between facility age and education outcomes. Instead, they found that the lack of or absence of modern building components led to facility conditions that were not conducive to learning (Earthman & Lemasters, 2011).

School and Class Size

There is a growing body of research in K-12 linking smaller school and class size to variables that affect higher student achievement (Bosch 2003; Earthman, 2002; Earthman & Lemasters, 1998, 2011; Schneider, 2002). Bosch citing research conducted by Nathan and Febey in 2001 concluded that smaller schools provide a safer, more positive and challenging environment than large schools. Students experienced fewer discipline problems, garnered higher academic achievement, graduation rates and satisfaction among families and students and teachers (Bosch 2003). Similarly, Duyar employed descriptive analysis to research a correlation between facility size and learning outcomes and concluded that the quality of delivery of instruction would increase 0.22 for every one-unit of change in the quality of size or configuration of classrooms (Duyar, 2010). However, unlike other variables addressed in this section, the size of the classroom or facility may have little to no relevance within higher education. Typically, in higher education, students have a much greater ability to self-determine when, where, and how frequently they attend classes. Thus, individual choice has the potential to limit the overall impact that size may or may not have on a student's individual academic outcome.

Maintenance and Operations (M&O) Quality

There are varied methods of providing M&O within both K-12 and higher education facilities. Across the spectrum of education, M&O services are provided through staff working directly for the educational entity, privatized firms contracted through competitive selection or through a public-private arrangement where services are split between staff personal and private service organizations. Unfortunately, due to an economic downturn in 2008 and subsequent recession, many educational institutions were faced with reducing their overall expenditure of maintenance dollars and indicated that cuts in 2012 would rival those of previous years (Kennedy, 2011). A survey by the American Association of School Administrators (AASA) found that 52% of school districts deferred maintenance in the 2011 budget year with 60% anticipating doing the same in 2012 (Kennedy, 2011). The primary implication being the continued reductions of M&O budgets within education would further aggravate and add to the existing national deferred maintenance backlog and could impact the learning environment of educational institutions (Duyar, 2010; Earthman & Lemasters, 1998, 2011; Kennedy, 2010). Consequently, Earthman and Lemasters assert that "educational leader's willingness to fund M&O within schools directly contributes to the quality of the facility" and that "the condition of the school building influences faculty, administrators, parents, and students" (Earthman & Lemasters 2011, p. 16).

Where deferred maintenance requires the allocation and expenditure of capital funding, M&O is recognized as a continuous expenditure line of an institution's annual operations budget. In education, the M&O cost for facilities routinely accounts for 20%-25% of the overall education budget (Beynon,1997); thus accounting for the second largest expenditure of education dollars trailing only the compensation for educators **(**Beynon, 1997**).** As an example, in the May 2012 edition of the Chronicle of Higher Education, it was reported that universities spend 3%-15% of their operating budgets on facility maintenance costs (Carlson, 2012) and indicated that the variation in cost were mostly predicated by the size of the institution (Carlson, 2012). In the same article, it was reported that large research institutions spend 3%-5% of their annual operating budgets on facility maintenance costs; midsized public universities spend 10% and small private colleges routinely spend 12%-15% on theirs (Carlson, 2012).

In Figure 2 below, Earthman and Lemasters explicitly link maintenance and operations to student achievement and student behavior. The link between staffing, building quality and the cleaning of the facility was depicted as key components of the building condition. Figure 2 further linked building conditions to subjective and objective outcomes with the parent and student attitudes linked as subjective outcomes and student achievement and behavior linked as objective outcomes. The figure clearly depicted a complementary relationship between key components shown within the figure (Earthman & Lemasters, 2011) and led to an acknowledgment that elements depicted in the figure were presumed to be synergistic and inexorably linked (Earthman & Lemasters, 2011). Similarly, a study conducted by Buckley et al. (2004) concluded that M&O factors within schools and geographical placement of the facility could affect occupant attitudes to the extent that teachers might be willing to accept lower salaries in exchange for perceived better working conditions, improved teacher retention, teacher morale and the perceived health and safety of teachers.

Figure 2: Model Showing the Relationship between Student Achievement and Behavior and the Building Condition.

Graphic redacted, paper copy available upon request to home institution.

(Earthman & Lemasters, 2011)

Aesthetics

The belief that an educational space should contain elements above and beyond the basic necessity of sheltering learners from the elements is an idea that has ample merit. Kuuskorpi and González (2011) citing a 2006 report by the Organisation of Co-operation and Development include the provision of a stimulating setting for occupants in their definition of learning space. When expanded, the definition sought to explain why occupants of educational space place value on the educational setting by conceptualizing a sense of personal wellbeing and ownership. This definition arguably provided a link to the premise that the physical learning environment could be affected by elements other than mechanical or built systems contained within the spaces. To that end, Kuuskorpi & González conclude that the physical learning environment is "pivotal to a user's desire to develop the school's operational environment as well as their need to renew its operational culture" (Kuuskorpi & González, 2011, p. 4). Further research by Duran- Narucki expanded upon the idea of school culture and concluded that, where education was conducted, many social forces are at play that determine the perceived quality of the space (Duran-Narucki, 2011) and that the overall impression of the learning environment was a "reflection of the personality of a place" (Uline & Tschannen-Moran, 2007, p. 59). Simply put, the condition of the school is much more than brick and mortar components of an institution but also consists of those items that form the culture, ambience and history of a facility (Durán-Narucki, 2011 & McFarlane, 2011).

Technology

Although the majority of the research conducted on the relationship between the facility built environment and educational outcomes has been conducted in K-12, there is little to no discussion of technology as an independent or mediating variable. Of the K-12 literature reviewed for this study, references to technology as a variable were vague or had to be inferred by the reader. As an example, Earthman and Lemasters state that "the lack or absence of modern building components lead to facility conditions that are not conducive to learning" (Earthman & Lemasters, 2011, p. 20). Where the previous statement could lead to an inference of technology as a variable, it was obviously inconclusive. However, research in higher education, although sparse, specifically listed technology as a variable in regard to learning (Hill & Epps, 2009 & Veltri et al., 2006). Accordingly, Hill and Epps concluded that "smart" classrooms equipped with a "wide range of computer, media, projection and communication equipment had the ability to reach more learners" (Hill & Epps, 2011, p. 16) and catered to more learning styles.

The Academic Dean's Role in Facilities

The most responsive way to introduce the role of academic deans in facilities planning and operations within higher education is to make a contextual argument that academic deans, due to their unique role in institutions of higher learning, are primary stakeholders in the endeavor to ensure that quality exists in learning and in academic space. Freeman puts forth ideas derived from organizational management and ethics theories that address morals and values within an organization and establish mechanisms for accountability for its leaders (Freeman, 1984). Freeman expanded upon ideas put forward by the Stanford Research Institute (SRI International, Inc.), in 1963 that identified stockholders as the only group to whom management needed to be responsive and in the process offered the definition of stakeholder as “those groups without whose support the organization would cease to exist” (Freeman, 1984, p. 31). With the idea of stakeholders, there is an implicit argument for the concepts of accountability and governance to whom and for what. In the case of educational facilities, the idea that academic deans are responsible for the direction, functionality and use of facilities is unquestioned (Ferren & Stanton, 2004; Walters & Keim, 2003) and therefore must be considered a prime stakeholder in the relationship between education and facilities.

The Dean as an Educational Stakeholder

From a global perspective, the role of the academic dean is to facilitate the “effective functioning of the academic unit” (Hyun, 2009, p. 90) and to promote student academic success. Hyun citing Gould, 1962 and Bright & Richards, 2001 maintains that an academic dean’s responsibilities comprise “academic advocacy, fiscal expertise, fundraising, political activism, collaboration, intellectual leadership, strategic planning, mediation and diplomacy” (Hyun, 2009, p. 90).

Although varied, the role of the academic dean has been nuanced over the last decade to be much more responsive to social and political forces aimed at the restructuring of higher education (Hyun, 2009 citing Rich, 2006). As a result, the academic dean’s role has morphed from being simply reactive and celebratory into a more pronounced stakeholder role in that the position is now frequently held responsible for measureable student outcomes (Hyun, 2009). The outcomes that are routinely linked to political and economic dictates that now face higher education institutions include equal access, affordability, quality of technological innovation, accountability and internationalization (Hyun, 2009). As a result, Hyun contends that a market sea change has occurred in higher education in that student academic success and their employability "is no longer viewed as a private student matter but as a collective responsibility between higher education, K-12 school systems and private industry" (Hyun, 2009, p. 92).

The role of the academic dean in college and university nonacademic operations is essential to the continued success and achievement of the university's mission to provide a quality education to its students (Ferren & Stanton, 2004; Walters & Keim, 2003). In doing so, the academic dean's role invariably becomes directly immersed in the programming of and the planning for new facilities to support the campus and academic mission of an academic college (Walters & Keim, 2003). Therefore it could be easily argued and research promotes the idea that academic deans' involvement in the construction of new facilities or management of an existing facility creates a unique role for an academic dean. Accordingly, Tucker and Bryan equate the role of the academic dean within facility operations to that of a "de facto landlord" (Tucker & Bryan, 1991, p. 140). Arguably the role of a facility landlord has a number of inherent risks for the academic dean. Namely, more often than not, academic deans lack the expertise in building systems and operations and have little to no control of the actual facility maintenance budget. Therefore, the academic dean's role in existing facility operations is much more nuanced and tends to follow a more traditional service provider customer/consumer relationship.

In a 2003 study, Walters and Keim surveyed 300 academic deans at publicly funded community colleges. Of the respondents, 98% indicated that they participated in the facility planning process and 22% indicated that they had served in the leadership role for the planning team on a referenced facility project (Walters & Keim, 2003). Where the aforementioned study succinctly demonstrates a high degree of involvement by the academic deans in the facility planning process, subsequent research indicate a tangential, yet important, role for the academic dean in the day to day operations of a facility once constructed (Tucker & Bryan, 1991). Therefore, the question then becomes what is the actual role of the academic dean in the relationship of facility and academic outcomes. Walters and Keim's research indicates that deans perceived their most important duties in regard to facilities to be (1) assisting in the planning of academic buildings or renovation of existing facilities; (2) planning of infrastructure at locations slated to receive new equipment related to academic programs; (3) reviewing and allocating space needed to support projected increases in enrollment; (4) establishing internal procedures that outline reporting procedures for equipment needs, facility repairs and alterations needed to support the academic mission; and (5) directing long range facility planning activities within their individual colleges to support the goals and mission of the academic college and institution (Walters & Keim, 2003).

Similarly, in a study conducted by Washington State University's Center for Academic Leadership, over 1300 academic deans from 360 universities were surveyed with a response rate of 60%. The research identified six core role sets that define "what deans do today." The research conclusively showed that deans see the management of college resources as an essential role (Wolverton & Gmelch, 2002) and adds to an evolving narrative that deans are essential to the symbiotic relationship that exists between facilities, learning and measurable educational outcomes. The management of college resources forms the link between both studies. The resources that the deans routinely have direct control of is space allocation, infrastructure spending to support new programs within their college and the administrative staff to request and track the status of maintenance repairs and planned renovations (Wolverton & Gmelch, 2002).

Career Path of an Academic Dean

A typical career path for an American university faculty member begins with a requirement to spend a minimum of seven years within the classroom in order to achieve tenure and to be promoted to the position of associate professor (Gmelch, 2009). Then the professor routinely spends an additional seven years in the classroom prior to achieving the rank of full professor (Gmelch, 2009). On average, an academic dean will spend a total of sixteen years within their academic disciplines prior to making a decision, if ever, to venture into academic leadership (Gmelch, 2009, citing Carroll, 1991).

Although it is encouraging that professors spend a reasonably lengthy time in their academic discipline prior to seeking academic leadership, research conducted by Gmelch found that only 10% of academic leaders indicated that their academic institutions had leadership development programs. To that end, Gmelch states that academic deans in higher education usually come to their position "without leadership training; have little to no prior executive experience; have a lack of understanding regarding the ambiguity of their new role; and the lack of awareness of the toll the deanship may take on their academic and personal lives" (Gmelch, 2009, p. 38). This finding, when coupled with the inherent conflict that exists between the faculty and administration, means that academic deans are often forced to walk a line between promoting the university mission to faculty and advocating for the causes and needs to the university (Gmelch, 2009). As a result Gmelch likens the academic administrator's role to that of the "Roman god Janus who has two faces and thus required to look in two directions at the same time" (Gmelch, 2009, p. 39).

Similarly, a national study of beginning academic leaders indicated that a transition from faculty to administration requires an individual to change certain patterns in order to complete the metamorphosis. Patterns identified by the study included the following shifts: (1) faculty move from *solitary* academics requirements to *social* requirements of leadership; (2) faculty move from activities that are *focused* on scholarly pursuits to social activities that are characterized by brevity, variety and *fragmentation*; (3) faculty move from scholastic *autonomy* to *accountability* for the actions of the academic unit; (4) faculty move from writing scholarly *manuscripts* to writing clear *memos*, position papers and policies; (5) faculty loses *privacy* and the ability to block long periods of time for scholarly work due to an obligation of accessibility to the *public* constituents of their academic unit; (6) a faculty member *professes* to be an expert and disseminator of information while leaders profess less while practicing consensus *(persuading)* building; (7) faculty focus shifts from *professional* academic growth within their academic discipline to a leadership role requiring *persuasion*, mobility, vision and political awareness; (8) faculty moves from a role as a *client* who requests and expects institutional resources to a *custodian* and allocator of resources; and (9) although the difference in salary between faculty *(austerity)* and administrator may be insignificant, the new experience of resource control leads an illusion of considerable *prosperity* (Gmelch, 2009).

Trends in Higher Education

As the literature details and logic suggests, a large influx of money could resolve some of the facility issues within education, but due to the complexity, magnitude and lack of political will that currently exists for increased governmental spending at any level, there is no single solution (Zusman, 2005). In fact, current trends indicate that funding for most public and private postsecondary educational institutions is declining (*GAO-12-179*, 2012). Specifically, an analysis by the Government Accountability Office (GAO) on education funding indicated that the majority of public and private nonprofit schools in America saw a 6% decrease in state and local appropriations from 1999-2009 (*GAO-12-179*, 2012).

Where there has been a continued decline of funding for postsecondary education for America's colleges and universities for the last several years (*GAO-12-179*, 2012), the amount of deferred maintenance for postsecondary institutions has continued to grow as well (Ericson, 2011). The deferred maintenance totals for the facilities that were built in the 1950s and 60s to support enrollment of the baby boomer generation and the additional buildings and infrastructure that were added during the 1980s and '90s to support an ever increasing college enrollment was estimated to be $26.5 billion dollars in 1994 with $5.7 billion defined as urgent (Kaiser, 2009), (Most current data available). To address deferred maintenance in a comprehensive manner, policy makers would have to be willing to fund recognized deferred maintenance shortfalls at a national level with a program dedicated to the repair and modernization of America's schools. The program would have to tackle a broad range of issues that include the repair and or replacement of outdated buildings, repair or replacement of aged building infrastructure, overhaul or repair of major mechanical, electrical & plumbing (MEP) systems and technology upgrades (Beynon, 1997; Hunter, 2009; Ericson, 2011; Marmolejo, 2007).

With budget appropriations for educational institutions declining by 6% between 1999 and 2009 (*GAO-12-179*, 2012), the possibility to address the issue of deferred maintenance in a holistic manner may not be attainable. However there are some areas that appear to be gaining support from many stakeholders within America's education system. One is the idea of sustainability in existing facilities and the other being the growth of distance learning as a mechanism to deliver academic instruction.

Sustainable Operations

Sustainability (green building) is defined by The Office of the Federal Environmental Executive as “the practice of increasing the efficiency with which buildings and their sites use energy, water, and materials, and the reduction of a building’s impact on human health and the environment through better siting, design, construction, operation, maintenance, through the complete building life cycle” (Building Construction and Design Sustainability, 2003, p. 1). The processes to obtain sustainability in existing facilities is a process that seeks to improve how building equipment and systems function together in order to reduce operational costs, increase efficiencies and improve the functionality of existing building systems (Thorne & Nadel, 1993). However, for the process to be successfully implemented in an existing facility, a number of key elements are required. Namely, the condition of the MEP systems must still be within its functional life expectancy; increased maintenance or minor modification can prolong existing system life; modifications or repairs correct deficiencies in system operations that may impact building occupants; and efficiencies are realized in the form of reduced energy and maintenance costs (Hunter, 2009; Marmolejo, 2007). Where Whitfield refers to deferred maintenance as a “spoiler for campus programs and events due to its cost implications and potential for untimely failure” (Whitfield, 2006, p.32), sustainable operations have the potential to provide educational institutions with an opportunity to leverage saved M&O dollars for use in other areas more aligned with an institution’s academic mission. In this study, this concept was addressed in order to focus on the benefit that could be obtained by the repair and update of MEP system components that directly impact variables linked to educational outcomes. The variables include IAQ, noise, lighting, and thermal comfort.

The viability of the two practices is inexorably linked to the notion that sustainable operations can reduce the backlog of deferred maintenance in educational facilities. Depending upon the age of a facility, retro-commissioning can often resolve problems that occurred during design and construction or address problems that have developed throughout the building's life cycle. Appropriately, retro-commissioning (RCx) processes "improves a building's operations and maintenance (M&O) procedures to enhance overall building performance" (Thorne & Nadel, June, 1993, p. ii). Although the act of improving building performance is a noble exercise, arguably the most important byproduct of the RCx process is the ability of the process to lead to energy savings and occupant satisfaction. The techniques and practices involved in the RCx process provide a proven method for utility reduction and improved system efficiencies. The reduction is gleaned through a systematic process of optimizing building performance that often results in vast improvements in building operational performance and a reduction in utility consumption that can lead to a 5%-20% reduction in energy costs (Thorne & Nadel, 1993). As a point of discussion, sustainable operations are not being put forth as the ultimate solution to produce the required capital needed to address the deferred maintenance backlog in America's schools. However, it must be advocated for as one of the drivers that could become part of the solution for an immense political and national problem that has far-ranging implications in education for years to come (Whitfield, 2006 & Ericson, 2011).

Distance Learning and Facility Impacts

Although there are a number of variations that define the concepts that have evolved to describe distance learning and/or similar web enabled learning delivery methods (Moore et al., 2011), for this paper, all forms of learning that occur between two parties (learner and instructor), held at different times and/or places and using varying forms of technology assisted instructional learning were referred to as distance learning (McFarlane, 2011; Moore et al., 2011; Valentine, 2002).

All instruction using web based technologies as a means to deliver or receive course instruction was intentionally excluded from this section's discussion and was assumed to occur in a conventional "brick and mortar," built facility environment. However, when 30% or greater of the course content is delivered outside of the conventional facility built environment, utilizes technology as a means to facilitate learning and requires little to no direct face to face interaction between the instructor and the student, Allen and Seaman concluded that the instruction being delivered was consistent with the relevant principels of distance/online learning and instruction (Allen & Seaman, 2011).

Allen and Seaman, conducting research for the Sloan-C Consortium, concluded that the majority of educators in a higher education environment still prefer conventional methods of instructional delivery yet perceived little difference in the effectiveness and learning outcomes between courses whether using distance learning or conventional means (Allen & Seaman, 2011). Where educators weigh distance learning from a standpoint of effectiveness and outcomes of instruction, facilities management personnel consider distance learning to assess its implications for space, technology, infrastructure and cost. From this perspective, the rise in popularity of distance learning may have little to no effect on the conventional built environment. The effect may be limited because distance learning space has no requirement to be housed in an environment built specifically for instruction. In the distance learning world, the learner and instructor have a much greater ability to self-determine their individual preference for teaching/learning space. This has the potential to nullify many of the facility variables addressed in Table 2 that have been shown to affect educational outcomes in K-12.

The widespread use of smart phones, mobile hotspots, WI-FI enabled entertainment, dinning and other nontraditional learning spaces facilitate the continued growth of distance learning (Moore et al., 2011). However, with the continued growth of distance learning, the recognition exists that linking facility variables to learning outcomes in a distance learning environment may not be possible nor have any merit.

It was recognized that distance learning instruction can occur in a space that is far less costly than in conventional brick and mortar institution (Bennett, 2007; Mcfarlane, 2011). However, it could be argued that distance learning conducted in nontraditional venues cannot provide many of the intangibles intuitively accepted to be part of the built environment in education. Namely, distance learning in nontraditional venues cannot provide the facility characteristics that afford occupants the opportunity to develop a historical and social connectivity between themselves, the school and the community (Bennett, 2007; Duran-Narucki, 2011; McFarlane, 2011). McFarlane, citing Lenski & Lenski, 1974, stated that the "brick and mortar or traditional schools are able to better and more accurately model the real world in which we must live and allow individuals to build better bonds of friendship and genuine likeness as they are able to better understand others in face-to-face encounters and conversations" (McFarlane, 2011, p. 10). Simply, as one researcher states, "the public school building, as the main setting where the education of many takes place is also deeply and specifically set within many social forces that determine its quality and thus the condition of the school building is not a symbol of the social characteristics of the town or city where the school is located instead it is an indicator of them" (Duran-Narucki, 2011, p. 114).

Summary

This review of literature provided an outline to support the overall argument, assertions and statement (hypothesis) made within this study. In this chapter, facility variables were identified that had been empirically linked to learning outcomes in both higher education and K-12. Present within the literature was a noticeable segmentation of identified facility variables into two distinct clusters. One cluster included variables that affected the environment within an educational facility and the other consisted of variables resulting from the physical condition or attributes of an educational facility. A key facet and intent of this chapter was to address the use and applicability of literature generated primarily from K-12 research that linked facility condition and environment to educational outcomes. Therefore, Figure 1 was created to acknowledge the contribution of K-12 research to this study. Figure 1 also provided the rationale for this researcher to assume that facility variables identified within K-12 research would have similar effects on learning in higher education. Similarly, Table 2 listed mediating variables identified in K-12 facility research, identified key researchers, key educational variables (outcomes) and associated mediating facility variables. Further sections defined key concepts (variables) and expanded upon the data presented in Table 2.

Subsequent sections introduced the academic dean as a primary stakeholder in the relationship between facilities and education and made an argument as to why an academic dean’s perspective on facilities was important. In doing so, a contextual argument was put forth regarding the warrant of conducting a study in higher education which entailed the perception of a key stakeholder group but sought no data on institutional or student outcomes for empirical evaluation. To address this obvious concern, this researcher concentrated on the perception of academic deans as a means to validate the existence and effect of facility characteristics on learning in higher education.

The final sections concentrated on current trends in higher education. The trends identified were distance learning and sustainable operations. In both cases, the trends appear to have emerged from larger societal changes occurring within the United States (Kennedy, 2011; Kuuskorpi & Gonzalez, 2011; Marmolejo, 2007). Distance learning was addressed from the perspective that the "learning environment," in this digital age, has no requirement to be housed in a facility built specifically for learning and is thus less costly. Therefore, with the introduction of learner choice and a potential to lower capital expenditures, M&O and new construction for facilities, distance learning could render many of the facility variables identified in this and previous studies inconsequential. The other perspective that emerged regarding distance learning was that it still has its detractors (Allen & Seaman, 2011) and reportedly lacks the ability to develop connectivity between the school, the learner and the community (Bennett, 2007; Duran-Narucki, 2011; Mcfarlane, 2011). Sustainable operation was identified as a second trend in higher education that affected both facilities and education. In the chapter, sustainable operation was identified as a way to reduce M&O dollars expended in facilities on energy and maintenance costs and diverting those dollars to other areas more aligned with the academic mission of educational institutions.

Chapter 3

METHODOLOGY

Chapter three provides a description of the methodology for this study by presenting the overall research design, the question that forms the core area of inquiry to be researched and the rationale for the selection and exclusion of the research population. Additionally, Chapter three included an introduction of the methodology, the instrumentation and addressed steps for data collection and analysis. The chapter concluded with a summary of key points of interest.

Q methodology

Q methodology was developed by William Stephenson and first introduced in 1935 as an innovative adaptation of Charles Spearman's traditional method of factor analysis (Watts & Stenner, 2012). Stephenson, who held PhD degrees in both psychology and physics, developed Q methodology as a means to provide a systematic method for examining human subjectivity (Mckeown & Thomas, 1988). Factor analysis in R methodology is typically expressed as an R statistic using structured correlation tables seeking to measure the degree of agreement between standardized scores (Z) of two independent variables from a single individual and expressed statistically as an (r) value (Watts & Stenner, 2012). In contrast, factor analysis is used in Q methodology as a means to tabularize individuals as variables in an inverted correlation table and empirically evaluate normally qualitative, subjective data. In the process of introducing Q methodology, Stephenson advocated for the inversion of basic correlation tables that resulted in a radical departure from R methodological approaches. In a Q methodological approach, the persons become the actual variables to be measured and typical variables such as traits, test and abilities are treated as the sample or population (Watts & Stenner, 2012). Stated differently, Q methodology allows for the observation of response patterns across a participant pool that allows for the systematic identification of groups of people that share a common perspective in regard to a specific subject. Stephenson's advocacy for Q methodology or "by person factor analysis" was based on the recognition that the standardizing of (Z) scores in R methodology tended to disassociate the scores from the individuals that generated them (Watts & Stenner, 2012, p.11) and that individual subjectivity, personal characteristics and perspectives of the specific individuals (participants) were invariably lost (Stephenson, 1952; Watts & Stenner, 2012). Stephenson saw Q methodology as a departure from R statistics in that: (1) hypotheses, explanations and interpretations are proposed at the outset; (2) propositions are asserted and empirically tested; (3) structured Q sorts are composed to test the independencies of the theory at issue or implied; and (4) random variable designs are employed in order to identify dependencies (Stephenson, 1952).

Therefore, a typical R methodology utilizing conventional forms of logic, deduction and induction proved to be less than satisfactory. Where deductive logic begins with a formal theory or hypothesis, inductive logic omits theory/hypothesis yet seeks to gather data in order to describe or generalize findings as a means to explain phenomena. Abductive logic is used in Q to evaluate facts in order to devise a theory to explain or provide new insights into observed phenomena (Watts & Stenner, 2012). Therefore, abduction in Q is a process that is designed for discovery and theory generation. In this study, both the literature review and the researcher's subjectivity gave rise to a non-experimental research question that sought to expand phenomena identified in other empirical studies. This was important to this study in that factor rotations ultimately produced unanticipated relationships that were not expected by this researcher nor identified by previous research.

Three methodologies were considered as possible approaches for conducting a systematic evaluation of the subjective data needed to complete this study. The first methodology considered was the use of a structured survey as the vehicle for data collection from the study's participants. If chosen, a priori knowledge garnered from a comprehensive literature review and personal knowledge of the subject area would have been used to develop a questionnaire related to facilities and learning. Typically, as contemplated in this study, a survey instrument would have been sent to a large number of participants in order to accomplish two yet distinct outcomes: one being to generalize the findings of the survey to the larger population from which the sample was drawn and the other being to generate descriptive statistics from which data gathered via the survey could be explained.

Although the use of a structured survey would have allowed for the collection of a wide range of data from the proposed participants, the potential existed that the survey instrument would fail to adequately represent the participant's views or depict the complex nature of the subject to be researched. Simply put, the use of a structured survey would have allowed for the generation of mean scores from the data gathered from the research participants, but descriptive data in this case would only be representative of an average for the sample of the group from which the sample was drawn. Missing from the descriptive statistics would be the ability to capture the nuanced subjectivity of the participants and to adequately access or represent the distinct viewpoint of college deans regarding the facility built environment and learning in the higher education environment.

A Delphi research approach was the second methodology considered for this study. In a Delphi study, a panel of experts (academic deans) would have been selected to discuss an individual or a collection of proposition(s) regarding facilities and its impact on learning in higher education from a dean's perspective. If used, this method would have allowed participants within the study to communicate via researcher facilitation. Direct communication between the participants would have been discouraged, yet would have allowed a diverse group of individuals, acting in concert, to develop themes about the study's subject matter.

This advantage when coupled with the ability to ask participants both quantitative and qualitative questions within the same instrument would have provided a unique advantage when compared to a conventional survey. Unlike conventional surveys that only allow for analysis of a singular set of answers on a given set of questions, a Delphi study would have allowed for multiple stages of analysis and feedback until a consensus was reached between the participants that synthesized and clarified solutions to the posed question(s).

Although enticing, the prime rationale for not conducting a Delphi study was the concern that the researcher could not adequately justify the selection of the study's expert panel (participants). Although the research conducted for this study indicates that deans, on average, have sixteen years of higher education experience prior to ascending to a deanship (Gmelch, 2009), the literature fails to identify more than a tangential role for deans in facility operations. Therefore this researcher concluded that academic deans, by and large, lacked the subject authority to justify the establishment of an expert panel. This concern when coupled with subject literature that indicated that the methodology was more suitable as a process for facilitating problem solving and generating forecasts than conducting research. This ultimately led to the conclusion that a Delphi methodological approach would not be an appropriate means to investigate the research question posed earlier in this document. In this instance, the proposed research question in this study sought subjective data for evaluation, not subjective data for solving a facilities problem within education. Therefore, given the desire to access the unique perspectives of academic deans regarding facilities and learning, Q methodology provided the best developed means to statistically access the subjective data sought by this research.

The Q Sample

The research instrument for a Q study is called a Q sample. Brown citing Stephenson in 1978 stated that a communication concourse is composed of statements that represent "the flow of communicability surrounding any topic" (Brown, 1993, p. 94). This concourse provides the basis for the full development of a representative Q sample for the topic of this study. The concourse explored the perspectives of the academic deans regarding role of facility characteristics on student learning in higher education. The purpose for this phase of the study was to develop a Q sample that would represent a concourse or population of discrete thoughts and opinions that participants held about the topic at hand and elicited from the research question.

Given that this study explored the academic dean's perception of characteristics within facilities at institutions of higher learning that may impact student learning, there were a number of ways in which the concourse could have been developed. For this study, this researcher chose to employ a hybrid approach by sculpting the communication concourse from both naturalistic and quasi-naturalistic sources. The collection of Q statements from the online questionnaire generated naturalistic communications unique to the participants of the study and, therefore, the resulting Q sample mirrored their expressed opinions (McKeown & Thomas, 1988). In contrast, this researcher also made use of subject literature to augment the development of the Q sample by incorporating key concepts and themes identified in previous subject research. Therefore the sample statements gleaned from the literature, although not the direct communication of the participants (McKeown & Thomas, 1988), were instrumental in capturing the communication surrounding this research topic (Brown, 1993).

Although this Q sample's development relied on both naturalistic and quasi-naturalistic communication sources found within the subject literature and this study's concourse questionnaire that were intended to be representative of contextual communication around the study's topic, invariably all communications could not be represented (McKeown & Thomas, 1988). For this reason, this study's Q sample was developed in a "structured" manner in order to avoid over/under sampling of issues and to avoid personal subject bias being incorporated within the sample. This Q sample was developed both deductively and inductively by combining statements describing themes identified in both the topic literature and emergent patterns from the questionnaire. Like structured sampling, the goal of this research was to find a representative sample of a larger process to be modeled among the participants of the study (Dziopa & Ahern, 2011 citing Brown, 1993).

While this study used a structured Q sample, an argument could have been made to use an unstructured Q sample in that the research literature on the subject contained a number of pronounced themes/variables that reasonably could have represented the communication around this study's topic. Although McKeown and Thomas caution against the use of unstructured sampling in research due to the possibility of bias and component issues being under- or oversampled, they do concede that the method provides a reasonably accurate "survey" of the "positions taken or likely to be taken on a given issue" (McKeown & Thomas, 1988, p. 28).

For this study, the concourse was developed primarily from two different sources. One source relied solely on informational themes garnered from previous research and academic literature investigating relationships between facilities and educational outcomes in K-12 and higher education. In many of the previous studies, a number of key facility variables were statistically linked to learning outcomes. Of the variables identified in the research, the variables mostly clustered within two unique groups. One group consisted of environmental qualities within the facility and the other consisted of variables related directly to the condition of facility. In the review of literature, these variables and themes were identified by multiple researchers in both K-12 and higher education studies. As a direct result, the development of the concourse depended much more heavily on the abundance of professional literature than other studies may have considered. Common outcomes linked to facility variables within the literature and subgroups included test scores, student/ teacher retention, satisfaction and others (Lackey, 1994; Roberts et al., 2008; Schneider, 2002).

The second source of data for this study's concourse and subsequent Q sample was an electronic questionnaire. This instrument consisted of five items in the form of an open-ended prompt and four items related to participant demographics. It was sent out to thirty academic deans working at postsecondary institutions in Florida. From the initial thirty instruments, a total of four valid responses were received. A second solicitation was made to an additional sixty-five academic deans that resulted in an additional nine valid responses. The open-ended question invited the deans to identify the characteristics of their current facilities that they perceived to impact student learning as well as those facility characteristics they believed to generally impact student learning beyond their home institution. Demographic information was collected in order to assess whether the participant pool offered diverse perspectives on the issue.

Concourse Development: Literature Review

The literature review conducted in Chapter two offered a number of opportunities to select specific statements that continued the facilities and education narrative explained within

Chapter one. In Chapter one, learning space along with other constructivist ideas were presented as the theoretical constructs to which (facilities) space and student educational outcomes could be linked. Therefore, only those statement that specifically addressed facility variables in relation to educational outcomes were selected for the concourse. Data collected from the literature generated ninety concourse statements.

Concourse Development: Concourse Questionnaire

The concourse questionnaire was sent out to 95 deans working at academic institutions located within the State of Florida. As a precursor to soliciting participants for the study, an attempt was made to identify academic deans and/or representatives that were tasked with or had assumed facility responsibilities within their respective college. However, after reviewing a number of college and university websites, it became readily apparent that the sites did not provide information in which facility duties assigned to a specific dean could be discerned. Therefore, the survey instrument was modified to allow each participant to articulate their perceived role and perception of facilities in regard to learning.

The 95 participants were randomly chosen from a previously compiled list that identified a number of college/university deans and their email addresses. The demographics collected for this study included race, gender, ethnicity, academic institutions' classification, tenure in current position, and specificity of facility assignment. The identification of demographics in this Q study was important because it provided a means of generalizing related concepts, theoretical propositions and models of practice (Watts & Stenner, 2012). To that end the American Psychological Association (APA) states that the "appropriate identification of research participants is critical to the science and practice of psychology" (*APA*, 2010, p. 29). Similarly Sifers, Puddy, Warren and Roberts (2002) expand on the APA statement by asserting that it is "inherent in all sciences research to provide a comprehensive and accurate description of a research sample and the population from which it was drawn" (p. 19). A second reason for gathering and reporting demographic data lies in the understanding that the participants bring "different, important and relevant knowledge and perspectives about how to do work, how to design processes, reach goals, frame tasks, create effective teams, communicate ideas and lead" (Thomas & Ely, 1996, p. 2).

In this phase of the study, the instrument was developed and administered within the Qualtrics Research Suite. As a user-selected feature of the Qualtrics Research Suite, this researcher opted for participants to remain anonymous. As a facet of the Qualtrics Research Suite, once participants opted to participate they were each assigned random numbers in order to track the origins of statements and demographics attributable to each participant. The assignment of the number provided the means to link the participant's demographic information gathered from the survey to each individual respondent (Appendix A). The estimated duration required to respond to the online questionnaire was 20 minutes. All participants were contacted via email to introduce the researcher, state the purpose of the study, provide information about Institutional Review Board approval (IRB) and ask for their participation in the study. The email contained a link to the online questionnaire. As a feature of the instrument, once a participant opened the imbedded link to the questionnaire, they were required to read and acknowledge informed consent (Appendix B), prior to being able to complete the questionnaire. The consent form informed the participants that the study was being conducted as part of a doctoral dissertation that was approved by the University of North Florida IRB.

The participants were asked to respond to the following open-ended question by listing up to ten statements that identified facility characteristics that they perceived as having an impact on student learning:

Thinking about your entire campus, w*hat characteristic of the facility built environment do you perceive as having the greatest impact on student learning in higher education? When sorting the statements below, please do so with the understanding that the facility built environment is defined as any man-made environment that provides structure for human activity. (USGBC,* n.d., pg. 106)

Ninety-five deans were sent a link to the electronic questionnaire. Of that number, thirteen deans completed the questionnaire. Data collected from the completed questionnaires generated twelve concourse statements. The review of the scholarly literature yielded 94 concourse items. A total of 106 concourse items were generated for this study. There were a number of common themes identified within both concourse statement sources.

Although this study's concourse relied heavily on items selected from the scholarly work of others, the resulting sample was augmented with items selected from participant questionnaires that ultimately validated and expanded the concourse items gleaned from the literature. Therefore, with the inclusion of items drawn from the two sources previously identified, the resulting concourse proved to be highly reflective of the overall population of statements surrounding this study's question (Watts & Stenner, 2012).

Sculpting the Q Sample

Ideally, a Q sample would include all distinct thoughts and ideas surrounding a topic (Brown, 1993). However, for this study, two intentional processes were embraced in order to reduce the 106 item concourse to the 32 item Q sample. The first was to distill the 106 concourse statements into a taut and parsimonious representation of the broader and often repetitive concourse. The second was to reduce the concourse items into a more manageable 32 item Q sample for participants to sort (Mckeown & Thomas, 1988). As a result, the reduction of the 106 concourse items into the 32 item Q sample represented numerous purposeful decisions to construct a Q sample that was representative of the broadest range of perspectives possible, while also being manageable for participants to sort. Therefore, a discussion of how the 106 item concourse was reduced to a 32 item Q sample and how some items were included or excluded from the Q sample was important and required further clarification (Mckeown & Thomas, 1988).

Items garnered from the concourse questionnaire and scholarly literature generated a total of 106 Q statements. From the 106 statements, a 32 question Q sample was created that represented a "collection of stimulus items" (Mckeown & Thomas, 1988, p. 25) around the topic at hand:

What characteristic of the facility built environment do academic deans perceive as having the greatest impact on student learning in higher education?

The Q sample was developed from the communication concourse by eliminating identical items, combining similar items, and eliminating items extraneous to the research question and condition for sorting. This process was facilitated by allotting a similar numbers of items for each distinct theme that emerged from the theoretical content identified within the literature.

The process of developing a useful Q sample representative of the communication surrounding the research question (concourse statements) involved a meticulous review of all concourse items generated. As stated earlier, all items were reviewed for clarity to ensure that potential participants would understand the prompts. Then all statements were individually evaluated to ascertain a basic level of relevance to the research topic.

Next, this researcher collaborated with his dissertation's methodologist to refine core statements that represented the key mediating variables or facility characteristics that were identified within the concourse. This process involved the consolidation of similar statements that identified a common theme or characteristic. An example of this was the consolidation of the following three statements: (18) "We already know that clean air, good light and a quiet comfortable safe learning environment are needed for learning to occur"; (64) "Eight of nine students found a significant relationship between the thermal environment of the classroom and student achievement and behavior" and (96) "Good space temperature exists when occupants are comfortable and satisfied." The researcher noting the similarity of the three items combined the three items to form Statement 3 ("Room temperature that is comfortable and satisfactory"). This method of combining similar statements resulted in the concourse items being reduced into the 32 item Q sample

Participants

In Q methodology the participant sample is called the P set. As discussed earlier in the chapter, unlike R methodology, the focus of Q methodology is on small samples of individuals. Where R methodology's primary focus is on the correlation of tests or traits of participants, Q methodology looks to identify "internal frames of reference" (Mckeown & Thomas, 1988, p. 12) for individual participants. Simply, Q study is designed to place emphasis on a smaller sample of individuals and, unlike R methodology, places no emphasis on the correlation of traits or test scores.

The decision by this researcher to select a participant pool constrained by title, nature of work, education sector, state, and accreditation still allowed for a generalization of the study's finding. Unlike other methodologies, generalization in a Q study is obtained by eliciting the widest range of opinions on a given topic and identifying the widest range of individual perspectives within a similar group (Mckeown & Thomas, 1988). McKeown and Thomas (1988) postulate that a "Q study consisting of 50 participants would be considered an extensive Q study if the intent of the study was to determine the variety of views on an issue" (p. 37). In this study, it was anticipated that Q factors would either emerge due to the proper selection of the participant pool or would mirror factors already identified within the literature (Mckeown & Thomas, 1988).

Although great care was taken to identify those participants whose duties included facility responsibilities, the concourse questionnaire revealed that all academic deans, regardless of demographics, were able to provide subjective opinion statements regarding the relationship of facilities to student learning. In order to identify the broadest possible range of opinions, electronic Q samples were sent to 305 potential participants selected from a varied mix of higher education institutions within the state. The participants selected represented three readily identifiable institutional demographics present in higher education in Florida: (1) Historically Black Colleges and Universities (HBCU), (2) private, not for profit, and (3) public. Demographic information pertaining to the participant's institution was obtained through SACS and within the instrument. A total of 43 Q sorts were completed and returned, which resulted in a response rate of 14 %.

The final step taken to access the broadest range of opinions for the P set was to identify the ethnicity and gender of the participants. As with the concourse questionnaire described above, participants were asked to complete a demographic questionnaire (Appendix D) included with the Q sample. The demographic data collected for the study included: (1) race/ethnicity, (2) gender, (3) number of years in present position, and (4) size of student population of institution. The importance of the collected demographic data was that it added a contextual value to the Q sample. Simply put, the demographic data when matched with the responses of the individual participants comprising an emergent factor could provide a means to link response patterns to gender and/or race distinctions or work experience (Thomas & Ely, 1996). The demographic data for the 43 participants is contained in Appendix H.

Q Sort Procedures

It was assumed by this researcher that academic deans would be able to articulate components of the facility that they perceived as impacting student learning and be able to rank order, by level of importance, those identified facility components. For this study, all participants were contacted via email to request their participation in the study (see Appendix E). Included in the email was an embedded link that allowed the participants to access the Q sample. Once the participants accessed the link, instructions were provided to clearly explain the process of completing the online Q sample (Appendix D). After a period of two weeks, a second follow-on email was sent out to all participants as a reminder (Appendix F).

All participants were asked to rank order Q statements in a manner that required the participants to place a numerical value on each item statement ranging from -4 (“least impactful”) to +4 (“most impactful”). In keeping with the conventions of Q methodology, the researcher created a forced distribution grid in the shape of a normal distribution. Although McKeown and Thomas (1988) state that the “the shape of a Q sort distribution is methodologically and statistically inconsequential” (p. 34), a quasi-normal distribution pattern was used in this study as a tool to encourage participants to consider the items in a more systematic manner (Mckeown & Thomas, 1988). As illustrated by Figure 3, respondents were able to place two statements under the “least impactful” column (-4), two statements under the “most impactful” column (+4), followed by four items respectively under each of the remaining seven columns (-3, -2, -1, 0, +1, +2, +3), which represent the next most/least impactful characteristics and so on.

Figure 3: 32 Factor Q Sort depicting a normal distribution

-4	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**

Due to the availability of FlashQ data collection software, the decision was made that all participants would self-administer the Q sorts. As stated previously, all participants were sent an email that outlined the purpose of the study (Appendix E) that included attachments for the participants’ records. The email attachments informed participants that the University of North Florida Institutional Review Board had approved this study (Appendix I) and included the participant background questionnaire (Appendix D) and the sorting instructions for the Q sample (Appendix G).

Data Analysis

Factor analysis is used to analyze Q methodology data. Unlike R methodology, Q methodology departs from the correlation of data by item. Instead, Q methodology focuses on the collection and interpretation of subjective data (responses) of the participants within a study (McKeown & Thomas, 1988; Watts & Stenner, 2012). Therefore, factor analysis is fundamental to Q methodology because it provides the statistical means for participants to group themselves

(McKeown & Thomas, 1988). For this study, factor analysis produced distinct opinion groupings or factors derived from the perceptions of academic deans. In doing so, the study also looked at the strength of the individual participant's agreement with factors identified within the study. The individual factors that were extracted proved to be highly correlated with other factors identified within the study. Factor loading indicates the degree to which individual Q sorts are associated with a factor (Mckeown & Thomas, 1988). Factor loadings are considered to be statistically significant ($p < .01$) if they exceed $\pm$ 2.58 times the standard error (SE) (Mckeown & Thomas, 1988). The equation for calculating SE is $1/\sqrt{N}$, where N is the number of statements in the Q sort (McKeown & Thomas, 1988). For this study, SE = $1/\sqrt{32}$ =.1767 so factor loadings exceeding $\pm$ 2.58 (.1767) or $\pm$ (.46) were considered statistically significant.

Factor rotation is used in Q methodology as a means to simplify the structure or to "maximize the purity of saturation" of Q sorts on emergent factors (McKeown & Thomas, 1988, p. 52). Conversely, Watts and Stenner explain factor rotation in spatial terms by associating factors with coordinates (Watts & Stenner, 2012) that provide a means of mapping the position or viewpoints of all Q sorts in a study (Watts & Stenner, 2012). Simply put, in the Watts and Stenner explanation, participants within this study, as a function of the research question and instructions, had the ability to offer unique perspectives. Space was therefore defined as the level of agreement or disagreement between the individual perspectives (Watts & Stenner, 2012). Essentially, space is the level of correlation in which a Q sort is associated with each extracted factor and each factor location within the space, "coordinate" "becomes the means of mapping the relative positions or viewpoints of all Q sorts in a study" (Watts & Stenner, 2012, p. 114).

Although there is little consensus on which factor rotation method is most preferred, a common argument centers on the notion that any factor rotation method that results in a simple structure is acceptable (Gorsuch, 1983; McKeown & Thomas, 1988). To that end, Kim and Mueller argue that "if identification of the basic structuring of variables into theoretically meaningful sub-dimensions is the primary concern of the researcher, as is often the case in an exploratory factor analysis, almost any readily available method of rotation will do the job" (Kim & Mueller, 1978, p. 50).

As stated earlier, factor rotation is used in Q methodology to "maximize the purity of saturation" of Q sorts on emergent factors (McKeown & Thomas, 1988, p. 52). Therefore the purpose of any such procedure is to change the "coordinates" of the Q sorts across factors without disturbing the established relationships expressed by the correlation matrix (Watts & Stenner, 2012; McKeown & Thomas, 1988). For this study, this researcher chose PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) as the means to compute inter correlations among Q sorts and subsequently to extract factors. A decision was made to use Varimax rotation to mathematically manipulate the data in order to position the factors so that the overall solution "maximized" the amount of study variance explained (Watts & Stenner, 2012, p. 125). Varimax factor rotation is a statistical procedure that approximates simple structure by grouping participant sorts on one of the study factors.

For this study, the researcher used PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) to correlate and factor-analyze the data. The resulting correlation analysis contained all participant Q sorts as variables that represented distinct clusters of perspectives held by participants with similar viewpoints regarding facilities and learning in higher education.

Interpretation of Factors

Factor interpretation in Q methodology is based on the examination of a participant's assigned ranking of a Q sort. With this method, factor arrays can be directly interpreted by comparing the rankings of Q statement items (factors) in factor arrays (Dziopa & Ahern, 2011). This interpretation serves as a means to represent the underlying meaning of the sorts associated with the factors and produce a series of accounts that clarifies the viewpoint or position being expressed by a particular factor. Simply, unlike R methodologies, Q methodology factors are derived from the sorting activity of a study's participants' rather than from the analysis and classification of themes identified by a researcher.

This researcher used PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) to construct a factor array for each factor identified within the study. A factor array represents a mathematical model that depicts the relation of an individual Q sort to a related factor. Once established, this researcher was able to compare themes exposed in various response patterns to identify similarities and differences within the factors. This process allowed for the consolidation of multiple items into a single theme that represented the entirety of a participant's views on a subject (Watts & Stenner, 2012).

Post Sort Questionnaire

Given that all participants within this study were asked to use the FlashQ software to self-administer the Q sort, all participants, as a component of the software had the opportunity to complete a post sort questionnaire. In this spirit, this researcher asked for all participants to complete the post sort questionnaire located at the end of the instrument. The prime rationale for encouraging all participants to complete the post sort questionnaire was to "achieve a fuller, richer and more detailed understanding of each participants Q sort" (Watts & Stenner, 2012, p. 83). In this study, 43 participants self-administered the Q sort on line and provided written responses to the post Q sort questionnaire. Of the 43 participants that completed the Q sorts, 18 participants failed to complete or partially completed the post Q sort questionnaire.

Of particular interest to this researcher were individuals whose sorts contained factor loadings that were decidedly associated with an individual factor. McKeown and Thomas conclude that Q sorts of this type were considered ideal in that the individual sort subjectively represents the expressed underlying meaning of a given factor. The data collected from Q sorts were used to strengthen the narrative description of the perceptions presented by each factor.

The intent of the post Q sort questionnaire was to concentrate on the participant's explanations as to why they sorted the Q sort in the manner that they did with primary emphasis being placed on the -4 and +4 statement rankings. The post sort questionnaire was also used as a tool to identify underlying perceptions and or details that the Q sample failed to account for or anticipate. Finally, the Q sort for this study was designed to allow participants to express other issues not elicited within the actual instrument, provided an outlet for participants to put forth constructs not anticipated within the instrument design, and encouraged participants to identify facility characteristics using single word definitions or short phrases in a vernacular common to their profession (see Figure 3). Questions included in the post sort questionnaire focused primarily on how participants perceived the Q sample statements and on the decision making process of the participants when determining the placement of items in the normal forced distribution. The prompts and questions included in the post sort questionnaire included:

1. Describe why you believe the items that you placed at the +4 end of the continuum are important to learning in higher education.
2. Describe why you believe the items that you placed at the -4 end of the continuum are less important to learning in higher education.
3. Identify specific statements, by statement number, that you had particular difficulty in placing within the continuum.

4. Describe any additional facility characteristics that you believe to affect student ability to learn in higher education.

Summary

It is important to recognize that the perception of academic deans has the potential to add to the scant literature addressing the facility's impact on learning in higher education. Therefore this research is designed to add to the existing body of research by illuminating the academic dean's views on the facility built environment and learning. As a consequence of this study, it is anticipated that other perception studies may be derived whose participant pool includes faculty members, administrative staff and students.

Q methodology was employed to examine academic deans' perceptions of the facility built environment, its characteristics, and how those characteristics were perceived to affect learning. Q methodology provided a means to empirically analyze the mostly subjective data derived from the study and allowed the researcher to explore an area of education and facilities using subjective views from a primary higher education stakeholder. The research instrument, or Q sample, was composed of opinion statements derived from responses to a concourse questionnaire and items selected from subject literature. Forty-three participants completed Q samples designed to solicit experiences of their individual interaction with the facility built environment in higher education. Factor analysis was employed to analyze data derived from the Q samples. In Chapter three the researcher reports the results of the data analysis and in Chapter 4 the researcher discusses the results and provides implications for future research.

Chapter 4

Research Findings

Introduction

The purpose of this Q study was to explore the perceptions of academic deans in regard to the characteristics of the facility built environment and its perceived effect on student learning and outcomes in higher education. The data for this chapter was derived from 43 completed Q samples by academic deans in the State of Florida. The participants sorted 32 statements describing characteristics of the facility built environment to identify their perceived impact on student learning in higher education. The research question guiding this study is listed below:

Q-1: How do academic deans perceive the characteristics of the facility built environment to impact learning in higher education?

A key aspect of Q methodology is the ability of a researcher to use data analysis as a tool to distinguish the relationship of participant Q sorts to each other. The correlation of individual Q sorts, factor analysis and the computation of factor scores were the primary statistical procedures used to distinguish relationships between Q sorts in this study (Mckeown & Thomas, 1988). Where correlation represents the level of similarity among participant sorts, factor analysis is used to discern how participant's sorts mathematically cluster to form a factor. Subsequently, factor scores and arrays were generated from statements within the factors that represented a "mathematical model Q sort" for a specific factor (McKeown & Thomas, 1988, p. 53).

Data from 43 Q samples was entered into the PQMethod freeware for Q analysis (Schmolck & Atkinson, 2013). Once completed, the Q sorts were processed and analyzed using the PQMethod freeware, which employs a distinct set of specialized algorithms designed specifically to analyze Q data (Schmolck & Atkinson, 2013). From the entered Q sample data, the researcher used the software to statistically compute factors, variances and strength of relationships that existed between and among participant Q sorts. The subsequent narratives that led to the naming of the three factors were derived from statistical and qualitative data garnered from this study's participants. The data included factor loadings that contained defining participant sorts (Table 3), data contained within the factor arrays (Table 5), distinguishing statements (Tables 8; 10; and 12) and finally post sort statements provided by participants of this study.

Q Data Analysis

Factor Correlation Matrix

As discussed in Chapter three, Q and R methodologies both share common analytical tools and procedures inherent to correlation statistics (Watts & Stenner, 2012). Primarily, in both methodologies, the calculation of the correlation matrix is the initial step required to explore the degree of agreement or disagreement between variables (Q sorts) (Watts & Stenner, 2012). Once completed, the matrix provides a visual representation of the relationships between individual Q sorts.

In this study, PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) was used to calculate the correlation matrix that depicted the level of agreement between participant sorts. The correlation matrix for this study measured 43X43 based on the number of participants (N=43). The level of agreement between participant sorts were determined by the direction and distance by which a response moved away from zero. A correlation of +1.0 would indicate a perfect agreement between two sorts. In contrast, a correlation of -1.0 would indicate a complete disagreement between sorts and 0.00 would be an indicator of no agreement between participant sorts. Simply put, a high correlation between sorts indicates the strength of the relationship. Therefore for this study, participant's sorts that were highly correlated were an indicator that they shared similar perceptions regarding the impact that facility characteristics had on learning in higher education. The correlation matrixes of the Q sorts included in this study are presented in Table 4.

Factor Analysis

Factor analysis is the second step required by PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) to analyze data. The PQMethod freeware for Q analysis (Schmolck & Atkinson, 2013) was used by this researcher to cluster the sorts contained within this study's 43X43 correlation matrix into eight unrotated factors with the primary purpose being to structure the data into relevant groupings. The factors that eventually emerged were representative of the participant's sorts that clustered around common themes. Accordingly, McKeown and Thomas (1988) indicated that the grouping of factors "lend statistical clarity to the behavioral order implicit in the matrix by virtue of the similarity or dissimilarity of the clustered sorts" (p.50). In a Q study, factor loadings indicate the degree to which each sort is associated with any given factor array. Therefore, factor loadings in Q are correlation coefficients (McKeown & Thomas, 1988). Factor loadings are statistically significant ($p<.01$) if they are in excess of $\pm$ 2.58 times the standard error (SE). Standard error is shown as SE = $1/\sqrt{N}$ with N representing the number of statements in the Q sample (McKeown & Thomas, 1988). For this study SE = $1/\sqrt{32}$ =.1768, so factor loadings in excess of ± 2.58 (.1768) or ±.46 were considered statistically significant.

Factor Rotation

According to Brown, unrotated factors are usually of little interest to the researcher in that they only provide “the raw materials for probing subjective vantage points that might be of interest” (Brown, 1994, p. 112). Therefore, a method of factor rotation is typically employed to mathematically manipulate raw data in order to “maximize the purity of saturation” (McKeown & Thomas, 1988). One such method, Varimax, is commonly used to “maximize the purity of saturation” and to reduce the inherent “muddling that occurs when individual Q sorts either load on more than one factor or fail to load on any” (McKeown & Thomas, 1988, p. 52). Of great importance to this study was the underlying desire to employ a rotational method that would optimize the separation of factors without altering the relationship depicted within the correlation matrix. Therefore for this reason and a desire to identify simple structure (McKeown & Thomas, 1988), Varimax rotation was chosen as the procedure for this study.

For this study, three, four and five factor rotations were selected for comparison. After reviewing all three rotations, this researcher identified the three factor rotation as a more satisfactory solution than either the four or five factor rotations. Although the three factor rotation explained slightly less of the study’s variance (53%) than the four (59%) and five (64%) factor rotations (see Table 3), the three factor solution resulted in less muddling and produced the most distinct factor themes and traits. Furthermore, more participants loaded on the three factor rotation (38) than both the four and five factor solutions, which both had 33 participants that loaded significantly. Although the three, four and five factor solutions shared statistical attributes of varying levels, the substantive meaning and significance (Watts & Stenner, 2012) of all three factors was given as much consideration as their pure statistical ranking. As a result, the three factor solution was found to be most relevant because contextually it produced factors that were determined to be significant from a theoretical, purposeful and statistical significance (Watts & Stenner, 2012).

The three factor rotation resulted in eight individual sorts, 2, 14, 17, 26, 38, 39, 40 and 43, that loaded significantly on two factors and were thus deemed to be confounding. Moreover, six individual sorts, 1, 5, 8, 10, 13 and 22, significantly loaded on one factor and had comparatively high loadings on at least one additional factor. Finally, one individual, sort 12, loaded significantly on all three factors and was also considered to be confounding. Consequently, the participant Q sorts that loaded relatively high on two or more factors indicated some level of equal agreement between two or more views on how they perceived facilities and its impact on learning. The three factor rotation is shown in Table 3.

Table 3

Factor Loadings (With an X Indicating a Defining Sort)

Q Sort	A	B	C
1 wmBL7Pu4	0.6645X	0.2763	-0.0633
2 wmDE2Pu4	0.7044X	0.3963	-0.0186
3 wmDE2Pu4	-0.0004	0.4792X	-0.0653
4 wmad2Pu4	-0.3543	0.1558	0.7281X
5 wmAd3Pu4	0.3668	0.3938	0.3289
6 wfDe7Pu7	0.3020	0.4015	0.2650
7 wmAD4Pu4	0.7381X	0.2129	0.1789
8 bfAD8Pu4	0.3410	0.6510X	0.0623
9 wfAD9pu3	0.2695	0.3653	0.5526X
10 BFD4Pu2	0.5641X	0.3807	0.0976
11 wmF32Pu4	0.7602X	0.1203	0.1859
12 wmAD3Pu3	0.4455	0.4168	0.5142
13 wmADpu#4	0.6364X	0.2788	0.2810
14 wmDEpu13	0.6329X	0.5413	-0.2576
15 lmAD6pr2	0.8126X	0.0998	0.0273
16 wmaD#pr1	0.2976	-0.2811	0.6428X
17 wfaD#pu3	0.4821	0.5849X	0.0711
18 wmAD6pr2	0.5773X	0.2774	0.0205
19 wfDE#pu3	0.1918	0.6429X	0.1232

(*table continues*)

Table 3 (continued)

Factor Loadings (With an X Indicating a Defining Sort)

Q sort	A	B	C
20 wmDE3pr1	0.1548	0.6208X	0.0992
21 wfDE#pu3	0.2437	0.5657X	0.2980
22 wfDE2pu4	0.5901X	0.3089	-0.0553
23 wmDE6pr2	-0.0706	0.7011X	0.1831
24 wfDE4pu2	0.0175	0.1639	0.5047X
25 wmDE#pu3	0.7247X	-0.0433	0.0277
26 wfAD3pu3	0.6216X	0.0911	0.4308
27 wmAD8pu3	-0.0063	0.7829X	0.2194
28 wfDE3pu4	0.5090X	0.2354	0.1836
29 wfAD7pu4	0.1188	0.6964X	0.0520
30 wmAD4pr3	0.7135X	-0.2135	0.2924
31 wfDE3pr2	0.4675X	0.0642	0.0742
32 wmAD#pu4	0.8225X	0.2753	0.2154
33 wmDE7pu4	0.1999	0.3388	-0.0962
34 wmAD#pu4	0.0777	0.5139X	0.1437
35 lmAD7pr3	0.5864X	0.3285	0.2513
36 wfAD5Pu4	0.8020X	0.2741	-0.1765
37 wmDE1Pu4	0.8190X	0.0319	0.0140
38 wfDE1PU4	0.5756	0.5876X	-0.0785

(*table continues*)

Table 3 (continued)

Factor Loadings (With an X Indicating a Defining Sort)

Q sort	A	B	C	
39 wmAD#Pu4	0.5979X	0.3845	0.4359	
40 wmAD#Pu4	0.6020	0.6023X	0.0026	
41 wmAD8Pu4	0.8094X	-0.0293	0.0024	
42 wfAD8Pu4	0.6144X	0.3173	0.1699	
43 wmAD5Pu4	0.5822	0.4705	-0.3593	
% Expl. Var.	29	17	7	53%

Correlation between Factor Scores

A correlation matrix of the factor scores depicts the level in which factors are related to each other. In this study, Table 4 depicts the correlation matrix for the factors. As stated previously, correlations can range between -1.0 and 1.0, with any correlation of 1.0 being an indicator of perfect agreement and the inverse -1.0 representing a complete disagreement. Similarly, as a point of reference, factors with a correlation of less than .5000 are indicative of a lower level of agreement or relatedness between factors and correlation between factors exceeding .5000 would be an indicator of a higher level of agreement between factors. In this study the highest correlation between factor scores was between Factors A and B (.5270). Therefore, using the criteria listed above, and according to Brown, this relatively high correlation between Factors A and B exhibited a higher level of agreement or relatedness (Brown, 1999). Stated differently, the relatively high correlation between Factors A and B suggests that similarities exist between the participant’s perception of facility characteristics and their impact on learning. Likewise, the relatively low correlation between Factors A and C (.1474) and B and C (.2562) indicate that Factor C represents a fairly distinct perception of facility characteristics and their impact on learning than Factors A and B.

Table 4

Correlations between Factors

Factors	A	B	C
A	1.000	0.5270	0.1474
B	0.5270	1.000	0.2562
C	0.1474	0.2526	1.0000

Factor Scores and Arrays

Factor scores are used in Q methodology as the primary means of interpreting data (McKeown & Thomas, 1988). The interpretation is based on the notion that the factor score marginally assigns an average score for a Q sort statement associated with a factor (Brown, 1994). Once established, the resulting factor array becomes a "model Q sort" composed of participant Q sorts loaded on a given factor (McKeown & Thomas, 1988, p. 53).

The individual Q sort that each contains some degree of relatedness to an ideal factor score is referred to as a weighting of the Q sort. This weighting of Q sort is expressed mathematically as $w=f/(1-f^2)$ with *w* representing the weight and *f* the factor loading. The computation of factor scores are expressed as z scores and, according to McKeown and Thomas, converted into whole numbers to facilitate the comparison between factor arrays and for convenience (McKeown & Thomas, 1988). For this study, the whole numbers matched the range of the sorting scale used by the participants of this study -4 to +4. The three factor arrays for this study are shown in Table 5.

Distinguishing Statements

An individual factor array for this study represented a distinctive configuration of an individual participant's sort of this study's 32 Q statements. The factor arrays allowed this researcher to observe how the relative placement of the statements distinguished one factor from the other two. This researcher also evaluated the distinguishing statements (Table 8, 10 and 12) and the -4s and +4s that occupied the anchor points of each factor array prior to developing the narrative themes for the factors. The themes were fully discussed and expanded later in this chapter and fully defined in Chapter four.

Table 5

Factor Arrays and Q Sample

No.	Statement	Factors: A	B	C
1	Room air that is not stale or stuffy.	2	-2	-2
2	Spaces that are free from unpleasant or annoying smells.	3	-2	-2
3	Room temp that is comfortable and satisfactory.	3	0	1
4	Spaces that are free from sounds that could disrupt learning.	2	1	-1
5	Acoustics within the space that enhance learning in ways appropriate for the purpose.	1	3	0
6	Presence of good lighting, both artificial and natural.	3	1	2
7	Ability of users to control lighting.	1	-1	-4
8	Occupants are able to control temperature.	-1	-3	-4
9	Classrooms need to have adequate space for instructors, students and their equipment.	4	3	3
10	Learning spaces of various sizes and shapes to accommodate different needs.	0	2	3
11	Facilities that are cleaned and sanitized regularly.	3	-1	1
12	Building systems are well maintained and in good order (heating, cooling, lighting, technology, building envelope, roof, etc.)	4	2	3
13	Sustainable “green” facilities that support learning.	-3	-4	-3
14	Spaces contain new amenities and technology.	-1	2	2
15	Spaces provide “wow” factor for users.	-4	-4	1
16	Spaces that are orderly and uncluttered.	-1	-2	0

(table continues)

Table 5

Factor Arrays and Q Sample

No.	Statement Factors:	A	B	C
17	Facilities and spaces equipped with modern “smart” technologies (hardware, computers, data projectors, smart boards, etc.)	1	4	1
18	Campus, all its facilities and learning spaces provided with WI-FI access.	1	3	-1
19	Learning spaces equipped with enough outlets to support smart devices (smart phones, laptops, tablets, etc.).	0	2	3
20	Furnishings are modern, functional, and comfortable.	-1	1	-1
21	Spaces equipped with mobile furnishings that support interactivity.	0	4	0
22	Facilities and spaces specifically designed to accommodate specific functions (lectures, discussions, discovery, collaboration and individual learning).	2	3	-3
23	Buildings in close proximity that allow for easy student movement between classes.	-2	-2	-3
24	Buildings and spaces that encourage a sense of belonging.	-2	1	2
25	Fair and equitable distribution of campus resources so that large disparities in facilities, spaces and technology do not exist.	-2	-3	0
26	Spaces and facilities that provide a sense of safety and security.	2	0	4
27	Facilities and spaces that provide a cultural and social statement regarding the value of learning and education.	-3	0	3
28	Facility and features that attract high quality students and faculty.	0	0	4
29	Facilities and spaces that promote civic engagement and values.	-4	-1	2
30	Facilities and spaces inform users about the behavioral expectations and set a tone for what can and cannot occur within them.	-3	-1	-2
31	Facilities and spaces exemplify core values of the institution.	-2	-3	-2
32	Multipurpose spaces and facilities that convey ownership to individual users.	-3	-3	-1

Factor Characteristics

In Table 6, immediately following this paragraph, the statistical characteristics of the three factors identified by this study are displayed. Included in the table is the reliability coefficient, the standard error (SE) for the factor scores and the number of variables that define each factor. In the parlance of Q methodology, the overall quantity of variables defined references the number of participants that loaded significantly and purely (see Table 8, 10, 12) on each factor. To illustrate, in Table 6 below, 22 participants loaded on Factor A; 12 participants loaded on Factor B and 4 participants loaded on Factor C.

Table 6

Factor Characteristics

Factors	A	B	C
No. of Defining Variables	22	12	4
Average Rel. Coef.	0.800	0.800	0.800
Composite Reliability	0.989	0.980	0.941
SE of Factor Scores	0.106	0.143	0.243

The formula to estimate the reliability of a factor is expressed as r = 0.80/[1+(p-1) 0.80], where p is the number of persons that define a factor and .80 stands for their reliability coefficient (McKeown & Thomas, 1988). In the table above, reliability expressed the possibility that this study's participants would perform a Q sort in an exact manner in a future sort and convey that the factor scores were stable (McKeown & Thomas, 1988). It is not abnormal for a magnitude of error related to factor scores to be lower than the expressed factor reliability. As a result, a higher composite reliability score provides greater confidence that a factor may be stable and distinct.   As depicted in Table 6, the composite reliability coefficients for this study's three factors ranged from 0.941 to 0.989. The coefficients indicated that differences between the three factor arrays could be discerned and that the dean's perceptions of facility characteristics in higher education were relatively static.

Examination and Interpretation of Factors

In the sections to follow, the three factors identified within the study were examined and interpreted. All three factors were examined within the framework defined by this study's research question: "What characteristic of the facility built environment do you perceive as having the greatest impact on student learning in higher education" and explored by its participants. In doing so, the emergent themes that tagged the groups were identified and expanded upon.

Factor Correlations

As stated previously in this chapter, the correlation between factors was an indicator of factors being similar or dissimilar to one another. Simply put, the higher the correlation established the level of similarity that was represented by those factors. In this study, Factors A and B had the highest correlation (.5270), thus indicating that there were some strong similarities between the two factors. Yet, because the correlation was less than 1.00, it was also understood that there was some differences between the two factors on how facility characteristics were perceived as impacting learning in higher education. The correlations between factors A and C (.1474) and B and C (.2562) were considerably less. The correlation between Factors B and C had the lowest correlation thereby indicating that the perceptions of facilities expressed between these two factors were distinct. Thirty-eight of 43 participants loaded significantly on at least one of the three factors; seven participants loaded significantly on two factors; one participant failed to load significantly on any factor and one participant loaded significantly on all three factors.

Factor Interpretation

As described previously in this chapter, 43 Q sorts were entered into the PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) to be factor analyzed in order to determine the number of factors or viewpoints that academic deans held regarding facilities in higher education. The analysis of the data for this study revealed three distinct factors or perspectives on how 43 academic deans perceived characteristics of the facility built environment to impact learning in higher education.

The examination and description of the factors was primarily conducted using themes garnered from two sets of data. The first were the distinguishing statements for all three factors and the second were the anchor statements for each factor. However, at times in this data set, a statement was both an anchor and a distinguishing statement that allowed this researcher to more aptly identify emergent themes. As an example, in Factor B, Statement 17 (Facilities and spaces equipped with modern "smart" technologies (hardware, computers, data projectors, smart boards, etc.)) was ranked as a + 4, most impactful, and became the catalyst for framing the emergent theme for the factor. Distinguishing statements proved to be highly important because they represented the facets of each factor that differentiated each factor from the others. Similarly, the anchor statements defined by the -4 and +4 statements in each factor were used to facilitate the description and explanation of the factors. In both cases, the opposing anchor statements proved to be the least or most representative of the perspectives on facilities forming the factor.

In qualitative research, a thick rich narrative consists of describing a phenomenon in a manner in which the "non-studied can understand and draw upon their own interpretation about its meaning and substance" (Patton, 2002, p. 438). Basically, an attempt was made in this study to provide simple narratives that would enable most learned individuals to recognize the story being told of the emergent themes. In this study, distinguishing and anchor statements, participant responses to post Q sort prompts and questions were used to thicken the narrative of the three factors. These three forms of data were used to gain more insight into and understanding of the varying perspectives that dean's held regarding facilities and learning in higher education. Thirty-six participants responded to the post sort prompts and questions regarding their rational for sorting in the manner that they did. In particular and of most interest was their selection of -4 and +4 items that proved to be most representative of their view of facility characteristics and its perceived impact on learning.

Based upon the analysis of these multiple data sets, the three emergent factors for how academic deans perceived the characteristics of the facility built environment that most impact student learning were aptly named: (A) Traditionalist – Focused on Functionality and Universal Rationality, (B) Modernist – Technologically Conscious, Seeking Innovation and Flexibility and (C) Abstractionist – Contextual and Expressive. The factor descriptions provided below each began with the provisions of demographic information of the participants who comprised each factor. Next a description of each factor was provided based upon each one's factor arrays and distinguishing statements. Finally, each of these factor descriptions also included quotes taken from the written responses to the post sort questionnaire. This added data proved valuable in providing clarity and to facilitate an understanding of the participants' viewpoints contained within each factor regarding the way deans perceived facility characteristics in higher education.

Factor A: Traditionalist – Focused on Functionality and Universal Rationality

Factor A accounted for 29% of the explained variance in the study with 26 of 43 participants loading on the factor. As discussed previously in this chapter, a number of these participants loaded on Factors B (five participants) or C (three participants) and with one participant loading significantly on all three factors. In an attempt to provide clarity to Factor A, the responses to open-ended prompts by eight participants who significantly loaded on more than one factor were not used to evaluate or describe the factor even though their sorts were integral to the formation of the factor array. The demographic makeup of the participants that loaded on Factor A was provided in Table 7.

The remaining participants that comprised this factor included twelve men and six women. Two participants on this factor were Hispanic/Latino, fifteen were Caucasian, and one was African American. The participants' experience as an academic dean, associate or assistant dean in higher education ranged from 1-32 years with a mean of 8.1 years of experience. Thirteen participants worked at public state funded institutions and five worked at private nonprofit institutions. Of the eighteen participants, eleven worked at institutions with student populations greater than 25,000, three with student populations ranging from 10,001-25,000 and four with student populations that ranged from 3001 to 10,000. Of particular note, this factor was the only factor in which a participant was employed at a public state funded Historical Black College or University (HBCU). This study and the purpose of Q methodology are not intended to draw correlated inferences from the demographic data provided by the participants; instead, the data was only used to add to the overall descriptive narrative of the factors. For Factor A, the participants that loaded on the factor were fairly representative of the overall person sample.

The distinguishing statements for Factor A along with the factor array and data collected from the post Q sort responses seemed to place a perceived value or emphasis on characteristics of the facility built environment that accentuated functionality and universal rationality. In other words, participants that loaded on this factor placed a premium on basic, practical characteristics of the facility built environment that have widespread acceptance as being needed. Furthermore, the perspectives put forth in the factor weighted the overall usefulness and the basic attributes of the learning space over aesthetics and amenities and exclusively focused on the basic necessities that a brick and mortar facility appeared to provide. These participants put forth perspectives that concentrated on usability and espoused a no nonsense practical application for the space, its components and basic amenities. They appeared to embrace technology as a tool to promote/improve the learning environment but not as a replacement for the environment itself.

Notably, this factor seemed to have little to no concern for the “extras,” to include amenities and the expectation for space to be or convey any meaning beyond an adequate built environment in which learning could occur. There was also a perceptible rejection of an idea that individual control of building systems within the learning space would contribute to learning. These participants valued security as a basic necessity of the facility but probably had little expectation for the facility to engender a feeling of security. Finally, although this group of participants appeared to embrace technology, they also seemed to reject technological excesses and amenities that led to or created perceived distractions within the learning space.

Table 7

Demographic Characteristics for Participants on Factor A

Sort #	Sex	Ethnicity	State	Years Current Job	School Type	School Size (Students)
1	M	Caucasian	Fl	7	Public	>25,000
7	M	Caucasian	Fl	4	Public	>25,000
10	M	Af Am	Fl	4	Public	3,001-10,000
11	F	Caucasian	Fl	32	Public	>25,000
13	M	Caucasian	Fl	10	Public	>25,000
15	M	Hisp/Latino	Fl	6	Private	3,001-10,000
18	M	Caucasian	Fl	24	Private	3,001-10,000
22	F	Caucasian	Fl	2	Public	>25,000
25	M	Caucasian	Fl	10	Public	10,001-25,000
28	F	Caucasian	Fl	3	Public	>25,000
30	M	Caucasian	Fl	4	Private	10,001-25,000
31	F	Caucasian	Fl	3	Private	3,001-10,000
32	M	Caucasian	Fl	11	Public	>25,000
35	M	Hisp/Latino	Fl	7	Private	10,001-25,000
36	F	Caucasian	Fl	5	Public	>25,000
37	M	Caucasian	Fl	1	Public	>25,000
41	M	Caucasian	Fl	8	Public	>25,000
42	F	Caucasian	Fl	8	Public	>25,000

Table 8

Distinguishing Statements for Factor A

No.	Statement	Factor A RNK	Factor A SCORE	Factor B RNK	Factor B SCORE	Factor C RNK	Factor C SCORE
3	Room temp that is comfortable and satisfactory.	3	1.43*	0	-0.29	1	0.15
6	Presence of good lighting, both artificial and natural.	3	1.28*	1	0.45	2	0.53
11	Facilities that are cleaned and sanitized regularly.	3	1.21*	-1	-0.30	1	0.41
2	Spaces that are free from unpleasant or annoying smells.	3	1.20*	-2	-0.53	-2	-0.80
4	Spaces that are free from sounds that could disrupt learning.	2	1.06*	1	0.34	-1	-0.14
22	Facilities and spaces specifically designed to accommodate specific functions (lectures, discussions, discovery, collaboration and individual learning).	2	0.81*	3	1.67	-3	-1.25
26	Spaces and facilities that provide a sense of safety and security.	2	0.71*	0	-0.07	4	1.75
1	Room air that is not stale or stuffy.	2	0.70*	-2	-0.77	-2	-0.61

(*table continues*)

Table 8 continued

Distinguishing Statements for Factor A

No.	Statement	A RNK	A SCORE	B RNK	B SCORE	C RNK	C SCORE
18	Campus, all its facilities and learning spaces provided with WI-FI.	1	0.66*	3	1.54	-1	-0.20
7	Ability of users to control lighting.	1	0.06*	-1	-0.44	-4	-1.62
10	Learning spaces of various sizes and shapes to accommodate different needs.	0	-0.17*	2	0.70	3	1.40
19	Learning spaces equipped with enough outlets to support smart devices (smart phones, laptops, tablets, etc.).	0	-0.21*	2	0.76	-3	-1.42
14	Spaces contain new amenities and technology.	-1	-0.39*	2	0.81	2	0.84
8	Occupants are able to control temperature.	-1	-0.55*	-3	-1.29	-4	-2.36
24	Buildings and spaces that encourage a sense of belonging.	-2	-0.87*	1	0.35	2	0.69
27	Facilities and spaces that provide a cultural and social statement regarding the value of learning and education.	-3	-1.51*	0	-0.25	3	1.14

(*table continues*)

Table 8 continued

Distinguishing Statements for Factor A

No.	Statement	A RNK	A SCORE	B RNK	B SCORE	C RNK	C SCORE
29	Facilities and spaces that promote civic engagement and values.	-4	-1.55*	-1	-0.51	2	0.87
15	Spaces provide “wow” factor for users.	-4	-1.55	4	-1.94	1	0.36

(p<.05; Asterisk (*) following factor scores indicates significance at $p < .01$)

The perspectives that that were identified within Factor A proved to be more closely aligned with previous research on the facility built environment, primarily because this factor addressed and restated the importance of basic characteristics of the facility built environment that appear to be universally accepted as "needed" in order for space to be considered adequate for learning activities. Literally, the characteristics espoused by the participants of this factor directly or indirectly identified all tangible, concrete characteristics of the facility built environment. Statement 12 (Building systems that that are well maintained and in good working order) and Statement 9 (Classrooms need to have adequate space for instructors, students and instructors) both occupied the +4 spot on the factor array but neither were distinguishing statements for Factor A. Although not distinguishing statements, when Statements 9 and 12 are viewed contextually within the prism of functionality and "need," both statements proved highly representative of the participant perspectives of Factor A.

Rank	Statement
+4	(9) Classrooms need to have adequate space for instructors, students and their equipment.
+4	(12) Building systems that are well maintained and in good working order, (heating, cooling, lighting, technology, building envelope, roof, etc.).
+3	(3) Room temperature that is comfortable and satisfactory.

Statement 3 (Room temperature that is comfortable and satisfactory) was a distinguishing statement for Factor A and occupied a +3 spot on the factor array. The relatively high Z score and its high sort value indicated that it was representative of the factor. Participant 32 was an exemplar for Factor A. Of particular interest, this participant succinctly identified those universal rational expectations for learning space and argued for the importance of functionality and "need" by ranking Statements 9, 12 and 3 as characteristics of the facility built

environment that he perceived to be most impactful on learning in higher education. On the subject of functionality and universal rationality, Participant 32 wrote that: (Respective quotes of the participants are followed by the sort/participant number in parentheses.)

> To me the most important features of the physical space is that it is comfortable to facilitate learning, interaction, etc. … that means adequate **lighting, temperatures, etc**. (Participant 32)

> If there is inadequate **space** to conduct face to face learning activities, the class would be better offered through a distance learning/web environment. (Participant 32)

For this participant, the notion of inadequate space provided an impetus to recommend distance learning as a viable alternative. Apparently, this participant offered distance learning as a "contingency," not as a better means of instruction, but as a fallback position to compensate for inadequately sized learning spaces. Other participants that loaded on this factor voiced similar sentiments that emphasized functionality and rational use of space as a component of classroom size.

> Interaction between students and the instructor, or students and other students, creates a learning environment. Adequate space that allows for the interaction as well as space that does not compromise "personal" space supports learning. (Participant 42)

Other participants continued the narrative by identifying additional characteristics of the facility that they perceived to affect learning. In doing so, participants' identified technology as an absolute functional requirement for learning and not just an amenity.

> Technology is changing the delivery of instruction. Educational facilities must be equipped with the latest technology. (Participant 35)

> Technology (WI-FI) is no longer considered a luxury. It is now an expectation of faculty and students. It provides an opportunity for students and faculty to explore all information and the classroom is no longer restricted to the four walls. (Participant 13)

As stated earlier, participants that loaded on Factor A provided a narrative that emphasized and literally detailed basic facility characteristics that were seen as needed for quality learning space to exist. In doing so, some participants personalized their lived experiences as a means to explain their subjectivity regarding the impact of certain characteristics of the facility built environment to affect learning in higher education.

> Students must be in an environment where they can concentrate on the class whether it is a lecture or discussion. In our old science building, this was a common complaint when an experiment in a lab was particularly stinky, "hard to concentrate in a **stinky** environment." (Participant 31)

> Students need to be comfortable in the environment so they can concentrate on what they are to be learning. If they are **cold or hot**, it is hard to think and learn. (Participant 31)

> This is what I call the "broken window" effect. In a neighborhood with broken windows, people feel it is ok to trash it with graffiti or other vandalism. In a classroom that is not **clean**, it invites disrespect for the institution and disrespect for the instructor.
>
> Students may also feel that they are not valued. (Participant 41)

> **Environmental discomfort** is a distraction that prevents the transmission of information. (Participant 18)

Lighting is imperative to visual learning. (Participant 22)

Participant 18 proffered information that provided some additional insight on this participants' experience as an instructor and administrator. This participant indicated that he had been a professor for over twenty-four years and six years as an associate dean. The importance was that this participant actually identified the years of experience as an instructor without being asked to do so. This expression along with a relatively high factor loading (.5773) appears to indicate that this administrator wanted to emphasize that his sort was reflective of his experience in the higher education classroom and was knowledgeable on characteristics that affected learning. Of most importance, this participant's sort represented the opposing perspectives of the facility built environment that emerged at the polar ends of the continuum for Factor A. Participant 18, ranking of Statement 12 (Building systems that are well maintained and in good working order), Statement 4 (Spaces that are free from sounds that could disrupt learning) as +4 and Statement 15 (Spaces that provide a "wow" factor for users) as a -4 proved to be highly indicative of the perceptions expressed in Factor A.

In the factor array, the "least representative" statements of the perspective of functionality and universal rationality for characteristics of the facility built environment were anchored by two statements ranked as -4. These two statements either explicitly or implicitly addressed perceptions of facility characteristics that emphasized social and cultural motivations as well as a statement of aesthetical wonderment ("wow").

Rank	Statement
-4	(15) Spaces provide a "wow" factor
-4	(29) Spaces provide civic engagement and values

Unlike statements that factored high in Factor A, the participants' sorts that ranked lowest on this factor were those that gave little credence to statements not directly related to functionality or usability. They also appeared to have little desire to look beyond traditional somewhat acceptable facility purposes that didn't address "needs." For example, when discussing a statement regarding a facility promoting civic engagement (Statement 29), a participant articulated that it would be nice for students to promote civic engagement but wasn't sure how an institution did this without having people who engage in civics in spite of the environment that they were in.

> Other participants stated: how does a facility promote civic engagement or values? Those are the things that my college does well but not because of the facility. I cannot think of an example where a facility would ever promote such a thing. (Participant 31)

> Another stated that professors and students can achieve these goals without the need for buildings to encourage such activities. (Participant 13)

Participant 32 continued the overall pattern of this factor's participants to reject the more abstract characteristics of the facility built environment but added an additional element of relatedness. In this case this participant indicated that he failed to understand the meaning of Statement 29 (Facilities and spaces that promote civic engagement and values) and could relate to Statement 30 (Facilities and spaces that inform users about behavioral expectations and set the tone for what can and cannot occur within them). Instead the participant proffered his classroom experience in higher education as proof of being knowledgeable on what is needed to form a learning environment in higher education and all but dismissed the more abstract characteristics of the facility to something that was incomprehensible.

> Not sure what the statement is intended to represent of mean, but I was not able to relate to it as an instructor or administrator. (Participant 32)

> Not sure what the statement means, but I can't relate to it in terms of my experience as a classroom teacher in a university academic setting. (Participant 32)

Similarly, other participants of Factor A placed less value on statements that espoused extraneous concepts that were harder to define in relation to facility characteristics and learning. As a result, participants appeared to have little enthusiasm or acceptance that a requirement existed for facilities to provide a statement of aesthetical wonderment ("wow"). As one participant emphatically stated, "wow" is not necessary to learn (Participant 36). Others stated:

> If the people in the spaces do "wow" things the space doesn't need to create the "wow." (Participant 41)

> The wow factor should not affect the learning environment; it may actually be distracting to students. (Participant 42)

Interestingly, a desire to control the environmental conditions and to have "green" learning spaces appeared to not exist within this factor. A number of participants saw the idea of occupants controlling the environmental conditions within a learning space as an impediment to learning. Instead, participants who loaded on this factor found that a functional system trumped the ability to individually control the environment within a learning space.

> Having individuals control the temperature would lead to a disruptive learning environment as the temperature of a learning environment varies among individuals. It is best to have the temperature at a reasonable, constant temperature and have individuals dress appropriately for their own comfort. (Participant 13)

> As long as students are in a "window of comfort" there is no need for them to directly adjust the temperature. It is least on my scale because I haven't been able to control temperature in my building and it has never been an issue. (Participant 31)

In a similar thread, the concept of "green" facilities appeared to be rejected as a characteristic related to or required for learning higher education and regulated to a nicety.

> Being green is something that provides little to enrich a learning environment. As long as the environment is safe and healthy, being green adds little in the process of learning. (Participant 13)

From the factor analysis, responses to post sort questions and the data collected from post Q sort prompts, the deans that loaded on Factor A appeared to embrace the characteristics of the facility built environment as they related to learning from two unique perspectives: (a) functionality with purpose and (b) universal rationality. The deans that comprised this factor viewed space in a contextual perspective that was easily defined by variables identified to impact learning in previous research. This emphasis on the more practical purpose and use of space and its attributes defined this factor as one of basic needs and efficiencies. Finally, the perspectives espoused in Factor A placed its greatest emphasis on simplicity and the overall use of space to be no more than a structure to house learning activities, nothing less or nothing more.

Factor B*: Modernist – Technologically Conscious Seeking Innovation and Flexibility*

Factor B accounted for 17% of the explained variance in the study with 17 of 43 participants loaded on the factor. As discussed previously in this chapter, a number of these participants loaded on Factors A (five participants). However, unlike Factor A, there were no participants that significantly loaded on both Factors C and B with the exception of a lone participant that loaded on all three factors. To gain a clearer view of the factors, the responses to open-ended prompts by six participants who significantly loaded on more than one factor were not used to evaluate or to describe the factor even though their sorts were integral to the formation of the factor array. The demographic makeup of the participants that loaded on Factor B was provided in Table 9.

The remaining participants that comprised this factor consisted of six men and five women. Ten participants on this factor were Caucasian, and one was African American. The participants' experience as an academic dean, associate or assistant dean in higher education ranged from 3-17 years with a mean of 6.4 years of experience. Six participants worked at public state funded institutions and five worked at private nonprofit institutions. Of the eleven participants, six worked at institutions with a student population greater than 25,000, three with student populations ranging from 10,001-25,000 students, one with a student population that ranged from 3001 to 10,000 and one with a student population less than 3,000. Unlike Factor A, this factor's participants were representative of all four student class population sizes established within this study and were fairly representative of the overall person sample.

Through an analysis of the distinguishing statements for the Factor B along with the factor array and data collected from the post Q sort responses, this perspective seemed to place emphasis on characteristics of the facility built environment that favored the use and availability of technology in learning spaces. The participants also placed emphasis on learning space that could be altered to accommodate users and yet placed great value on the spaces designed for specific purposes. Finally, the participants placed greater value on modern amenities that provided comfort and was user friendly than participants in other factors.

Table 9

Demographic Characteristics for Participants on Factor B

Sort #	Sex	Ethnicity	State	Years Current Job	School Type	School Size (Students)
3	M	Caucasian	Fl	3	Public	>25,000
5	M	Caucasian	Fl	3	Public	>25,000
6	F	Caucasian	Fl	7	Public	>25,000
8	F	Af Am	Fl	8	Public	>25,000
19	F	Caucasian	Fl	10	Public	10,001-25,000
20	M	Caucasian	Fl	3	Private	<3,000
21	F	Caucasian	Fl	15	Public	10,001-25,000
23	M	Caucasian	Fl	6	Private	3,001-10,000
27	M	Caucasian	Fl	8	Public	10,001-25,000
29	F	Caucasian	Fl	7	Public	>25,000
34	M	Caucasian	Fl	17	Private	>25,000

Table 10

Distinguishing Statements for Factor B

No.	Statement	Factor A RNK	Factor A SCORE	Factor B RNK	Factor B SCORE	Factor C RNK	Factor C SCORE
17	Facilities and spaces equipped with modern “smart” technologies (hardware, computers, data projectors, smart boards, etc.).	1	0.56	4	1.84*	1	0.28
21	Spaces equipped with mobile furnishings that support interactivity.	0	-0.15	4	1.67*	0	-0.02
22	Facilities and spaces specifically designed to accommodate specific functions (lectures, discussions, discovery, collaboration, individual learning).	2	0.81	3	1.67*	-3	-1.25
18	Campus, all its facilities and learning spaces provided with WI-FI access.	1	0.66*	3	1.54*	-1	-0.20
12	Building systems that are well maintained and and in good working order (heating, cooling, lighting, technology, building envelope, roof, etc.).	4	1.85	2	-0.77*	3	1.53
19	Learning spaces equipped with enough electrical outlets to support smart devices (smart phones, laptops, tablets, etc.).	0	-0.21	2	0.76*	-3	-1.42

(*table continues*)

Table 10 continued

Distinguishing Statements for Factor B

No.	Statement	Factor A RNK	Factor A SCORE	Factor B RNK	Factor B SCORE	Factor C RNK	Factor C SCORE
10	Learning spaces of various sizes and shapes to to accommodate different needs.	0	-0.17	2	0.70	3	1.40
26	Spaces and facilities that provide a sense of safety and security.	2	0.71	0	-0.07*	4	1.75
27	Facilities and spaces that provide a cultural and social statement regarding the value of learning and education.	-3	-1.51	0	-0.25*	3	1.14
11	Facilities that are cleaned and sanitized regularly.	3	1.21	-1	-0.30	1	0.41
7	Ability of users to control lighting.	1	0.06	-1	-0.44*	-4	-1.62
29	Facilities and spaces that promote civic engagement and values.	-4	-1.55	-1	-0.51*	2	0.87
16	Spaces that are orderly and uncluttered.	-1	-0.22	-2	0.57	0	0.10
8	Occupants are able to control temperature.	-1	-0.55	-3	-1.29*	-4	-2.36
15	Spaces that provide a “wow” factor for users.	-4	-1.55	-4	-1.94	1	0.36

($p<.05$; Asterisk (*) following factor scores indicates significance at $p < .01$)

The participants that formed the perspective espoused in Factor B appeared to embrace the idea that amenities, flexibility and technology were requirements in the facility built environment to enhance learning and for learning to occur. Significant statements within this factor included key words that emphasized “smart technology” (Statement 17), “mobile furnishings” (Statement 21), WI-FI and “electrical outlets for laptops” (Statement 19). As evidenced by the aforementioned key words and the listing of distinguishing statements to follow, this factor placed considerable emphasis on learning space that was technology assisted, where furnishings could easily be rearranged and space that was comfortable and pleasing to its occupants. Statements 17 and 21 were distinguishing statements for Factor B and occupied the +4 spots on the factor array. The relatively high Z score of both statements and their high sort value indicated that both were highly representative of the factor. Participant 27 was an exemplar for Factor B and had a Z score of .7829. In this participants’ sort, the participant indicated that technology was their +4 statement because it was perceived to increase efficiency by making it easier to access and to present information used in learning activities. (Respective quotes of the participants are followed by the sort number in parentheses.)

Rank	Statement
+4	(17) Facilities and spaces equipped with “smart” technology
+4	(21) Spaces equipped with mobile furnishings
+3	(18) Campus, and all spaces, have WI-FI

Although the participants that loaded on Factor A also placed value on technology, their emphasis seemed to be more functional in nature. However, in Factor B, the emphasis appeared to transcend functionality and moved into a realm of modernity that saw technology as a revolutionary new means to facilitate learning and instruction. As an example of this thought process, one participant framed the response below:

> Taking advantage of current electronic technologies keeps academic programs at the cutting edge and the ability of these technologies is an expectation of students today. (Participant 6)

> Another stated that in spaces equipped with smart technology "anywhere" becomes the learning environment. (Participant 8)

For these two participants, their technology emphasis seemed to be on an institution's ability to provide newer, more up-to-date learning spaces as well as the flexibility created for occupants when smart technology was deployed throughout an institution.

> Participant 19 stated that this is what students use. They are "digital natives" and need to multitask. (Participant 19)

Participant 19 proffered a statement that was somewhat unique in that a component of learning, not found in the research literature, was put forward that identified a specific group of learners as "digital natives." In this statement, the participant not only acknowledges the perceived impact that technology has on learning but addresses it as a functional requirement needed for some learners to succeed.

> Finally, another participant opined that smart technology offers the ability today to do new things from the flipped classroom to bringing in Skyped speakers from another country can only be done with smart technology in place. (Participant 20)

In the statements above, all of the participants seemingly placed great emphasis on the technology enhanced space as a new innovative way to deliver instruction and to expand the learning experience beyond the walls of the conventional classroom and the confines of the institution.

Other participants that loaded on Factor B identified flexibility, functionality and specificity of designed space to be another key theme for the factor. Participants of this factor appeared to favor characteristics of learning space that offered versatility as well as flexibility yet understood that some spaces needed to be designed with a specific purpose or function in mind. Participant 21 articulated this position by stating that it was particularly necessary for spaces to be designed to accommodate specific functions where a unique learning requirement existed. Learning activities listed by the participant included labs and clinical practices. Similarly and more simply stated, Participant 27 indicated that "design should follow function." Other participants provided additional reasons or rationale for placing importance on the designing spaces specific to a unique learning function.

> Spaces have to be adaptable to use the most current and future technologies. (Participant 34)

> Spaces have to be versatile. (Participant 25)

> Spaces need to accommodate learning in small groups, large groups, or one-on-one. (Participant 5)

Another predominant theme that emerged from this factor seemingly emphasized mobile furnishings as a catalyst for flexibility and innovation in learning spaces in higher education. In this emergent theme, participants linked the mobile furnishings to “creativity,” “engagement” and “interaction.” Participants made clear that a space that encouraged or only allowed a “sage on stage” method of instruction had its limitations and flaws. Participants echoed this sentiment in the statements below:

> Course requirements differ according to their purpose. For instance some can be taught efficiently in a larger lecture hall, while others require small class size and a high degree of interaction and collaboration among students. In addition, administrators need the ability to adapt class space to the needs of the changing learning environment. Mobile furnishings enable that. (Participant 23)

> The biggest detriment to learning is a lack of classrooms that allow instructors to be creative. It is CRITICAL to have flexibly configured classrooms. (Participant 3)

> Students should have the opportunity to engage with each other around the material being presented as a way to enhance learning. Also it’s what is familiar to students right now. (Participant 29)

Of note, the statement provided by Participant 29 adds another facet to mobile furnishings as a characteristic of learning space in higher education. What emerges and was alluded to in statements provided by Participant 19 and 29 is that mobile furnishings may be required to support today’s digital learners and current pedagogical trends because that’s what today’s learners are familiar with and seek in their classroom environment.

In the factor array, the “least representative” statements -4 that supported the perspective that saw technology, innovation and flexibility as a desired characteristic of the facility built environment were anchored by two statements. These two statements either explicitly or implicitly addressed facility characteristics that emphasized a statement of aesthetical wonderment "wow" or nuanced the statement regarding sustainable "green" facilities to be solely important to the environment but added little to the learning process.

Rank	Statement
-4	(15) Spaces provide a "wow" factor
-4	(13) Sustainable "green" facilities that support learning

Unlike statements that ranked high in this factor, the participants' sorts that ranked lowest on this factor were those that gave little credence to statements not directly related to technology, flexibility or innovation. Where the participants that comprised Factor A placed great value on conventional needs, participants that comprised Factor B seemingly moved technology from a want to necessity in higher education, yet they dismissed those items the espoused concepts that were less than concrete. For example, when discussing a statement regarding space providing a "wow" factor (Statement 15), a participant expressed that she was not sure that wow was that important. "In times of fiscal stress, the question is how we best anticipate our needs. Wow is great … but it has its place" (Participant 8).

> Another stressed that wowing does not necessarily mean learning. (Participant 34)
>
> Finally, another stated that "wow" is good for public relations and recruiting but may have nothing to do with teaching and learning that is to take place in a facility. (Participant 27)

As stated previously, the idea of sustainable "green" facilities being rejected as a facility characteristic that enhanced learning by this factor and Factor A was surprising. Again, it was surmised that the participants of this factor conceptualized sustainable “green” facilities as only a component of the facility and not an enhancer of learning. As an example Participant 3 stated that “sustainable “green” facilities are critical for facilities, but don’t really impact learning” and Participant 6 stated that a “green environment may be desirable, but I haven’t seen that it significantly impacts learning”. Finally, another participant continued the narrative of not seeing sustainable green facilities as a facilitator of learning by providing the following statement.

> I don’t see the connection between learning and green facilities. Students can learn in some pretty funky places and love the space for its weirdness. I don’t think students know or consider the greenness of a building or space. (Participant 19)

Like Factor A, a key facet of the Factor B was its participants’ lack of enthusiasm for abstract characteristics of the facility that created or conveyed social or cultural meanings. The participants of this factor appeared to reject the proposition that the facility built environment could convey such meaning or whether it could realistically create it. (Respective quotes of the participants are followed by the sort number in parentheses.)

> Spaces exemplifying the core values of the institution have nothing to do with learning. (Participant 20)

> Spaces that promote civic engagement have very limited effect on learning. (Participant 5)

> Don’t see the point of facilities and spaces being used as a means to inform users about behavioral expectations. (Participant 23)

From the factor array, responses to post sort questions and the data collected from post Q sort prompts, the deans that loaded on Factor B appeared to embrace the characteristics of the facility built environment as they related to learning from three unique perspectives: (a) technologically conscious, (b) innovation and (c) flexibility. The deans that comprised this factor viewed space in a contextual perspective that moved technology from a want to a necessity in learning spaces. The perspectives espoused in Factor B placed greatest emphasis on facets of space that engendered “creativity,” “engagement” and “interaction” but rejected less salient facility concepts such as sustainable “green” and “wow” as important characteristics of learning spaces. Finally on the opposite end of the continuum for Factor B, the participants appeared to place little emphasis on characteristics of the facility built environment that were abstract in nature. Therefore, characteristics of the facility built environment that emphasized the facility as a tool to create or to promote abstract concepts like social or cultural meaning were ranked as least impactful characteristics of the facility built environment to impact learning.

Factor C: Abstractionist – Contextual and Expressive

Factor C accounted for 7% of the explained variance in the study with 7 of 43 participants loaded on the factor. As discussed previously in this chapter, some of these participants loaded on additional Factors. Two participants loaded on Factor A and one participant loaded on Factor B. As stated previously, a single participant sort loaded significantly on all three factors. In order to provide clarity to Factor C, the responses to open-ended prompts by three participant sorts that loaded significantly on the other two factors were not used to evaluate or to describe the factor even though their sorts were integral to the formation of the factor array. The demographic makeup of the participants that loaded on Factor C was provided in Table 11below.

The remaining participants that comprised this factor were two men and two females. All remaining participants on this factor were Caucasian. The participants' experience as an academic dean, associate or assistant dean in higher education ranged from 4-20 years with a mean of 9.5 years of experience. Three participants worked at public state funded institutions and one worked at a private nonprofit intuition. Of the four participants, one worked at an institution with a student population greater than 25,000, one with a student population ranging from 10,001-25,000 students, one with a student population that ranged from 3001 to 10,000 and one with a student population less than 3,000. Unlike Factor A, this factor's participants were representative of all four student population size classes established within this study.

The distinguishing statements for Factor C along with the factor array and data collected from the post Q sort responses seemed to place a perceived value or emphasis on characteristics of the facility built environment that were abstract in nature. The participants also placed emphasis on the facility providing a sense of security for its occupants and conceptualized that amenities and qualities of the facility played a role in attracting high quality students and staff. Finally, participants that sorted on Factor C saw the facilities as a promoter of civic engagement and values.

Table 11

Demographic Characteristics for Participants on Factor C

Sort #	Sex	Ethnicity	State	Years Current Job	School Type	School Size (Students)
4	M	Caucasian	Fl	5	Public	>25,000
9	F	Caucasian	Fl	9	Public	10,001-25,000
16	M	Caucasian	Fl	20	Private	<3,000
24	F	Caucasian	Fl	4	Public	3,001-10,000

Table 12

Distinguishing Statements for Factor C

No.	Statement	Factor A RNK	Factor A SCORE	Factor B RNK	Factor B SCORE	Factor C RNK	Factor C SCORE
26	Spaces and facilities that provide a sense of safety and security.	2	0.71	0	-0.07	4	1.75*
28	Facility features and amenities that attract high quality students and faculty.	0	-0.19	0	-0.21	4	1.57*
10	Learning spaces of various sizes and shapes to accommodate different needs.	0	-0.17*	2	0.70	3	1.40
27	Facilities and spaces that provide a cultural and social statement regarding the value of learning and education.	-3	-1.51	0	-0.25	3	1.14*
29	Facilities and spaces that promote civic engagement and values.	-4	-1.55	-1	-0.51	2	0.87*
11	Facilities that are cleaned and sanitized regularly.	3	-0.17*	-1	-0.30	1	0.41
15	Spaces that provide a “wow” factor for users.	-4	-1.55	-4	-1.94	1	0.36

(*table continues*)

Table 12 continued

Distinguishing Statements for Factor C

No.	Statement	Factor A RNK	Factor A SCORE	Factor B RNK	Factor B SCORE	Factor C RNK	Factor C SCORE
5	Acoustics within the space that enhance learning in ways appropriate for the purpose.	1	0.67	3	0.90	0	0.03
25	Fair and equitable distribution of campus resources so that large disparities in facilities, spaces, and technologies do not exist.	-2	-1.10	-3	-0.97	0	0.12*
32	Multipurpose spaces and facilities that convey a sense of ownership to the individual user.	-3	-1.13	-3	-1.20	-1	0.14*
18	Campus, all its facilities and learning spaces provided with Wi-Fi access.	1	0.66	3	1.54	-1	-0.20
22	Facilities and spaces specifically designed to accommodate specific functions (lectures, discussions, discovery, collaboration, individual learning).	2	0.81	3	1.67	-3	-1.25*
19	Learning spaces equipped with enough electrical outlets to support smart devices (smart phones, laptops, tablets, etc.).	0	-0.21	2	0.76	-3	-1.42

(*table continues*)

Table 12 continued

Distinguishing Statements for Factor C

No.	Statement	Factor A RNK	Factor A SCORE	Factor B RNK	Factor B SCORE	Factor C RNK	Factor C SCORE
7	Ability of users to control lighting.	1	0.06	-1	-0.44	-4	1.62*
8	Occupants are able to control temperature.	-1	-0.55	-3	-1.29	-4	-2.36*

(p<.05; Asterisk (*) following factor scores indicates significance at $p < .01$)

The perceptions identified in Factor C conceptualized the idea that security, amenities and social/cultural traditions of an institution's learning spaces were a requirement to enhance and promote learning by participants within this study. Significant statements within this factor included key words that emphasized "security" (Statement 26), "civic engagement and values" (Statement 29) and amenities that attracted students and staff (Statement 28). As evidenced by the aforementioned key words and the listing of distinguishing statements to follow, this factor placed emphasis on the facility not only being secure but providing a sense of the security for its occupants. Essentially, participants of this factor acknowledged that conventional concrete security measures such as lockable doors (component of Statement 12(+3), Statement 26 (+4)), good lighting (Statement 6 (+2) and policing (component of Statement 26) to be important aspects of learning. Yet, they offered another component of security that put forth a notion that a perception of a lack of security could also impact learning. As an example, Participant 33 stated that if there are safety considerations, it will be hard to focus on educational tasks. Although both Factors A and B placed some emphasis on spaces providing a sense of security, in Factor C, participants saw this as a primary requirement for which the facility should exist and it comports with some studies that identified security in K-12 facilities as an important characteristic of learning space. As an example, Participant 4 stated that the "safety of the faculty, staff and students should be the number one priority" and Participant 9 stated that "facility security is critical for students, faculty and staff".

Statements 26 and 28 were distinguishing statements for Factor C and occupied the "+4" spots on the factor array. The relatively high Z score of both statements and their high sort value indicated that both were highly representative of the factor. Participant 4 sort (.7281) had the highest factor score and was the defining sort for the factor. In this participants' sort, the participant indicated that he chose Statement 26 as his +4 statement because it was his belief that the safety of the users of the facility (faculty, staff and students) was the primary reason for a facility to exist. (Respective quotes of the participants are followed by the sort number in parentheses.)

Rank	Statement
+4	(26) Spaces that provide a sense of security
+4	(28) Features attract high quality students and staff
+3	(27) Facilities that provide a statement of learning and education

Although both Factors A and B placed some emphasis on spaces providing a sense of security, in Factor C, participants saw this as a primary requirement for which the facility should exist. As with Factor A, the participants that loaded on this factor were in agreement with some studies that identified security in K-12 facilities as an important characteristic of learning space. In agreement with Participant 4, Participant 24 also stated that the "facility security was critical for students, faculty and staff".

Where two of the participants who loaded on this factor placed great value on securing the facility as a catalyst for learning and instruction, other participants believed abstract characteristics of the facility built environment to be just as important. Statements related to obscurity in both Factors A and B were rated more favorably by participants that loaded on this factor. Even though the participants placed value on amenities, it was not seen as a statement of excess or niceties; instead it was considered a tool for recruitment and a generator of an environment for learning. Participant 28 stated that "features within an institution create an environment that produces the best faculty, staff and students that lead to a better institution and that the facilities should be a recruitment tool". Similarly, Participant 9 rated Statement 14 as a

+4 because she perceived that amenities had greater value than just aesthetics. Another participant saw the facility as an incubator to promote civic engagement and values while others that sorted on this factor saw the facility itself as providing a statement of learning and education. Unlike other factors, an element of this factor was the idea that learning space did not require a specific blueprint or schematic. Instead, participants placed great importance on having a variety of learning spaces composed of rooms of various sizes and shape to accommodate learning. Finally, and of note, Statement 15 (spaces provide a "wow" factor) was ranked as a +1 in Factor C but was ranked as a -4 in both Factors A and B.

In the factor array, the "least representative" statements (-4) that supported the perspective for characteristics of the facility built environment to be abstract, contextual and expressive were those statements that implied a desire for building occupants to control systems and the environment within learning spaces.

Rank	Statement
-4	(7) Ability of users to control lighting
-4	(8) Able to control temp

The statements that were ranked lowest on this factor by its participants were those that were perceived to provide little to no added value to a facility built environment's learning spaces. For example, when discussing the statement regarding space users being able to control temperature (Statement 8), all remaining participants of this factor dismissed the idea and gave little credence to the notion.

> Participant 4 stated that air should be controlled centrally for cost effectiveness and because it is the easiest mode of management (maintenance etc….)

Another stated that “it may be nice but was not critical to learning” (Participant 24). Finally, all participants that loaded on this factor appeared to espouse the idea that facilities were more nuanced than just brick and mortar constructed space. Instead, they saw the facilities as an expression of an institution’s commitment to learning and equated the qualities and amenities provided within the walls of the facilities as statements of its importance within higher education. They saw the facility as providing safety both physically and contextually and expressed little desire to control environmental and mechanical systems within learning spaces. In support of and aptly stated by Participant 24, a belief existed among the participants that loaded on this factor that a “facility is a reflection of the importance that the institution places on the learning environment.”

Conclusion

This study used Q methodology to examine how academic deans perceived characteristics of the facility built environment to impact learning in higher education. Forty-three academic deans, associate deans, and assistant deans from the State of Florida sorted 32 statements representing facility characteristics on a continuum of “least impactful of learning in higher education” (-4) and “most impactful on learning in higher education” (+4). These resulting 32 sorts were factor analyzed and rotated. As a result, three factors emerged that represented unique perspectives of academic deans in higher education regarding the impact of facility characteristics on learning in higher education.

The interpretation of these factors generated themes that aided in the identification of the factors. The three factors were named (a) Traditionalist – Focus on Functionality and Universal Rationality, (B) Modernist – Technologically Conscious, Seeking Innovation and Flexibility, and (C) Abstractionist – Contextual and Expressive. As stated earlier in this chapter, distinguishing statements, exemplar sorts that aided in defining the factor and finally post sort statements made in response to post sort questions were included in the interpretation of the factors.

Chapter 5

Discussion, Challenges and Suggestions for Future Research

This chapter begins with a summary of the previous four chapters. Subsequent to the summary, an overall discussion of the chapter was presented that emphasized key aspects of this study. Key discussion items included the comparison and contrasting of the three distinct perspectives identified within this study; a brief discussion of consensus statements were reviewed in order to add to the contextual understanding of the three perspectives and concluded with a discussion of the theoretical framework that supported this study's focus and eventual findings. Next, findings and implications were addressed in regard to future policies within higher education. Subsequent to the examination of future practices and policies, a discussion followed regarding the limitations of this study and implications for future research, and the chapter concluded with a summary of its contents.

Summary

This Q study explored the relationship of the facility built environment to learning in higher education from the perspective of academic deans. In doing so, this study sought to expand upon the 60 years of education research conducted in K-12 and higher education that linked characteristics of the facility built environment to learning. Key issues identified by this study to impact the facility built environment within higher education included the quantity and type of deferred maintenance, reduced budgets and distance learning. From a theoretical perspective, the findings of this study supported constructivist learning theory. Elements of constructivist learning identified within this study included an inference that learning and the facility built environment were perceived to be interconnected and created meaning for its occupants; it included an inference that the facility built environment shaped the learned experience for its occupants and, finally, intuitively participants within this study believed that synergistic transactions occur between the facility built environment and the learner in higher education.

As stated previously, the literature review for this study spanned over 60 years. The literature review for this study provided the basis for connecting K-12 research to similar facility conditions and outcomes in higher education. In Table 2, key researchers were listed that have added to this body of research. Of particular note, the concepts put forth by Roberts et al. (2008) that indirectly linked facility variables to learning outcomes through mediation proved to be highly important to this study. Similar arguments made by Lackney (1994), Schneider (2002) and Duran-Narucki (2011) provided the framework to identify abstract characteristics of the facility built environment that were also addressed within this study.

Other key areas of literature included the introduction of “stakeholder” by Freeman in 1984. In this instance, Freeman’s definition and writings on the idea of stakeholder importance served as the impetus to select academic deans as the stakeholder (participant) for this study. Once selected, the substitutive literature reviewed in order to write on background, qualifications and challenges that deans encounter in higher education was provided by Gmelch (2009), Hyun (2009), Walters and Keim (2003) and Wolverton and Gmelch (2002). These researchers provided thick, rich literary sources that identified the training, career development, tenure, rigors and metrics by which deans were evaluated and held accountable. Finally, the definitive literature sources engaged to identify and explain this study’s methodology was Brown (1994, 1999), McKeown and Thomas (1988), Stephenson (1952) and Watts and Stenner (2012).

No hypothesis was put forth in this Q study; instead, a Q statement/question was crafted in order to capture all of the “communication surrounding this research topic.” The Q statement for this study is displayed below:

What characteristics of the facility built environment do academic deans perceive as having the greatest impact on student learning in higher education?

The instrument for this study (Q sample) resulted from the formation of a communication concourse composed of statements derived from a pilot questionnaire and the subject literature. The resulting 32 item Q sample was sent out to 305 academic deans in Florida. Of the 305 potential participants, 43 participants completed the Q sample, which resulted in a 14% completion rate. The completed Q sorts were entered into PQMethod 2.33 freeware for Q analysis (Schmolck & Atkinson, 2013) for factor analysis. Varimax rotation was employed to rotate the factors. Although Q and R methodologies share common analytical tools commonly utilized in quantitative research studies to manipulate raw data, once data has been factored, the analysis and discussion in Q methodology is qualitative in nature and by design. Accordingly, McKeown and Thomas (1988) argue that the findings put forth in a Q methodology study on matters of "meaning and significance are fundamentally self-referential and with public data others are free to examine the factor arrays and arrive at their own independent conclusions, not over the quality of the data but over the significance and implications of the meanings" (p. 66).

From the rotation, three, four and five factor solutions were produced and evaluated. A three factor solution was selected due to statistical and practical reasons. Once evaluated and descriptions developed, three distinct perspectives were identified for the factors that were named Traditionalist, Modernist and Abstractionist. Findings in this study identified characteristics of the facility built environment consistent with and identified in previous research.

Key findings identified by this study are listed below: (1) Participants within this study identified both abstract and concrete characteristic of the facility built environment that were perceived to impact learning in higher education; (2) from the rankings, it appeared that this study's participants failed to connect learning to sustainability; (3) the participants exhibited little desire to control environmental systems within learning space; (4) participants in the study indicated that technology was considered a necessity for "digital natives" (students) to learn and considered essential to support current pedagogical trends; (5) this study's participants indicated that size does matter in higher education learning space in that it supported collaborative learning and allowed for added flexibility; (6) participants appeared to express security in both abstract and concrete terms; (7) basic characteristics, prevalent in previous research, were found to be valued by all three perspectives; (8) and finally, abstract characteristics of the facility built environment that create individual meaning and convey purpose were also identified as key characteristics of the facility built environment perceived to impact learning.

Discussion

Compare and Contrast of Factors

Traditionalist vs. Modernist

The correlation between the Traditionalist and Modernist perspectives was .527. The beliefs and views expressed by the two perspectives were similar in nature but had more than enough divergence to espouse wholly separate perspectives. The two perspectives shared some common perspectives on functionality, technology and practicality. The greatest divergence between the perspectives occurred on statements related to technology. As an example, the Traditionalist appeared to view Statement 14 negatively. Although not definitive, this statement could have been viewed negatively because the Traditionalist assumed a negative connotation of the statement because it contained phrases alluding to both technology and new amenities.

The Modernist perspective appeared to have much less trepidation regarding the use of the amenities phrase and apparently linked both new amenities and technology to the intent of the concourse question. Similarly, the participant views again diverged on Statements 17 and 18. In both instances, the Traditionalist viewed statements referencing facilities and spaces equipped with smart technology and Wi-Fi as impacting learning favorably but failed to rate the statements as highly as the Modernist. As with Statement 14, there was a large divergence between the Traditionalist and Modernist perspectives on Statement 19. In this case, this divergence was more likely to be attributed to the Traditionalist view that emphasized pragmatism and need. Where the Modernist probably conceptualized additional electrical outlets as supporting technology enhancement, the Traditionalist probably saw it as a want but not a need.

Traditionalist vs. Abstractionist

The Traditionalist and the Abstractionist views identified within this study were only slightly correlated (.147). The two perspectives share common perspectives in regard to space for instructors and students (Statement 9); agree that building occupants should not control building systems (Statement 7 and Statement 8); agree that building systems should be maintained (Statement 12); have similar notions of the importance of smart technology in learning spaces (Statement 17); agree that additional electrical outlets to support smart devices are not required and that mobile (Statement 21), modern and functional (Statement 20) furnishings don’t greatly impact learning.

The greatest divergence between the Traditionalist and Abstractionist perspectives was the inability or unwillingness of the Traditionalist perspective to give credence to characteristics of the facility built environment that was less than concrete. Statements 15 and 26-32 were reflective of subject literature that saw the facility built environment as crafting meaning and required conceptualization by its occupants (Duran-Narucki, 2011). As stated earlier, the Traditionalist perspective most likely viewed these statements as nice to have, but in their perspective, not essential for learning. Of note, both perspectives viewed Statement 26 favorably but from obviously different vantage points. The Abstractionist view of security appeared to be self-conceptualized as an awareness or feeling. However, given the Traditionalist perspective that placed a much greater emphasis on pragmatism, security to them, in all probability, meant features such as site lighting, lockable doors, alarms or the presence of security personnel.

Modernist vs. Abstractionist

The Modernist and the Abstractionist views identified within this study varied greatly on the importance of technology and the importance of non-concrete characteristics of the facility built environment to impact learning. The Modernist and Abstractionist perspectives (.256) were more closely correlated than the Abstractionist and the Traditionalist (.147). However the Modernist appeared to accept more of the Abstractionist views of the facility built environment than the Traditionalist, but only marginally. The one abstract characteristic in which the two perspectives agreed was on the idea that the facility built environment should engender a sense of belonging (Statement 24). Other perspective views that the Modernist and Abstractionist had in common were those that referenced amenities and smart technology (Statement 14); the maintenance and upkeep of building systems (Statement 12); smart technology in learning spaces (Statement 17); and adequate space for instructors (Statement 9).

As stated in the previous paragraph, the Modernist and Abstractionist perspectives had differing views on the impact that technology had on learning in higher education. In comparing the two perspectives, the Abstractionist obviously viewed technology as something important to have but didn't necessarily see it as greatly impacting learning in higher education. Similarly, the Modernist viewed Statements 21, spaces equipped with mobile furnishings (+4) and 22, spaces designed to accommodate specific functions (+3) as highly desirable and impactful of learning in higher education. Yet the Abstractionist viewed Statements 21(0) and 22 (-3) to have a considerably smaller impact on learning. Where the different viewpoints regarding technology between the two perspectives were more understandable and easier to explain, the differing opinions on these two statements was more perplexing. This researcher could only surmise that the Abstractionist viewed Statement 22 to be the embodiment of a Traditionalist view of learning space yet viewed Statement 21 as an impediment to maintaining a sense of decorum or aesthetics.

Consensus Statements

The descriptions and discussions for the three factors in this study previously discussed were partly based on the distinguishing statements for each. As a result of the distinguishing statements, a focal point was identified in which meaning could be constructed for each individual factor. The data analysis also produced five statements that did not distinguish between any pair of factors, consensus statements. The five consensus statements, 9, 13, 16, 23 and 3, all merited some discussion, with Statements 9 and 13 meriting a much closer look.

Statement 9 ("Adequate space for instructors") was seen as impactful to learning by the Traditionalist +4, Modernist +3 and Abstractionist +3. Statement 9 was derived from information provided by Participant (R2958iip0nMyXHyb) in the concourse questionnaire. The idea that Statement 9 would be highly representative of all three perspectives was not surprising for a number of reasons. Namely, Schneider states that "teaching is a complex task, requiring collaboration, flexibility and teaming with colleagues" (Schneider, 2003, p. 2) and attributed the lack of teacher work space as one of the contributing factors to teacher satisfaction and retention in a K-12 study. Therefore, the idea that professional administrators, all former or current instructors, would place great value on adequate work space for instructors was not a surprising outcome, which was exemplified by the high factor loading of this statement on all three factors.

Statement 13 (Sustainable "green" facilities that support learning), surprisingly, was not a statement that either of the perspectives saw as highly impacting learning in higher education. The Traditionalist ranked the statement a (-3), the Modernist ranked the statement as a (-4) and the Abstractionist ranked the statement a (-3). As stated previously in the descriptive narrative for the Traditionalist perspective, these results were somewhat surprising and somewhat troubling. Foremost, over the last few years there has been a consistent buzz and clamor regarding sustainability in higher education (*USGBC*, n.d.). Secondly, academic deans who are key stakeholders in the planning and programming of new and renovated buildings on college/university campuses (Wolverton & Gmelch, 2002; Hyun, 2009) showed little enthusiasm for the practice in this study. Notably, the lack of a commitment for sustainability by these key stakeholders of facilities could be an indicator that deans viewed sustainability as a competitor for resources and not as tool to build and operate buildings more effectively and efficiently. Obviously these inferences indicate that sustainability "green" practices need more definition and require facilities administrators, planners and professional designers to not just propose "green" practices and features but to explicably link them to learning. Specifically, indoor air quality (Statement 1 and Statement 2), comfortable room temperature (Statement 3) facility maintenance practices (Statement 11, Statement 12 and Statement 16) and quality of indoor lighting (Statement 6) were meditating variables that emerged thematically within this study that are most often linked to sustainable practices (*USGBC*, n.d.).

Statement 16 (“Spaces are orderly and uncluttered”) ranked in the center quartile of the continuum for all three perspectives: Traditionalist (-1), Modernist (-2) and Abstractionist (0). While the scores provided little aid in evaluating and interpreting the three perspectives, the statement did contribute to an overarching theme for the three perspectives that started to develop. The one thread that all three perspectives appeared to share was an idea that some statements were reflective of universal “basic expectations.” As evidenced by the three rank scores, the participants were seemingly less concerned with the impact of an orderly or uncluttered space on learning than on Statement 11 (Facilities are cleaned and sanitized regularly) that directly addressed space cleaning and sanitization. Where Statement 16 failed to load significantly on any of the three perspectives, Statement 11 was ranked positively by both the Traditionalists (+3) and the Abstractionist perspectives (+1).

Statement 23 (“Buildings are in close proximity to each other”) ranked extremely low when compared with other statements in the Q sample. In fact, the statement’s highest ranking was in Traditionalist and Modernist perspective where it was ranked as a -2 in both factors and was ranked as a -3 in Factor C. However, as stated previously, this low ranking again points to practicality as a theme. Seemingly, the participants saw this characteristic as a novel idea but failed to link this characteristic to learning. In this case, an argument could probably be made that the ranking of this characteristic was a direct result of this study being solely conducted within the State of Florida, a state known for its sunshine and temperate climate.

Statement 31 (“Spaces exemplify core values of the institution”) was the final consensus statement. As with previous statements, this statement was ranked in the lowest percentile of the continuum by this study's participants. Both the Traditionalist and Abstractionist ranked this statement as a -2 and the Modernist ranked it a -3. Unlike Statements 16, 23 and 31, this statement identified a characteristic that was somewhat intangible and less concrete. Therefore, it could easily be surmised that the participants could not conceptualize physical space as capable of accentuating core values of an institution and therefore dismissed it.

Although not a consensus statement, Statement 12 ("Building systems are well maintained and in good order") was ranked relatively highly by all three perspectives, Traditionalist (+4), Modernist (+2) and Abstractionist (+3) and therefore required additional discussion. This statement's relatively high ranking and general consensuses among the participant groups greatly aided in developing the narratives for the individual groups. Of particular interest, Statement 12 was viewed by all three perspectives as having a positive impact on learning in higher education. The significance of this was that the participants of this study were cognizant of an idea that the maintenance of building systems, within the facility built environment, formed the nexus upon which all characteristics of the facility built environment were interdependent.

As an example, multiple participant statements supported the link between other facility variables and Statement 12 regarding the importance of building systems being maintained and in good working order. Participant 21 implied that it was necessary "to prevent faculty and student distractions"; Participant 25 stated that the concept was a "basic functionality of the facility"; Participant 24 offered that it was a "reflection of the importance that an institution placed on learning"; Participant 36 postulated that any problems in any areas associated with Statement 12 would "detract from the learning environment"; and Participant 26 extended the definition to include both spaces and technology and stated that both the "spaces and technology needed to be functional in order to facilitate learning". Reviewing the participant statements above, it became quite evident that Statement 12 transcended all three factors in that the meaning of the statement seemingly became the be all and end all for the participants' understanding of the facility built environment and its purpose. In the participant statements, elements contained in all three factors' composite descriptions could be easily be discerned (functionality, technology and reflection).

Learning Space and Constructivism

Found within this study was an implicit and tactile notion that learning and the facility built environment was interconnected and created meaning for its occupants. As theorized by Alice and David Kolb and other constructivist theorists, the three themes (factors) that emerged within this study were distinct and arguably resulted from meaning that each participant placed on their relationship with their built environment. Of particular note was the inference that academic deans placed on the overall expectations for the space. The participants of this study indirectly or directly conveyed expectation for learning space to be functional and to adapt to current pedagogical changes in higher education. Accordingly, using the Kolbs' theory of learning space that incorporated principles from other constructivist theorists to compare learning space to a living ecosystem (Kolb & Kolb, 2005), the participants of this study clearly inferred that learning spaces in higher education required certain characteristics to have practical use in higher education. Namely, functionality, adaptability, security and technology were characteristics that were indicated by this study's participants to be important ecological components of learning space in higher education. Consequently, the participants' individual sorts of the 32 Q statements became variables that were explored both individually and collectively within this study to assess the perceived impact that characteristics of the facility built environment had on learning space in higher education. What resulted was an understanding that the participants of this study defined learning space from a "me" standpoint. Namely, participants expressed their perception of the facility built environment from a vantage point honed by multiple years (Gmelch, 2009) of interaction between their selves and mediating facility variables found within their respective institutions.

With the assertion in the previous paragraph, findings within this study support many of the components of constructionist learning put forth in Chapter one. Specifically, the participants of this study readily acknowledged that components of the facility built environment were perceived to impact learning in higher education from varied perspectives. One perspective saw space impacting learning by supporting the synergetic transaction between the learner and space by emphasizing functionality; another perspective viewed space from a Modernist perspective that emphasized adaptation and flexibility as mechanisms to shape the learned experience; and finally the last perspective saw space in abstract terms in which the space itself constructed meanings for its occupants.

Findings

This study outlined the distinct manner in which academic deans perceived characteristics of the facility built environment to impact learning in higher education. More importantly, the findings put forth specific insights on how the emergent viewpoints expressed by the participants within this study could facilitate greater collaboration between stakeholders of learning space to improve the overall efficacy of the facility built environment in higher education. Consequently, and of most importance, was the notion that both concrete and abstract characteristics of the facility built environment were present and were perceived by academic deans to impact learning space in higher education. This study adds to a narrative in the field of education that as pedagogies change so do the space requirements in which learning occurs. Therefore, a requirement appears to exist that necessitates that both educators and facilities administrators recognize that learning space is complex, conveys meaning, requires flexibility, and requires digital enhancement to support current learning styles and emerging pedagogies. Simply put, learning space can no longer just be a structure with a roof and walls; instead it has to compete with the digital learner's living room, the local coffee shop's decor and the tranquility of a nature trail, for in this digital age, all now compete with the conventional brick and mortar learning space.

Complexity of Learning Space

The data suggests that learning space transcends mere functionality. The three viewpoints expressed by the participants of this study suggest that the participants share a genuine belief that the quality of space does matter in higher education and, as Lackney asserts, "many educators who work in school settings on a daily basis accept almost axiomatically that the physical setting of the school has an effect on the teaching and learning which takes place within a school" (Lackney, 1994, p. 15). This study adds to a body of research and current knowledge by identifying unique perspectives held by one of many stakeholder groups vested in the quality of the facility built environment in higher education. The findings in this study also lend credence to a common theme identified in both K-12 and higher education literature that recognizes that the environment created by the facilities does impact a learner's ability to learn (Duran-Narucki, 2011; Beynon, 1997).

Statements 15, 24 and 26-32 were all sculptured to elicit thoughts and perceptions of the facility built environment not easily identifiable as characteristics of the facility built environment. As a result, these concourse items provided the participants of this study a chance to delve into more abstract and deeper meanings of the facility built environment in higher education (Duran-Narucki, 2011). Noticeably, these statements formed the nexus upon which the Abstractionist perspective of the facility built environment was identified and detailed. Six of the eight statements were rated by the Abstractionist to have a positive impact on learning: Statements 15(+1), 24(+2), 26 (+4), 27 (+3), 28 (+4), 29 (+2). Of particular note was the Abstractionist near significant rating of Statement 15. Statement 15, aesthetical wonderment "wow," was sculptured to weigh the perceived learning effect of a common marketing strategy used to entice students, faculty and staff to higher education campuses. Not so surprisingly, both the Traditionalist and Modernist saw "wow" as having a benign impact on learning and in some cases as negatively affecting learning by serving as a distraction. However, the Abstractionist was able to conceptualize the statement by justifying it as an attractant for perspective students, faculty and staff.

Some participants within this study articulated or accepted abstract characteristics of the facility built environment in higher education that were not emergent in K-12 research. In this study, characteristics did emerge that focused on amenities (Statement 14), occupant comfort (Statement 3) or attributes and security (Statement 26) that conveyed concrete as well as abstract meaning and concepts. Of note, security as a characteristic of space emerged within this study in two distinct forms. One participant group, Traditionalist, articulated security as a physical status and another, Abstractionist, articulated the concept to be self-reflective as a perceived status or feeling of security.

Other participants saw space complexity in the form of specificity. Learning spaces such as labs and science buildings were spaces that were identified by this study's participants as spaces that required unique systems and infrastructure to support specific learning activities. Both the Traditionalist (+2) and Modernist (+3) saw Statement 22 as impacting learning.

The significance of these finding and its implication for higher education stakeholders was that "wow" and other abstract characteristics of the facility built environment cannot be totally dismissed as needed characteristic of space during the planning, design and building of new facilities and learning spaces on higher education campuses. Likewise, this study indicated that the Abstractionist perspective appeared to be a minority opinion among the participants of this study and therefore could be easily drowned out during the clamor and conversation among stakeholders that routinely takes place when planning new space. However, as a counter point, all stakeholders need to be cognizant that the Abstractionist position is important but appears to be a minority opinion and therefore should not countermand proven, common sense characteristics of the facility built environment that were more strongly supported by the Traditionalist and Modernist perspectives in this study.

Common Inferences among Factors

A key finding of this study was the identification of a sub-set of basic expectations either directly stated or inferred within the three distinct perceptions of the facility built environment espoused by this study's participants. The findings were made even more significant in that the three perspectives were identified in this study's factor groupings that, although rather homogeneous in race/ethnicity, varied greatly in other study demographics. All three factors identified basic inferences that set an expectation for the facility built environment to meet basic expectations of its users. The basic expectations that were either inferred or directly identified by this study's participants included cleanliness (Statement 11); occupant comfort (Statement 3);

lack of clutter (Statement 16); safety and security (Statement 26); noise control (Statement 5); well-maintained building systems (Statement 12); and adequate space (Statement 9).

The significance of these finding and its implication for higher education stakeholders is that the concrete characteristics of the facility built environment are essential for learning in higher education. Basic necessities identified in the previous paragraph were readily accepted by Traditionalist, Modernist and Abstractionist as important to learning, but even more so, they recognized that these attributes formed the reason for the facility built environment to exist in higher education. Essentially these findings support assertions by Beynon and Earthman that provide a rationale for the facility built environments to exist in higher education. Beynon states that the "facility built environment is required because all learning will not take place in pristine environments" (Beynon, 1997, p. 19) and Earthman asserts "that a safe, modern and environmentally controlled environment will have a positive effect on the learning climate within a learning institution" (Earthman, 2002, p.1). With this understanding, it is important for all stakeholders to recognize that quality and functionality of learning space in higher education requires the basic necessities put forth collectively by all participants within this study.

Need for Flexibility and Size

Another key finding of this study was an understanding that a requirement currently exists for learning space in higher education to be more dynamic and flexible in order to support emerging pedagogies. Pedagogical trends and preferences, articulated by participants within this study, appeared to reject fixed classroom seating and lecture halls because of the appearance of "sage on stage instruction." Instead, they showed a preference for collaborative learning spaces requiring comfortable and mobile furnishings, learning spaces with larger physical dimensions, and spaces supportive of interactive technologies (Jones & Jones, 2008).

In support of this statement, some participants of this study appeared to steadfastly hold to the notion that learning space that was purposeful, functional and reasonably maintained met the criteria for sufficient learning space. However, the Modernist perspective articulated within this study expanded size as a characteristic of space to include space adequacy as a key component of the concept. In K-12 research, Schneider states that "teaching is a complex task, requiring collaboration, flexibility and teaming with colleagues" (Schneider, 2003, p. 2) and attributed the lack of teacher work space as one of the contributing factors to teacher satisfaction and retention. In this study, the idea that professional administrators, all former or current instructors, would place great value on adequate work space for instructors and students was not a surprising outcome, which was illustrated by the high ranking of Statement 9 (Classrooms need to have adequate space for instructors, students and their equipment) on all three factors.

The key implication of the aforementioned findings was in the acknowledgment that the flexibility desired by the participants of this study may be cost prohibitive. Accordingly, compromise among stakeholders may be required in order to accomplish what appears to be a consensus among all three perspectives. Namely, there is a cost implication to build and renovate learning space that arguably requires a greater space footprint. Secondly, dwindling budgets in higher education (GAO 12-179, 2012) continue to affect the ability of administrators to address deferred maintenance needs within existing space (Ericson, 2011) and respond to changes in education pedagogies (Hunter, 2009). Therefore, there is an implicit requirement for stakeholders and subsets of stakeholders to balance wants and needs when planning to add new or to renovate existing space.

Technology as a Component of Learning

Another key finding in this study was the acceptance and requirement of technology enhancements within the facility built environment. Specifically, technology as a component of learning appeared to have moved from a "want" to a "basic need" in higher education learning space. A number of the participants within this study saw technology as a requirement and component of learning in higher education facilities. Where technology as a component of learning was inferred in K-12 facilities, the concept was put forth as an outright necessity in higher education.

Four Q statements were sculpted in order to solicit feedback regarding the impact of technology in higher learning. Statements 14, 17, 18 and 19 all addressed technology from different vantage points. Statement 14 addressed technology and amenities as a component of learning and was viewed by both the Modernist (+2) and Abstractionist (+2) to impact learning but appreciably less by the Traditionalist (-1). These findings strengthened the narrative regarding the Traditionalist perspective of the facility built environment and their tendency to reject characteristics that they viewed as not essential to learning, namely new amenities. Statement 17 addressed "smart" technology as a component of learning and was viewed by all three participants groups to impact learning: Traditionalist (+1), Modernist (+4) Abstractionist (-1). Statement 18 addressed technology as a component of learning from a convenience standpoint. In this case, both the Traditionalist (+1) and Modernist (+3) considered a robust wireless environment to be an essential component of the facility built environment as impacting learning but appreciably less so by the Abstractionist (-1). Finally, like Statement 18, Statement 19 also addressed technology as a component of learning from a convenience standpoint. In this case, only the Modernist (+2) ranked this characteristic as positively impacting learning. In the data, it appeared that both the Traditionalist and the Abstractionist dismissed the notion of providing plug connections for smart devices as not important and not impacting learning.

Finally, a participant within this study referred to students in higher education as "digital natives." This pronouncement was significant in that it identified a subject matter not found in the research literature for this study and it provided insight as to why technology was viewed by the participants as impacting learning in higher education. Explicitly, technology has become to higher education what water is to a fish. It is not a want, it is an absolute need.

With the assertion put forth in the previous paragraph, the primary implication for stakeholders appears to be in the form of questions. The first is why is technology needed; the second is where technology is needed; the third is what technology is needed; and the final one is when to add new technology. In all four questions, stakeholders are faced with the same quandary that administrators face in the quest for flexibility. Again there is a cost implication that drives all four questions, both actual and transactional. Actual cost is somewhat easier to define because it is tied to an institutions' budget allocation for technology enhancements, computers, wireless infrastructure and digital labs. Transactional costs are harder but, as this study exemplifies, the transactional costs may be the more expensive of the two. The findings of this study clearly show that the participants of this study saw technology as an important characteristic believed to impact learning. With this notion, it was very evident that stakeholders in higher education need to look at technology under a new lens, a lens that requires collaboration at the onset of space planning to identify and determine technology needs; technology master planning at the institutional level to support planned growth and finally to identify a stable source of revenue to maintain the currency of technology systems.

Limitations

Two primary limitations of this study either emerged during the analysis of the data or *were* an intentional delimitation of the study at the onset. Initially, in order to limit the size of the potential participant pool, a decision was made to limit the participants of the study to deans in the State of Florida. Namely, the potential participants sought for this study were from colleges and universities located in the State of Florida, accredited by (SACS), classified by SACS in Florida as Level II to VI and categorized as a public or private not for profit institution. The Q sample was sent out to 305 potential participants. The 43 (14%) participants that completed the Q sample were from both private and public colleges/universities with varying student populations. However, the potential perspectives of academic deans from purely associate degree granting, for profit and community colleges accredited by SACS within the state were not solicited. Therefore, the results of this study and the representative views of the 43 participants might have been different had the academic deans from the excluded institutions participated or if the Q sample had not just been limited to the State of Florida.

The second limitation of the study was the overall demographics of the study's participants. The vast majority of this study's participants were Caucasian, male (25; 58%) and female (14; 32%), and only included the perceptions of (2; .05%) African American women and (2; .05%) Latino American men. Altogether missing from the participant pool were the perceptions of any deans who identified their self as an African American man or Latino American women. Therefore the views expressed within all three factors may not have been representative of actual demographics of deans employed at colleges and universities in the State of Florida, but, in all likelihood, reflected the apparent lack of diversity within this participant group in institutions of higher learning in Florida.

Implications for Stakeholders

It was the intention of this research design and methodology to accentuate one of many stakeholders' voices regarding the facility built environment and its perceived impact on learning. Although academic deans have enjoyed a place at the "facility" decision making table for a number of years (Hyun, 2009), their true impact and calling in the future may be to educate other stakeholders on current pedagogical trends within higher education.

As shown by this study, there appears to be a large divergence between what deans profess as important goals and how those goals are viewed when compared to other initiatives within their individual academic colleges. The most striking instance identified by this study was the low ranking of sustainability as an important characteristic for learning by all three of this study's perspectives. As discussed earlier, this reluctance to embrace sustainability by deans may result from the deans viewing sustainability as competing with other educational interests or goals. To address this, facility administrators, designers and other higher education administrators need to do a much better job of linking sustainability to goals commonly associated with academic colleges in higher education.

The idea that deans are one of many stakeholders in education needs to be embraced by the deans and especially designers and facility administrators. As shown by this study, no one design or building style or type will suffice to accommodate all learning styles or offer enough flexibility to continually address changing pedagogies. The implication previously listed was even more troubling for two specific reasons: the first being the consistent decline in funding for higher education institutions since the 2008 economic downturn (Hurley et al., 2010) and the second being the continued growth of deferred maintenance for higher education institutions. With prolonged funding shortages and a growing deferred maintenance backlog, it is imperative for political and higher education stakeholders to fund deferred maintenance shortfalls in order to ensure the continued quality of learning space in higher education.

There are obviously additional stakeholder's vested in the relationship between the facility built environment and learning in higher education. This study only explored the perspectives of academic deans but other stakeholder groups exist and require future study. The other stakeholder groups alluded to within this study include facility administrators, students, instructors, college administrators, planners/designers and politicians. Finally, as revealed within this study, the stakeholder group's perceptions that emerged were not completely homogeneous and undoubtedly offered conflicting and competing views as to what aspects of the facility built environment were deemed to impact learning in higher education.

Future Research

Future research regarding the perception of the characteristics of the facility built environment that may affect learning has a number of additional stakeholders in higher education. As stated earlier in this study, academic deans are only one of many stakeholder groups vested in the quality of the learning environment in higher education. Future studies involving other key stakeholders alluded to by this research but not queried include facility administrators, students, planners/designers, instructors, politicians and community. Notwithstanding, any one of the aforementioned stakeholder groups will undoubtedly add to the views of the facility built environment's impact on learning expressed by academic deans. Furthermore, the expectation would be that future research involving other stakeholder groups would yield more divergent viewpoints and further define views or themes that emerged in this study. Therefore, additional research on characteristics that may affect learning in the future may need to be geared toward bridging a gap between learning space that is used and learning space that is useful. Essentially, future research should continue to explore and unravel the subjectivity of academic deans in other locales and the subjectivity of other stakeholder groups identified within this study.

Finally, this study's use of Q methodology provided a means to measure the subjectivity of academic deans toward the subject at hand but not to evaluate variables readily identified in previous research and in this study. Therefore it would be remiss for this researcher not to recommend a future study employing R methodology to conduct research into this subject area. Subjectively, there is a strong belief that future research into this subject area should be conducted using both R and Q methodological perspectives, because variables and perspectives readily identified or discovered in both methodologies can only strengthen the overall understanding of an obviously complex area of higher education.

Conclusion

This study used Q methodology to identify the subjective beliefs and opinions held by academic deans on the characteristics of the facility built environment and their perceived impact on learning in higher education. The evaluation of the data identified three perspectives that warranted exploration. The three factors were aptly named: Factor A: Traditionalist – Focused on Functionality and Universal Rationality; Factor B: Modernist – Technology Conscious Seeking Innovation and Flexibility; and Factor C: Abstractionist – Contextual and Expressive. Conceptually, this study showed that learning spaces within the facility built environment were complex yet had basic requirements that were expanding in scope, function, amenities, and the required internal infrastructure to support the continual changes. This study added to the body of research regarding the impact that characteristics of the facility built environment had on learning in higher education from the perspective of academic deans. Their individual and collective perspectives indicated that facets of the facility built environment were important to learning – important not because variable x or y could be quantified, but more from the fact that the individual perspectives of the academic dean was qualitatively expressed and evaluated. From the evaluation, key perspectives emerged that appeared to differ in context from similar variables or characteristics found in research conducted in K-12: (1) Technology in learning space and the learning environment was articulated as a basic requirement for learning; (2) Safety was conveyed as both a physical presence and a self-awareness; (3) “Size does matter” in the learning environment in the context of flexibility, storage and individual personal space; (4) Sustainability (“green”) was not considered a characteristic of the facility built environment to positively impact learning; and (5) The maintenance and upkeep of the facility built environment in higher education transcends the mere brick and mortar purpose of the facility to house learning activities, but was instead seen by many in this study as defining the value that an institution places on learning.

APPENDICES

APPENDIX A

ONLINE CONCOURSE QUESTIONAIRRE

Wallace L. Harris

Dissertation Title: **Facility Matters: The Perception of Academic Deans regarding the role of Facilities in Higher Education**

Instructions: **Please respond to the prompt (Q-1) below with complete sentences that indicate up to (10) facility characteristics that you perceive as impacting student learning:**

Q-1: From your perspective what characteristics of the facility built environment do you perceive as having the greatest impact on student learning in higher education?

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

1. How do you classify your race or ethnicity:
   _____ White or Caucasian, European origin
   _____ Black or African America
   _____ American Indian or Native Alaskan
   _____ Hispanic or Latino
   _____ Asian
   _____ Native Hawaiian or other Pacific Islander
   _____ Other, please list ____________________

2. Gender or sex

_____ Male
_____ Female

3. How many years have you been in your current position?
   _____ < 1year
   _____ 1-5 years
   _____ 6- 10 years
   _____ > 10 years

Describe your role as it relates to physical facilities:

How would you describe the physical condition of the institution where you are employed?

APPENDIX B

INFORMED CONSENT LETTER, CONCOURSE QUESTIONAIRRE

Concourse Questionnaire Email with Informed Consent

My name is Wallace Harris. I am a doctoral student conducting dissertation research on how academic deans perceive the characteristics of the facility built environment in regard to student learning in higher education. I am requesting your participation in an online questionnaire. The questionnaire is very brief and will only take about 20 minutes to complete. The information gained from your answers will be used to complete the communication concourse for a Q study and ultimately contribute to the final dissertation research instrument, which you may be asked to complete at a later date.

You must be 18 years of age or older to take part in this research study. Your participation is voluntary and will remain anonymous. In compliance with IRB requirements and to ensure data security, your answers will be stored on a secure UNF server and destroyed at the culmination of this research. No personal identifiers will be collected. Your participation is voluntary and you are free to withdraw at any time. There are no foreseeable risks for your participation. The University of North Florida, Institutional Review Board has approved this survey. If you have questions about your rights as a participant, you may contact the University of North Florida's Institutional Review Board Chairperson by calling or by emailing irb@unf.edu. Should you have any comments or questions, please feel free to contact me at

Please click the link below to go to the questionnaire web site or copy and paste the link into your internet browser to begin the questionnaire. Upon opening the link below, you will be asked to read the consent letter for this study. Once completed, you will be asked to check a box indicating that you have read the consent letter and agree to participate in this research study. Upon checking the box, the actual survey instrument will be launched.

Survey link:

Thank you very much for your time and co-operation.

Sincerely,

Wallace L. Harris

Principal Researcher

APPENDIX C

CONCOURSE ITEMS

Concourse Items

1. I believe that I have worked in a facility that contributed to the poor health of me and/or a staff member (Lackney, 1994 & Schneider, 1995).

2. Students' interactions with the facilities environment contribute to student's ability to learn (Cash & Twiford, 2009).

3. Indoor air quality is important to the academic success of students (Bosch, 2003; Uline, Tschannen-Moran, 2008; Buckley et al., 2004; Schneider 1995, 2002).

4. Thermal comfort is important to the academic success of students (Bosch, 2003; de Dear & Brager, 2002; Earthman, 2002; Veltri et al., 2006).

5. Indoor air quality is important to the academic success of students (Bosch, 2003).

6. Quality lighting is important to the academic success of students (Duyar, 2010; Schneider, 2002; Jago & Turner, 1999; Bosch, 2003; Veltri et al., 2006; Hill & Epps, 2009).

7. Facility aesthetics is important to the academic success of students (Duran-Narucki, 2011).

8. Well maintained facilities contribute to my staff's ability to meet goals of the institution (Cash & Twiford, 2009).

9. Student's ability to learn is affected by their interaction with the facility built environment (Kolb & Kolb, 2005).

10. Facilities should be constructed with features that promote and encourage collaborative learning (Kuuskorpi & Cabellos-Gonzalez, 2011).

11. I embrace distance learning as new instructional tool (Walters & Keim, 2003).

12. Poor building conditions may contribute to respiratory problems and result in greater absenteeism or poorer student performance (Simons, Hwang, Fitzgerald, Kielb & Shao Lin, 2010).

13. Use wall decorations to brighten the room, to provide additional education space and opportunities to display student work (Cash & Twiford, 2010).

14. Hire and train custodians & maintenance employees to keep buildings structurally sound and physically attractive (Cash & Twiford, 2010).

15. Occupants of classrooms without good ventilation can’t function normally and can’t learn at their full capacity (Schneider, 2002).

16. Teachers seemed to hold a basic expectation that they would be able to control light levels, sun penetration, acoustic conditions, temperature and ventilation in their classrooms (Schneider, 2002).

17. Over 70% of teachers in a survey said that a smaller class size is more important than small school size (Schneider, 2002).

18. We already know that clean air, good light and a quiet comfortable safe learning environment is needed for learning to occur (Schneider, 2002).

19. Facilities and academic staff should collaborate on an institution’s long range planning activities (Beynon, 1997).

20. Educational buildings as well as sites that surround them and the furniture inside are “machines for learning,” specifically designed to accommodate their specific functions including receiving lectures, discussion, discovery, and individual learning (Beynon, 1997).

21. Physical facilities need to be created to be functional, economic, structural sound and attractive (Beynon, 1997).

22. Student behavior and facilities are linked (Schneider, 2002).

23. Every community school promotes the simple fundamental American value that school community and family are inextricably bound together and must work closely together to help children learn and succeed (Beaumont, 2003).

24. An increasing number of higher education leaders identify aging and expanding facilities as one of the top drivers of change in the field of higher education, exceeded only by insufficient financial resources, technological change and changing student demographics (Marmolejo, 2007).

25. The role and purpose of facilities is to provide a physical environment that supports the educational process, establishes visual statements about the quality and viability of the institution and creates an “academic community” (Daigneau, n.d.).

26. School buildings are perhaps the most visible expression of society’s investment in public education (Duyar, 2010).

27. I define my role as a landlord in the relationship between my college and physical facilities (Tucker & Bryan, 1991).

28. There are physical conditions that create a sense of security, wellbeing and aid brain development (Daigneau, n.d.).

29. Effective facilities design (types and usefulness of space) may have a greater impact on educational outcomes than facilities condition (Daigneau, n.d.).

30. A balance needs to exist between economics (maintaining building values) and enhanced educational processes (facilities redesign, renovation or replacement) (Daigneau, n.d.).

31. Additions and upgrades to existing facilities can create large disparities in classroom environments (Hill & Epps, 2009).

32. Increases in competition for scarce resources and a decrease in the public's trust in higher education practices have resulted in demands for campuses to demonstrate their productivity, effectiveness, and efficiency (Rosser, Johnsrud & Heck, 2003, p. 1).

33. Institutions have responded with a variety of data about student enrollment trends, student retention and graduation rates, job and career placement, and faculty workload studies (Rosser, Johnsrud & Heck, 2003, p. 1).

34. Deans must successfully work with a range of interests, individuals and groups (Rosser, Johnsrud & Heck, 2003, p. 2).

35. Aging buildings, many of them constructed quickly a generation ago to meet enrollment, need fixing (Kennedy, 2000).

36. Well-designed university buildings and physical environments have a documented positive impact on student participation, engagement, and feelings of support and belonging (Strange & Banning 2001).

37. School facilities affect learning. Spatial configurations, noise, heat, cold, light, and air quality obviously bear on teachers' and students' abilities to perform (Schneider, 2002).

38. The condition of the school building is not a symbol of the social characteristics of the town or city where the school is located; it is an indicator of them (Duran-Narucki, 2011).

39. School buildings may inform their users about behavioral expectations and set the tone for what can and cannot occur within its walls (Duran-Narucki, 2011).

40. All planned or not planned features of the built environment of the school are constantly interacting with school users and, therefore, creating and recreating meaning (Duran-Narucki, 2011).

41. The quality of the school building can affect the ability of teachers to teach, teacher morale, and the very health and safety of teachers (Buckley et al., 2004).

42. Poor indoor air quality (IAQ) is widespread in many schools, which increases student absenteeism and reduces student performance (Buckley et al., 2004).

43. It is not surprising to find that poor IAQ also affects teachers' health (Buckley et al., 2004).

44. The study indicated that students with the most classroom daylight progressed 20% faster in one year on math tests and 26% faster on reading tests than those students who learned in environments that received the least amount of natural light (Buckley et al., 2004).

45. Earthman and Lemasters (1997) report three key findings: that higher student achievement is associated with schools that have less external noise, that outside noise causes increased student dissatisfaction with their classrooms, and that excessive noise causes stress in students.

46. Sixty years of research continues to support the positive relationship between quality and student achievement (Cash & Twiford, 2009).

47. Research has indicated that controlled day lighting and appropriate artificial lighting improve the performance of students and teachers and their health (Cash & Twiford, 2009).

48. A connection has been made between lack of graffiti, clean floors or walls, and other measures of a school's cleanliness and student academic performance (Cash & Twiford, 2009).

49. School building quality and student outcomes are the mediating influence of school climate (Uline & Tschannen-Moran, 2008).

50. School climate may explain, at least in part, the deleterious impact that poor school facilities have on learning (Uline & Tschannen-Moran, 2008).

51. It may be that dilapidated, crowded, or uncomfortable school buildings lead to low morale and reduced effort on the part of teachers and students alike, to reduced community engagement with a school and even to less positive forms of school leadership (Uline & Tschannen-Moran, 2008).

52. Thus, poor school climate may play a contributing role in low achievement when school facilities are inadequate (Uline & Tschannen-Moran, 2008).

53. Studies have demonstrated a relationship between student achievement and building quality, newer buildings, improved lighting, thermal comfort and indoor air quality, as well as specific building features such as science laboratories and libraries (Uline & Tschannen-Moran, 2008).

54. Researchers found that students in non-modernized buildings scored lower on basic skills assessments than those students in modernized or new buildings (McGuffey & Brown, 1978; Uline & Tschannen-Moran, 2008).

55. Building age accounted for as much as 3.3% of the variance in students' scores on the Iowa Test of Basic (Uline & Tschannen-Moran, 2008).

56. School buildings are perhaps the most visible expression of society's investment in public education (Duyar, 2010).

57. In addition to cosmetic and structural factors, some studies pointed out the significance of school facility maintenance in creating a conducive teaching and learning environment (Duyar, 2010).

58. Specific building conditions or features shown to influence educational outcomes include building age, maintenance, renovation, acoustics and noise, indoor air quality, daylight and design (Duyar 2010).

59. As far back as the 1920s, industrial research established the relationship between environmental factors and employee productivity and morale (Young, Green, Roehrich-Patrick, Joseph & Gibson, 2003).

60. Every school year, many hours of precious and irreplaceable classroom time are lost due to lack of air conditioning, broken boilers, ventilation breakdowns, and other facilities-related problems (Young et al., 2003).

61. Students had higher achievement scores in newer facilities. Indeed, as the age of the facilities decreased, there was a corresponding increase in scores in mathematics, reading, and composition (Young et al., 2003).

62. Higher student achievement was associated with schools with better science laboratories (Young et al., 2003).

63. Higher student achievement was associated with well maintained schools (Young et al., 2003).

64. Eight of nine studies found a significant relationship between the thermal environment of a classroom and student achievement and behavior (Young et al., 2003).

65. Studies over many years have associated better lighting with increased productivity in industrial settings (Young et al., 2003).

66. Higher student achievement was associated with schools with less external noise (Young et al., 2003).

67. When students do not feel well when they are in school, or miss school due to air quality problems, learning is adversely affected (Young et al., 2003).

68. We know intuitively that stiflingly hot classrooms, poor lighting, and excessive noise have a negative effect on the learning process (Young et al., 2003).

69. The particular personality of various spaces within a school may encourage a sense of belonging and foster a collective commitment to shared learning goals (Uline, Tschannen-Moran & Wolsey, 2009).

70. Buildings, as both object and technology, represent a means of creating a teacher identity that convey values about space, learning, and community (Uline, Tschannen-Moran & Wolsey, 2009 citing Hughes, 2004).

71. Students and teachers across all participant groups at both schools cited the important role clean, well maintained schools plays in the learning and teaching process (Uline, Tschannen-Moran & Wolsey, 2009).

72. School absenteeism for all schools combined was associated with a number of mold, moisture, ventilation, and vermin problems (Simons, Hwang, Fitzgerald, Kielb & Lin, 2010).

73. Of the conditions most surely linked to health and academic achievement—indoor air quality, thermal comfort, lighting and noise, indoor air quality was of greatest concern (Schneider, 2003).

74. Teachers reported suffering health problems rooted in poor environmental conditions in their schools (Schneider, 2003).

75. Teachers reported that their classrooms and hallways were so noisy that it affected their ability to teach (Schneider, 2003).

76. If technology is to be fully integrated into learning environments, the culture prevalent in institutions must change (Lippman, 2010).

77. Findings of this research indicated that interactions between the building design and the building's occupants helped to define the learning climate of the schools (Uline, Wolsey, Tschannen-Moran & Lin, 2010).

78. Many educators who work in school settings on a daily basis accept, almost axiomatically, that the physical setting of the school has an effect on the teaching and learning which takes place within their school (Lackney, 1994).

79. “Smart,” technology equipped classrooms may impact student learning (Hill & Epps, 2009).

80. In cases where students attend school in substandard buildings they are definitely handicapped in their academic achievement (Earthman, 2002).

81. Many old buildings simply do not have the features, such as control of the thermal environment, adequate lighting, good roofs, and adequate space that are necessary for a good learning environment (Earthman, 2002).

82. Age of building in and of itself is usually not an important factor in influencing student performance, but the building components that are necessary for good student learning (e.g. thermal quality and acoustical control) are usually absent in older buildings (Earthman, 2002).

83. According to the teachers, the maintenance of the building seemed to impact the learning climate, as did the design and appearance of the building (Earthman, 2002).

84. Overcrowded classrooms have a negative impact on student achievement (Earthman, 2002).

85. The basic structures of teaching spaces have not changed to keep up with changes in pedagogy and information technology (Kuuskorpi & Gonzalez, 2011).

86. Good acoustics are fundamental to good academic performance (Buckley et al., 2004).

87. Prolonged noise exposure in learning environments hinders cognitive functioning and impairs reading skills (Uline & Tschannen-Moran, 2007).

88. Natural light has a profound influence on a student’s body and mind in a learning environment (Lyons, 1999).

89. Inadequate classroom lighting negatively affects student retention (Buckley et al., 2004).

90. A correlation exists between the quality of an educational facility and the learning outcomes of its students (Uline et al., 2010).

91. Proper temperature control in buildings improves students' ability to complete assigned tasks (Veltri et al., 2006).

92. Classroom noise distracts students to the extent that additional cognitive skills are required to perform menial tasks (Uline et al., 2010).

93. A relationship exists between the building and student achievement (Cash & Twiford, 2009).

94. Smaller class sizes in college classrooms leads to higher student achievement (Earthman, 2002).

95. **Good control of temperature and humidity is an important aspect of facilities for learning to occur.

96. **Good space temperature exists when occupants are comfortable and satisfied.

97. **Students require quiet spaces to study or collaborate (Rbj9lq6ue8qYc6UT).

98. **Learning requires good lighting (Rbj9lq6ue8qYc6UT).

99. **Classrooms need to have adequate space to support collaborative learning (R2958iip0nMyXHyb).

100. **Spacious rooms that support multiple arrangements of furnishings and activities (R2958iip0nMyXHyb).

101. **Buildings that are in close proximity that provides for easy student movement between classes and shelter from the elements (R7o0Pdmssn35D1).

102. ** Learning spaces specifically built for academic study.

103. **Cleaning (R7o0Pdmssn35D1& Rbj9lq6ue8qYc6UT).

104. **Furnishings that are modern, functional and comfortable (R7o0Pdmssn35D1 & Rbj9lq6ue8qYc6UT).

105. **Spaces equipped with immobile furnishings that promote "sage on stage" pedagogy (R2958iip0nMyXHyb).

106. **Good lighting, comfortable seating in study areas and common spaces, WI-FI, adequate eating facilities that can accommodate students in large or small groups all add to the ability of students to concentrate out their studies. I also believe that a building that is kept clean doesn’t have offensive smells or dirty carpets, encourages students to feel respected. I believe this contributes to good work habits; broken desks, chairs and poorly outfitted classroom technology do not (Rbj9lq6ue8qYc6UT).

APPENDIX D

Q SAMPLE

Q Sample

1. Room air that is not stale or stuffy.
2. Spaces that are free from unpleasant or annoying smells.
3. Room temperature that is comfortable and satisfactory.
4. Spaces that are free from sounds that could disrupt learning.
5. Acoustics within the space that enhance learning in ways appropriate for the purpose.
6. Presence of good lighting, both artificial and natural.
7. Ability of users to control lighting.
8. Occupants are able to control temperature.
9. Classrooms need to have adequate space for instructors, students and their equipment.
10. Learning spaces of various sizes and shapes to accommodate different needs.
11. Facilities that are cleaned and sanitized regularly.
12. Building systems that are well maintained and in good working order (heating, cooling, lighting, technology, building envelope, roof, etc.).
13. Sustainable “green” facilities that support learning.
14. Spaces that contain new amenities and technology.
15. Spaces that provide a “wow” factor for users.
16. Spaces that are orderly and uncluttered.
17. Facilities and spaces equipped with modern “smart” technologies (hardware, computers, data projectors, smart boards, etc.).
18. Campus, all its facilities and learning spaces provided with WI-FI access.

19. Learning spaces equipped with enough electrical outlets to support smart devices (smart phones, laptops, tablets, etc.).

20. Furnishings that are modern, functional and comfortable.

21. Spaces equipped with mobile furnishings that support interactivity.

22. Facilities and spaces specifically designed to accommodate specific functions (lectures, discussions, discovery, collaboration, individual learning).

23. Buildings that are in close proximity that allow for easy student movement between classes.

24. Building spaces that encourage a sense of belonging.

25. Fair and equitable distribution of campus resources so that large disparities in facilities, spaces, and technologies do not exist.

26. Spaces and facilities that provide a sense of safety and security.

27. Facilities and spaces that provide a cultural and social statement regarding the value of learning and education.

28. Facility features and amenities that attract high quality students and faculty.

29. Facilities and spaces that promote civic engagement and values.

30. Facilities and spaces that inform users about behavioral expectations and set the tone for what can and cannot occur within them.

31. Facilities and spaces that exemplify the core values of the institution.

32. Multipurpose spaces and facilities that convey a sense of ownership to the individual user.

APPENDIX E

INFORMED CONSENT, Q SAMPLE

Informed Consent, Q sample

My name is Wallace Harris. I am a doctoral student conducting dissertation research on how academic deans perceive the characteristics of the facility built environment in regard to student learning in higher education. I am requesting your participation in this research study. The research instrument (Q sort) will take approximately 45 minutes to complete.

You must be 18 years of age or older to take part in this research study. Your participation is voluntary and will remain anonymous. In compliance with IRB requirements and to ensure data security, your answers will be stored on a secure UNF server and destroyed at the culmination of this research. No personal identifiers will be collected. Your participation is voluntary and you are free to withdraw at any time. There are no foreseeable risks for your participation. One possible benefit from taking part in this research is the knowledge that you are adding to the body of research on the relationship between facilities and academic outcomes in higher education. The University of North Florida Institutional Review Board has approved this survey. If you have questions about your rights as a participant, you may contact the University of North Florida's Institutional Review Board Chairperson by calling or by emailing irb@unf.edu. Should you have any comments or questions, please feel free to contact me at

Please click the link below to go to the survey web site or copy and paste the link into your internet browser to begin the Q sort. Upon opening the link below, you will be asked to read the consent letter for this study. Once completed, you will be asked to check a box indicating that you have read the consent letter and agree to participate in this research study. Upon checking the box, the actual survey instrument will be launched.

Survey link: http://www.unf.edu/~n00607194/Flashq-WHarris/

Completion and return of the questionnaire implies that you have read the information in this form and consent to take part in the research. Please keep this form for your records or future reference.

Thank you very much for your time and co-operation.

Sincerely,

Wallace L. Harris

Principal Researcher

APPENDIX F

Q SAMPLE, Follow-up Email

Q sort, Follow-up Email

Hi, Dr. Jones, I hope that you are having a great day. In a previous email sent out on January 28, I asked for deans, associate deans and assistant deans to participate in a dissertation research project exploring facilities and learning in higher education. I am reaching out to you personally to explain why your participation in this research is highly important. Early on during my class work at the University of North Florida, a very senior professor at UNF advised my classmates and me to seek a dissertation topic that added to a body of knowledge, merited exploration, and provided a voice to a participant group. Unfortunately, as we are both aware, the perspectives and insights of deans within an academic college are all too often missing in facility planning, maintenance/repair and renovation discussions in higher education. Therefore, it is my ardent belief that your participation in this research is extremely important in that your personal insight will undoubtedly contribute to an underserved body of knowledge in higher education that warrants additional research. I understand that your schedule is extremely busy and that this request is just one of many that you may receive during the course of your academic year. However, as a facility administrator with over 22 years of experience at 5 different institutions of higher learning, I see this as a unique opportunity for both you and me to expand the level of scholarship in a subject area that is highly important to both of us. Finally, I would like to personally thank you for considering this request and for the work that you do, day in and day out.

For your convenience, the link to the survey instrument is shown below:

http://www.unf.edu/~n00607194/Flashq-WHarris/

APPENDIX G

Q SORT, INSTRUCTIONS

Q Sort Instructions

Step 1 of 5

Thinking about your entire campus, what characteristic of the facility built environment do you perceive as having the greatest impact on student learning in higher education?

When sorting the 32 statements representing characteristics of the facility built environment, please do so with the understanding that the facility built environment is defined as any man-made environment that provides structure for human activity.

Carefully read through the following 32 characteristics of the facility built environment and split them up into three piles: a pile for those characteristics you believe most impact student learning, a pile for those characteristics you believe to least impact student learning (relatively speaking), and a pile for the characteristics that fall somewhere in the middle for you or reflect characteristics you are unsure about.

You can either drag the cards into one of the three piles or press 1 (most impact), 2 (middle or unsure), 3 (least impact) on your keyboard. Changes can be made later.

If you want to read this instruction a second time, press the help-button at the bottom right corner.

Step 2 of 5

Take the cards from the “MOST IMPACT”-pile and read them again. You can scroll through the statements by using the scroll bar. Next, select the two characteristics of the facility built environment that you believe most impact student learning and place them in the boxes on the right side of the sorting grid below the “+4.” NOTE: The order of the statements under a column is not important.

Now read the cards in the “LEAST IMPACT”-pile again. Just as before, select the two characteristics that you believe least impact student learning and place them in the boxes on the left side of the sorting grid below the “-4.”

Next, select the four characteristics that you believe next most/least impact student learning and place them in the boxes under “+3”/“-3.” Follow this procedure for all statements in the “MOST IMPACT”- and “LEAST IMPACT”-piles. NOTE: The color coding for the three initial piles (MOST IMPACT, MIDDLE OR UNSURE, and LEAST IMPACT) are simply guidelines. Feel free to sort those characteristics in the column that best fits your perspective, regardless of its color.

Finally, read the “MIDDLE OR UNSURE”-statements again and arrange them in the remaining open boxes on the distribution grid.

-4	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**

Step 3 of 5

Now you have placed all characteristics of the facility built environment somewhere on the sorting grid. Please go over your distribution once more and, if necessary, shift any items around in order to best reflect your perspective.

Step 4 of 5

Please concisely describe why you believe the characteristics of the facility built environment which you have placed below the “+4” or “-4” most/least impact student learning.

Step 5 of 5

Finally, please answer the following questions regarding your background.

APPENDIX H

SUMMARY of PARTICIPANT DEMOGRAPHIC DATA

Appendix H

Demographic Characteristics for Participants

Sort #	Sex	Ethnicity	State	Years current job	School Type	School Population Size
1	M	Caucasian	Fl	7	Public	>25,000
2	M	Caucasian	Fl	2	Public	>25,000
3	M	Caucasian	Fl	2	Public	>25,000
4	M	Caucasian	Fl	2	Public	>25,000
5	M	Caucasian	Fl	3	Public	>25,000
6	F	Caucasian	Fl	7	Public	>25,000
7	M	Caucasian	Fl	4	Public	>25,000
8	F	Af Am	Fl	8	Public	>25,000
9	F	Caucasian	Fl	9	Public	10,001-25,000
10	M	Af Am	Fl	4	Public	3,001-10,000
11	F	Caucasian	Fl	32	Public	>25,000
12	M	Caucasian	Fl	7	Public	10,001-25,000
13	M	Caucasian	Fl	25	Public	>25,000
14	M	Caucasian	Fl	1	Public	10,001-25,000
15	M	Hisp/Latino	Fl	6	Private	3,001-10,000
16	M	Caucasian	Fl	4	Private	<3,000
17	F	Caucasian	Fl	12	Public	10,001-25,000
18	M	Caucasian	Fl	6	Private	3,001-10,000
19	F	Caucasian	Fl	25	Public	10,001-25,000
20	M	Caucasian	Fl	3	Private	<3,000
21	F	Caucasian	Fl	25	Public	10,001-25,000
22	F	Caucasian	Fl	2	Public	>25,000
23	M	Caucasian	Fl	6	Private	3,001-10,000
24	F	Caucasian	Fl	32	Public	3,001-10,000

25	M	Caucasian	Fl	25	Public	10,001-25,000
26	F	Caucasian	Fl	3	Public	10,001-25,000
27	M	Caucasian	Fl	8	Public	10,001-25,000
28	F	Caucasian	Fl	3	Public	>25,000
29	F	Caucasian	Fl	7	Public	>25,000
30	M	Caucasian	Fl	4	Private	10,001-25,000
31	F	Caucasian	Fl	3	Private	3,001-10,000
32	M	Caucasian	Fl	25	Public	>25,000
33	M	Caucasian	Fl	7	Public	>25,000
34	M	Caucasian	Fl	25	Private	>25,000
35	M	Hisp/Latino	Fl	7	Private	10,001-25,000
36	F	Caucasian	Fl	5	Public	>25,000
37	M	Caucasian	Fl	1	Public	>25,000
38	F	Caucasian	Fl	1	Public	>25,000
39	M	Caucasian	Fl	10	Public	>25,000
40	M	Caucasian	Fl	22	Public	>25,000
41	M	Caucasian	Fl	8	Public	>25,000
42	F	Caucasian	Fl	8	Public	>25,000
43	M	Caucasian	Fl	5	Public	>25,000

APPENDIX I

UNIVERSITY OF NORTH FLORIDA, INTERNAL REVIEW BOARD

APPROVAL LETTER

UNF
UNIVERSITY of
NORTH FLORIDA.

Office of Research and Sponsored Programs
1 UNF Drive
Jacksonville, FL 32224-2665
904-620-2455 FAX 904-620-2457
Equal Opportunity/Equal Access/Affirmative Action Institution

MEMORANDUM

UNF IRB Number: 521985-2
Approval Date: 11-25-2013
Expiration Date: Exempt - None
Processed on behalf of UNF's IRB KLC

DATE: November 25, 2013

TO: Mr. Wallace Harris

VIA: Dr. Luke Cornelius
LSCSM

FROM: Dr. Krista Paulsen, Chairperson
On behalf of the UNF Institutional Review Board

RE: Review of Revisions to New Project by the UNF Institutional Review Board IRB#521985-2: "FACILITY MATTERS: THE PERCEPTION OF ACADEMIC DEANS REGARDING THE ROLE OF FACILITIES IN HIGHER EDUCATION"

This is to advise you that your project, "FACILITY MATTERS: THE PERCEPTION OF ACADEMIC DEANS REGARDING THE ROLE OF FACILITIES IN HIGHER EDUCATION" was reviewed on behalf of the UNF Institutional Review Board and has been approved as "Exempt" Category 2. Therefore, this project requires no further IRB oversight unless substantive changes are made.

This approval applies to your project in the form and content as submitted to the IRB for review. All participants must receive a stamped and dated copy of the approved informed consent document when possible. Any variations or modifications to the approved protocol and/or informed consent forms that are substantive or might increase risk to human participants must be submitted to the IRB prior to implementing the changes. Please see the UNF Standard Operating Procedures for additional information about what types of changes might require an amendment. Any unanticipated problems involving risk and any occurrence of serious harm to subjects and others shall be reported promptly to the IRB within 3 business days.

Your study has been approved as of 11/25/2013. Because your project was approved as exempt, no further IRB oversight is required for this project unless you intend to make a change that is considered substantive or might elevate risk to participants. As an exempt study, continuing review will be unnecessary. When you are ready to close your project, please complete a Closing Report Form which can also be found in the documents library called "Forms and Templates" in IRBNet. This closing report will need to be submitted as a new package in IRBNet.

As you may know, **CITI Course Completion Reports are valid for 3 years**. Your completion report is valid through 11/12/2015 and Dr. Cornelius' completion report is valid through 11/02/2016. The CITI training for renewal will become available 90 days before your CITI training expires. Please renew your CITI training within that time period by following this link: http://www.citiprogram.org/. Should you have questions regarding your project or any other IRB issues, please contact the research integrity unit of the Office of Research and Sponsored Programs by emailing IRB@unf.edu or calling (904) 620-2455.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within UNF's records. All records shall be accessible for inspection and copying by authorized representatives of the department or agency at reasonable times and in a reasonable manner. A copy of this approval may also be sent to the dean and/or chair of your department.

APPENDIX J

Correlation Matrix between Sorts

Correlation Between Sorts

SORTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
1 wmBL7Pu4	100	64	-2	-18	20	22	45	35	33	28	47	37	41	60	69	8	39	30	19	37	28	51	16	-18	37	37	20	57	39	36	18	68	10	37	61	66	65	58	53	51	40	56	36
2 wmDE2Pu4	64	100	28	-15	59	16	63	45	27	52	44	55	37	66	74	23	53	49	29	48	38	51	39	15	54	31	35	26	40	30	55	73	5	7	56	68	64	62	49	65	66	51	58
3 wmDE2Pu4	-2	28	100	12	14	-10	-12	20	11	5	10	14	16	14	15	-6	22	37	36	37	23	18	22	47	5	-26	29	15	43	-15	3	10	-2	12	-3	5	19	28	22	23	27	16	47
4 wmad2Pu4	-18	-15	12	100	0	18	-13	-8	23	-6	-16	15	2	-32	-18	47	-9	-9	16	16	26	-12	24	36	-35	-2	15	11	19	-15	-2	-6	-5	12	-8	-40	-16	-8	19	-14	-28	3	-33
5 wmAd3Pu4	20	59	14	0	100	37	43	30	36	34	34	68	30	32	37	18	61	12	32	35	34	33	39	21	32	36	37	18	22	48	50	21	24	46	36	24	34	49	52	32	24	22	22
6 wfDe7Pu7	22	16	-10	18	37	100	50	27	32	49	34	41	44	35	22	5	47	22	50	14	48	27	15	-10	17	52	24	29	32	18	22	39	53	36	35	36	20	45	41	37	10	22	24
7 wmAD4Pu4	45	63	-12	-13	43	50	100	38	31	72	54	53	59	53	47	24	39	57	33	23	43	49	26	7	49	66	19	22	24	50	39	72	28	9	51	64	56	51	54	53	55	59	47
8 bfAD8Pu4	35	45	20	-8	30	27	38	100	51	51	53	43	36	49	36	-12	52	39	33	40	55	18	42	22	31	39	66	26	30	11	21	36	24	35	55	43	20	53	40	72	23	52	55
9 wfAD9pu3	33	27	11	23	36	32	31	51	100	36	52	52	46	23	26	22	32	29	20	40	24	14	27	25	7	45	52	34	29	39	23	36	5	41	51	19	22	33	43	39	22	36	14
10 BFD4Pu2	28	52	5	-6	34	49	72	51	36	100	60	37	41	52	44	5	39	55	24	15	50	32	27	12	47	52	40	25	37	34	41	60	37	37	39	48	47	60	31	47	41	48	47
11 wmF32Pu4	47	44	10	-16	34	34	54	53	52	60	100	43	57	44	61	19	34	56	5	21	38	34	-12	9	55	52	14	45	21	62	47	70	34	37	64	48	56	52	49	49	61	56	45
12 wmAD3Pu3	37	55	14	15	68	41	53	43	52	37	43	100	53	37	45	23	45	24	44	44	37	32	47	34	44	58	39	23	33	37	24	55	12	27	69	40	37	51	64	49	35	36	25
13 wmADpu#4	41	37	16	2	30	44	59	36	46	41	57	53	100	45	37	20	56	50	52	35	21	54	9	16	34	66	24	57	19	53	18	55	24	16	51	59	49	53	76	52	48	50	55
14 wmDEpu13	60	66	14	-32	32	35	53	49	23	52	44	37	45	100	53	-8	66	53	41	44	39	70	31	-5	42	34	38	40	49	36	31	68	32	22	47	67	43	64	47	74	41	49	65
15 lmAD6pr2	69	74	15	-18	37	22	47	36	26	44	61	45	37	53	100	22	40	36	17	24	25	50	-1	17	75	38	9	50	26	47	41	73	-3	26	45	64	78	51	56	52	71	48	47
16 wmaD#pr1	8	23	-6	47	18	5	24	-12	22	5	19	23	20	-8	22	100	10	30	-6	7	12	6	-9	20	18	36	-7	19	-2	30	26	29	-15	-26	21	10	25	-5	31	5	33	36	-16
17 wfaD#pu3	39	53	22	-9	61	47	39	52	32	39	34	45	56	66	40	10	100	29	61	39	38	68	28	8	25	42	51	55	31	31	25	49	27	19	41	59	28	57	66	78	32	51	48
18 wmAD6pr2	30	49	37	-9	12	22	57	39	29	55	56	24	50	53	36	30	29	100	23	22	45	34	18	13	40	36	28	29	36	31	31	57	23	2	39	51	47	40	34	44	50	55	61
19 wfDE#pu3	19	29	36	16	32	50	33	33	20	24	5	44	52	41	17	-6	61	23	100	48	35	49	38	25	6	27	33	40	51	7	9	38	23	21	20	38	26	44	52	54	21	19	39
20 wmDE3pr1	37	48	37	16	35	14	23	40	40	15	21	44	35	44	24	7	39	22	48	100	19	34	26	5	-1	9	43	23	64	-6	11	34	12	27	36	16	20	37	36	48	22	35	28
21 wfDE#pu3	28	38	23	26	34	48	43	55	24	50	38	37	21	39	25	12	38	45	35	19	100	18	44	30	22	35	44	16	48	7	18	59	49	38	44	30	26	35	43	53	16	32	19
22 wfDE2pu4	51	51	18	-12	33	27	49	18	14	32	34	32	54	70	50	6	68	34	49	34	18	100	8	6	25	33	11	48	37	48	18	62	5	11	26	48	43	49	64	56	39	46	45
23 wmDE6pr2	16	39	22	24	39	15	26	42	27	27	-12	47	9	31	-1	-9	28	18	38	26	44	8	100	27	-3	11	68	2	36	-12	6	18	3	27	29	23	-2	42	28	37	-9	23	26
24 wfDE4pu2	-18	15	47	36	21	-10	7	22	25	12	9	34	16	-5	17	20	8	13	25	5	30	6	27	100	34	4	26	13	14	14	11	21	-29	10	-10	-9	9	-6	36	12	21	11	10
25 wmDE#pu3	37	54	5	-35	32	17	49	31	7	47	55	44	34	42	75	18	25	40	6	-1	22	25	-3	34	100	39	7	31	13	41	37	60	2	14	32	52	56	30	41	30	66	42	43
26 wfAD3pu3	37	31	-26	-2	36	52	66	39	45	52	52	58	66	34	38	36	42	36	27	9	35	33	11	4	39	100	21	25	3	56	10	53	27	14	65	55	49	42	56	51	37	41	23
27 wmAD8pu3	20	35	29	15	37	24	19	66	52	40	14	39	24	38	9	-7	51	28	33	43	44	11	68	26	7	21	100	21	48	-6	-2	18	3	38	37	22	-9	43	35	42	-5	37	31
28 wfDE3pu4	57	26	15	11	18	29	22	26	34	25	45	23	57	40	50	19	55	29	40	23	16	48	2	13	31	25	21	100	20	43	16	51	11	41	22	46	48	39	66	44	29	63	34
29 wfAD7pu4	39	40	43	19	22	32	24	30	29	37	21	33	19	49	26	-2	31	36	51	64	48	37	36	14	13	3	48	20	100	-12	4	48	17	49	32	20	18	43	28	26	23	23	25
30 wmAD4pr3	36	30	-15	-15	22	18	50	11	39	34	62	37	53	36	47	30	31	31	7	-6	7	48	-12	14	41	56	-6	43	-12	100	23	61	2	-5	44	43	48	34	50	34	51	40	18
31 wfDE3pr2	18	55	3	-2	48	22	39	21	23	41	47	24	18	31	41	26	25	31	9	11	18	18	6	11	37	10	-2	16	4	23	100	48	27	10	18	24	34	31	14	37	40	23	33
32 wmAD#pu4	68	73	10	-6	50	39	72	36	36	60	70	55	55	68	73	29	49	57	38	34	59	62	18	21	60	53	18	51	48	61	48	100	30	31	62	64	72	54	67	62	66	52	40
33 wmDE7pu4	10	5	-2	-5	21	53	28	24	5	37	34	12	24	32	-3	-15	27	23	23	12	49	5	3	-29	2	27	3	11	17	2	27	30	100	35	27	19	20	36	16	40	7	16	24
34 wmAD#pu4	37	7	12	12	24	36	9	35	41	37	37	27	16	22	26	-26	19	2	21	27	38	11	27	10	14	14	38	41	49	-5	10	31	35	100	16	8	23	35	28	25	-2	24	8
35 lmAD7pr3	61	56	-3	-8	46	35	51	55	51	39	64	69	51	47	45	21	41	39	20	36	44	26	29	-10	32	65	37	22	32	44	18	62	27	16	100	59	43	60	50	52	44	37	31
36 wfAD5Pu4	66	68	5	-40	36	36	64	43	19	48	48	40	59	67	64	10	59	51	38	16	30	48	23	-9	52	55	22	46	20	43	24	64	19	8	59	100	65	65	52	68	62	52	69
37 wmDE1Pu4	65	64	19	-16	24	20	56	20	22	47	56	37	49	43	78	25	28	47	26	20	26	43	-2	9	56	49	-9	48	18	48	34	72	20	23	43	65	100	50	49	51	77	48	46
38 wfDE1PU4	58	62	28	-8	34	45	51	53	33	60	52	51	53	64	51	-5	57	40	44	37	35	49	42	-6	30	42	43	39	43	34	31	54	36	35	60	65	50	100	53	65	41	56	69
39 wmAD#Pu4	53	49	22	19	49	41	54	40	43	31	49	64	76	47	56	31	66	34	52	36	43	64	28	36	41	56	35	66	28	50	14	67	16	28	50	52	49	53	100	61	45	61	43
40 wmAD#Pu4	51	65	23	-14	52	37	53	72	39	47	49	49	52	74	52	5	78	44	54	48	53	56	37	12	30	51	42	44	26	34	37	62	40	25	52	68	51	65	61	100	40	57	62
41 wmAD8Pu4	40	66	27	-28	32	10	55	23	22	41	61	35	48	41	71	33	32	50	21	22	16	39	-9	21	66	37	-5	29	23	51	40	66	7	-2	44	62	77	41	45	40	100	41	52
42 wfAD8Pu4	56	51	16	3	24	22	59	52	36	48	56	36	50	49	48	36	51	55	19	35	32	46	23	11	42	41	37	63	23	40	23	52	16	24	37	52	48	56	61	57	41	100	52
43 wmAD5Pu4	36	58	47	-33	22	24	47	55	14	47	45	25	55	65	47	-16	48	61	39	28	19	45	26	10	43	23	31	34	25	18	33	40	24	8	31	69	46	69	43	62	52	52	100

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