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Academic librarians are struggling to find methods to demonstrate their impact on student learning and to understand what types of spaces within their physical libraries will contribute the most to institutional goals. At the same time, students are coming to higher education with more disabilities, distractions and competing responsibilities than ever before. These students need study spaces that will assist them in recovering from the mental fatigue that comes with everyday life and that makes it more difficult for them to direct their attention to important tasks, problem-solve, and think reflectively. Attention Restoration Theory (ART) has shown that exposure to natural environments, even through window views and interior plants, can decrease mental fatigue and restore the ability to direct attention. This study uses a revised version of the Perceived

Restorativeness Scale and the Perception and Compatibility Scale in an experimental setting to determine whether exposure to natural environments in simulated library study spaces is perceived as restorative and, thus, likely to have a positive impact on students' abilities to direct their attention.

Keywords: library space; study space; academic libraries; attention restoration theory

Restorative Library Study Spaces

by

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Chapter 1

Introduction

Research Problem and Significance

Academia is experiencing great changes in the United States. Shrinking budgets, increased calls for accountability, rapidly changing technologies, changing pedagogies, and an increasingly diverse population of faculty and students are all having great impacts on colleges and universities throughout the country. Academic libraries, as integral parts of these institutions, are also changing rapidly in response to these pressures. Shrinking budgets, along with the perception that "everything is on the web," cause administrators, legislators, and the public to question the need for brick and mortar library buildings (Demas, 2005). At the same time, lawmakers, the public, and students demand to see evidence of the positive impacts on individuals and communities from investments in higher education. The increasing role of technology in and outside of the classroom along with changing ideas about effective pedagogies demand that institutions and, more specifically, libraries provide increased maker-spaces, more group study areas, and increased access to high-end technologies (Stewart, 2010). Finally, an increasingly diverse faculty and student body need services and spaces, both virtual and physical, that are adaptable to their needs.

Within this milieu, where does the physical academic library stand? What is its future? How should investments in the physical space be leveraged to best serve the widest swathe of an institution's faculty, staff and students? Academic librarians have been struggling with these questions for some time and have responded in several ways. First, there have been some excellent conceptual writings such as Bennett's 2003 overview of academic library space planning in the 1990s and Demas' 2005 work comparing the new college library to the Library of Alexandria. Bennett (2003) noted that even with the renewed interest in library space in the 1990s in response to great pedagogical and technological changes in the academy, library space planning still favored the conceptualization of library space as a place for service provision rather than space that builds "social identity of learning and of knowledge" (p. 8). He further noted that most library space planning is still focused on the library as a place of storage and service provision where emphasis is placed on an assessment of library operations. Bennett believed that forward-thinking academic librarians should conceive of library spaces "as spaces where learning is the primary activity and where the focus is on facilitating the social exchanges through which information is transformed into the knowledge of some person or group of persons" (p. 10). Bennett also noted that, although projects in the 1990s were successful at some level, they were completed without being systematically informed by how students learn or how faculty teach. Demas (2005) in his essay about the Library of Alexandria and the new college library agreed with Bennett's assessment and noted that an academic library should be a space that "inspires, supports, and contextualizes its users' engagements with scholarship" (para 3).

In addition to these more conceptual writings, there have been more specific studies of changing academic library trends. Stewart (2010), in his survey of academic library buildings that were completed between 2003 and 2009, presented several interesting statistics. He documented ninety-nine academic libraries that were completed during this time period, approximately 55 of which responded to his survey. Of the institutions represented in his sample, 50% indicated an increase in the amount of quiet study space but "more than half of the institutions with exclusively undergraduate populations reported less or no areas in the new facility designated for quiet study" (Stewart, 2010, p. 67). However, study areas (defined as study tables, carrels, study floors, quiet study) were identified by the same survey participants as the second busiest areas in the new libraries, second only to group study rooms (Stewart, 2010, p. 73).

In 2009, Woodward published her book on the customer-driven academic library in which she answers the question of how to reinvent academic libraries through information learned from her extensive interviews with library patrons and librarians and her travels to many academic libraries in the United States. Two chapters are concerned with physical space. Woodward (2009) noted the need for students to have spaces in which they feel that they "belong" and areas in which to "nest" (p. 48). She pointed out that today's expectations are that spaces should be very different for different individuals and that the time for vast spaces with identical furnishings and color schemes is over. She noted the importance of individualized, comfortable spaces with access to books, computers, outlets, and food and drink and briefly discusses such features as temperature, furniture, signage, and lighting. However, there is no connection made to how these spaces assist in the learning process beyond encouraging students to come into the library and to stay. While both of these are important, the increased need for accountability and outcomes-driven planning requires a more detailed understanding of how library spaces support learning.

Nitecki (2011) noted that "formal inquiry about library spaces has only recently begun to be conducted and reported, suggesting that spaces mostly have been subjected to description assessments, with few sharable evaluations or evolved theories to inform practice" (p. 28). For example, from the recent literature (see chapter 2), research questions have been: "Are students satisfied with the library's space and/or facilities?" (Bailin, 2011), "Have students' use of laptops changed recently?," and "What is the potential role of new high-tech library spaces on laptop use?" (Briden & Marshall, 2010). While the answers to these questions provide useful data for planning hours to be open, what type of furniture to use, and where outlets need to be placed, they do not assist librarians in building a case for how library space contributes to student learning, one of the key goals of the larger educational institution.

How can spaces be evaluated for their impact on student learning? How can learning spaces be designed so that they increase students' ability to direct their attention and practice successful study/learning strategies? Observations of behavior and self-reports tell us what students are doing but do not tell us if their choices contribute positively to their learning. The literature in cognitive, educational, and environmental psychology can help us better understand the learning process and assist us in developing new methods to answer the questions raised in this study.

As libraries move away from being storehouses of information and concentrate more on being centers for academic activities and study, it is important that study spaces are designed to answer the needs of diverse students. However, current literature about the design of academic library spaces concentrates on the development of technologically rich "learning commons" with atmospheres similar to coffee shops (Fister, 2011). Recent studies indicate that students are asking for a variety of spaces, including study spaces that are quiet, solitary, and technologically disconnected, and that students spend more time studying when they are disconnected (Fister, 2011; Head & Eisenberg, 2011).

In addition, academic libraries are serving a more diverse student body than ever before, including students from four generations and students who have more stressors in their lives (National Center for Education Statistics, *n.d.*; Perna, 2010). A few statistics clearly illustrate this point. The enrollment projections for higher education from 2010-2020 project an 11% increase in enrollment by students under 25 and a 20% increase in enrollment of students over 25. In 2010, 40% of full-time traditional college students (aged 16-24) worked and 73% of part-time traditional students worked (National Center for Education Statistics, 2012). Again in 2010, almost one quarter (3.9 million) of undergraduate students in the U.S. are parents and half of those students are single parents. One-half of undergraduate students who are parents also work full-time (Institute for Women's Policy Research, 2011). Students are coming to higher education from more generations and with more distractions and competing responsibilities than ever before.

Study spaces that are designed for quiet contemplation, relaxation, and recovery from mental fatigue and stress could have a positive impact on student learning by providing places that restore the ability to direct attention and assist students with reaching their study goals (see Attention Restoration Theory on p. 25). By providing such spaces and assessing these spaces, librarians would have a better understanding of how their space contributes to student learning, an important measure for the larger educational institution. A more thorough theoretical framework, especially one that goes beyond the LIS field to incorporate applicable theories and research from other disciplines, can assist in developing better questions, ones that allow for supportable conclusions of import.

Research Aim and Objectives

In this study I draw on theoretical frameworks, research, and methodologies from cognitive, educational, and environmental psychology to examine one aspect of how physical library spaces can decrease mental fatigue, the ability to direct one's attention, and the ability to achieve one's goals for study. Specifically, I ask the question: Do students perceive "greenery-enhanced"[1] library spaces to be helpful for the restoration of directed attention and to assist in the attainment of study goals? This question is further refined into the following objectives:

1. To determine if library study spaces that include greenery are perceived to be more conducive to restoring directed attention than spaces without greenery.

2. To gain an understanding of whether students find "greenery-enhanced" study spaces more conducive to successfully completing their study goals (defined as reading a textbook or studying for an exam) when in the library.

Research Strategy

The approach I took in this study is to use a static simulation or scenario research design while collecting primarily quantitative data (Bosselmann, Craik & Craik, 1987; Stamps, 2010; see p. 61 for further discussion). The participants were undergraduate students at a small metropolitan commuter campus predominately comprised of non-traditional students and undergraduate students at a mid-sized midwestern regional institution predominately comprised of traditional undergraduate students.

The participants viewed slides, projected on a large screen, of various library study spaces and either completed the Revised Perceived Restorativeness Scale (RPRS) or the Perception and Compatibility Scale (PCS) for each slide (see Appendices A and B). Each participant also completed a short demographic survey (see Appendices C and D) that assisted in the determination of how representative the sample was of the undergraduate populations at these two institutions and how diverse the samples were based on age, transfer status, and study space preference. Age, transfer status and campus affiliation help to identify traditional from non-traditional students.

Scenarios depicted in the slides represent four types of library study areas (see Appendix E for examples):

Areas with a window view to green spaces (Green),

Areas with a window view to man-made structures (Built),

Areas with no windows and no indoor plants (No View), and

Areas with indoor plants (Plant).

The RPRS is a 5-point Likert scale instrument with answers ranging from "not at all" to "very much" and the PCS is a 7-point Likert scale instrument with answers ranging from "strongly disagree" to "strongly agree."

Summary

With the renewed interest in the design of library space, there have been calls to focus on library spaces "as spaces where learning is the primary activity" (Bennett, 2003, p. 10) and an increase in the study of spaces and space use in academic libraries. However, the design and study of spaces have been concentrated on learning commons, spaces of high activity, and methods of assessment that are not focused on learning, especially learning by reflection. At the same time, an increasing diversity of students on campus and a better understanding of learning styles has caused such institutions as the National Academy of Sciences to call for the need to support three key learning styles; learning through reflection, learning by doing, and learning through conversation (*Spaces for Learning*, 2006; National Research Council, 2000). The problem, therefore, is that academic librarians need better ways to understand how library spaces can support student learning in all three learning styles, especially the styles that call for reflection and individual "doing". With renewed interest in library spaces as spaces to support learning as opposed to storage spaces or spaces for services, it is critical for academic librarians, architects, and university officials to more fully understand the relationship between spaces and learning. In addition, library spaces need to support learning in all three learning styles in order to meet the needs of a diverse student body.

One way to begin to understand the way in which library spaces can support student reflective learning is to determine what types of spaces are considered by students to be supportive of their study goals and to assist them in directing their attention. Research from environmental psychology that looks at the impact of exposure to natural environments on recovery from mental fatigue, abilities to direct attention, and on supporting goal completion could help librarians begin to understand the complex relationship between physical space and support of learning. In undertaking this research, it is important to first consider the literature on library space and then to consider applicable research from cognitive, educational and environmental psychology as a way to situate this research in its theoretical foundation. In the next chapter, I summarize this literature.

In chapter three I look in more detail at my research strategy and method, including a discussion of the reliability and validity of the method chosen. And, finally, I discuss the analysis of the quantitative and qualitative results of this study. Chapter four presents the results and chapter five discusses the implications of the results, limitations of the study, and provides suggestions for further research.

Chapter Two

Literature Review

College students are faced with competing demands today. More students work longer hours, have children to care for, and are from more diverse backgrounds while all of them feel pressure to maintain good grades and to have a social life. Because the purpose of this study is to understand how the library's physical environment may support or impede a student's ability to study effectively, it is critical to look at current research into library space and then to understand some of the basic concepts that are key to successful learning.

Library Space Studies

With regard to physical library space, academic librarians have responded in two ways to the changes in academia brought on by technology, diversity, and societal expectations. First has been the trend toward building what has been called "information commons" and are, more recently, referred to as "learning commons." Second has been an increase in research on library space. It is important to look briefly at both of these responses to understand how they have contributed to solving problems around academic library space and why they have not been sufficient.

As access to technology for research, teaching, and project completion became a driving force in academia and changes in pedagogy created a need for students to work in groups for both problem-solving and project creation, academic libraries responded by building information commons. Beagle (1999), one of the early proponents of the "information commons," defined the concept as "a conceptual, physical, and instructional space" offering a "continuum of service delivery" in an "integrated digital environment"

(p. 82). Examples of information commons that were built during this time period are numerous, including Bennett's (2003) overview of numerous projects and projects such as the ones at Indiana University (Albanese, 2004) and Brigham Young University (Whitchurch & Belliston, 2006). In fact, Whitchurch and Belliston provide a succinct description of many information commons when they list what theirs included: "reference and student workstations; collaborative learning rooms and areas; electronic classrooms; multimedia workstations; consultation stations; writing lab; and lounge area" (2006, p. 264).

As libraries continued to embed themselves into the learning mission of their institutions, the idea of an information commons evolved into the "learning commons." Defined by Remy (2004), "the Learning Commons will have as its mission not merely to integrate technology, reference, instruction, and other services, but to facilitate learning by whatever means work best. As a library service environment, the Learning Commons will enable students to develop a framework to understand and evaluate the impact of information technology on the choices they make as researchers and practitioners" (p. 4).

In summaries of learning commons that were built in the last decade, it is easy to see that the idea behind learning commons goes beyond space for technology and service to facilitating student learning. However the spaces themselves look very similar to those of the information commons (Brown & Long, 2005; Stewart, 2009). Learning commons are highly interactive, technologically rich spaces, which are mainly designed as maker-spaces and group work spaces where multiple types of services are available on demand. While these spaces are critical spaces to have within academic libraries and do support group learning activities and learning by doing, they do not answer the needs of all students and certainly do not provide supportive spaces for individual, reflective learning.

The second response to questions about library space has been an increase in research on this topic. To understand the strengths and weaknesses of this research, it is important to look at how this research has evolved over the past ten years. Before 2007, much of the research into library space employed a single methodology, typically a self-report method or a simple count method, and tended to focus on "What are the most popular spaces" question. Cataldo, Freund, Ocha, and Salcedo (2006) and Lewellen and Fretwell (2006) are exceptions in that both studies used multiple methods that included the simple count method and focus groups. In 2000, Potthoff, Weis, Montanelli, and Murbach, using the Role Repertory Grid Procedure to study space, concluded that "librarians need to use a broader range of assessment techniques," (p. 192) especially those that would correct for biases in self-report methods. Their results, in combining self-report methods with the Role Repertory Grid Procedure method, suggested that there might be very clear differences in results between self-report methods and "less overt decision-making methodologies," (Potthoff, et al., 2000, p. 192) meaning more phenomenological-based methods such as direct observation, photos, and other ethnographical studies.

Architects, recognizing the inadequacy of earlier studies, also recommended a more ethnographical approach to learning about users and library space. For example, the Cohens (2005), partners in a library space-planning and architectural firm, called for photographic studies and discussions with library users as key to designing for the future. They go on to say, "for a library environment to be successful in our changing world, it is essential for human interaction and behavior to be given primary consideration" (Cohen, Cohen & Cohen, 2005, p. 25).

Since 2007, there have been more studies that have incorporated a wide range of methodologies to investigate how students use space in libraries. For example, in 2008 Webb, Schaller, and Hunley, at the University of Dayton, used campus surveys, online library surveys, a video study, and data from the National Student Survey of Engagement (NSSE) to understand current space use by students. The most well-known research is that of Foster and Gibbons (2007) at the University of Rochester, where librarians worked with an anthropologist to understand how undergraduates conduct research. Two studies that specifically addressed library space are Jordan's & Ziebell's (2008) study using surveys, maps, and design focus groups to understand library space as learning space and Suarez's (2007) research on how students use library space to study.

Even with the use of both new methods and multiple methods in space studies, there is still limited data that tell us what types of spaces actually impact student learning. For example, when looking at the papers given at the most recent two Association of Research Libraries Library Assessment Conferences, 2010 and 2012, it becomes clear how the library profession is still struggling with how to understand the impact of spaces on student learning. At the 2010 conference, of the five papers assigned to the "Library Space" track, only one comes close to addressing the issue of the impact of space on learning. Two focused on satisfaction (Fox & Doshi, 2010; Harvey & Lindstrom, 2010) and two focused on what spaces are used and how they are used (Ball & Wolnick, 2010; Diller & Phelps, 2010). The one paper addressed the question of the impact of space on learning asks students, faculty, and instructional support staff about their *perceptions* of how the library, including more than just its space, impacts student study (McCarthy & Nitecki, 2010). While a step forward, this study is limited because its feedback from students was only from a brief survey and sweep counts and concentrates on assessing the impact of spaces designed for active group learning. In fact, some of the results of this study support the need for the type of research undertaken here. McCarthy and Nitecki (2010) point out that there is little to be found in the literature on the assessment of the contribution that spaces make to learning outcomes. In addition, their observed seating patterns demonstrated that one quarter of the students (24.24%) were observed studying individually in "individual" spaces and that an additional fifty percent (50.40%) of students were working individually alongside others at larger tables or in soft seating areas. The remainder of students worked together in group settings. While the methodology (observations during sweep counts) did not allow for exact conclusions (i.e., Did the spaces allow for choice in type of study areas?), it did show that a significant proportion of students were involved in individual, quiet study (McCarthy & Nitecki, 2010).

Papers and posters at the 2012 conference show only a small step forward. Of the eleven posters on library space, most were a mixture of observations, post-occupancy perceptions, and mapping (e.g., Tchangalova, Barnachea, & Williams, 2012). However, one study asked students why they used certain spaces for study (Gierdowski & Duckett, 2012) and one study asked students to describe what their perfect study space would be (LaGuardia & Blake, 2012). The four conference papers presented a wide variety of methods, including a paper that reported research undertaken to investigate the impact of space on student learning (Abbasi, Elkadi, Horn, & Owen, 2012). However, once again, the methods used relied on self-reports, observations, and staff perceptions (for information on all papers and posters see *Proceedings of the Library Assessment Conference*, 2012).

In conclusion, recent library and information science literature contains a fair amount of studies addressing the issue of library space. These studies have touched on such issues as library as place (e.g., Bennett, 2003; Demas, 2005), redesigning libraries for the customer (e.g., Woodward, 2009), post-occupancy studies (e.g., McCarthy & Nitecki, 2010) and library space design to support active learning (e.g., Stewart, 2009). In addition, overall surveys of recent library construction and renovation projects provide additional sources on current library spaces (e.g., Stewart, 2010; *Libraries and maker culture: A resource guide*, n.d.). In this research, I focus specifically on issues that relate to the capability of library spaces to restore students' psychological and attentional resources.

Basic Concepts of Successful Study

Basic concepts that are key to successful study include attention, memory and mental fatigue from the cognitive research perspective, learning strategies from the experiential research perspective, and research into physical spaces and learning from educational psychology. Because this study looked at the reported impact of green spaces on the ability to study, it is equally important to consider theoretical foundations of environmental psychology and, specifically, Attention Restoration Theory.

Cognitive research. Research into attention, memory, and mental fatigue has a long history in cognitive psychology. Key works, summarized here, illuminate their connections to learning.

Attention. The research on attention and its relationship to how humans process information has been a long-standing research focus in psychology. William James' work, as published in 1890, is still considered key to the understanding of attention and states there are two types of attention, involuntary and voluntary (James, 1961). In this work, James described the various attributes that lead to different types of attention. Of concern here are his definitions of involuntary and voluntary attention, distinctions that are still recognized in today's research. Involuntary attention is effortless and instinctual and is the type of attention that allows people to continually monitor the environment. When the environment is compatible with an individual's objectives and is attractive to them, this involuntary attention requires little effort. However, if the environment is not compatible, there is more effort required to ignore the irrelevant stimuli (Szolosi, 2011, p. 13).

Voluntary attention is the type of attention that allows one to "*discriminate* a sensation merged in a mass of others that are similar" and to "*resist the attractions* of more potent stimuli and keep our mind occupied with some object that is naturally unimpressive" (James, 1961, p 91). It is the type of attention used when learning, planning, and problem solving. James goes on to point out that there is no such thing as a single, sustained voluntary attention but that sustained voluntary attention, such as one would need to apply when studying and problem solving, is really a "repetition of successive efforts which bring back the topic to the mind" (p. 91).

More recent research into voluntary and involuntary attention has helped in the understanding of the attention system and how resource-dependent it is. Muller and Rabbitt (1989), in their studies of eye movements and attentional orienting, point out that the attention system has a limited capacity and voluntary attention demands more processing resources. They also note that the ability to direct one's attention in a voluntary way is negatively affected by how much involuntary attention is being used and by competing tasks that require voluntary attention. Lezak (1982), in work with neurological patients, noted that sustained attention, which James (1961) noted is actually a succession of repeated efforts, is required for the completion of executive functions like formulating goals, developing plans, and seeing those plans through to completion.

Memory. Why is an understanding of attention key to the understanding of the learning process? As Herrmann, Raybeck, and Gruneberg (2002) point out, attention is key to memory performance and Szolosi (2011) noted "In essence, memory is a byproduct of attention" (p. 16). As one senses or attends to information, it moves from the senses into working memory and then it may be absorbed or encoded into long-term memory. At a later time, it may be retrieved from long-term memory and "manipulated" along with new information within working memory (Atkinson & Shiffrin, 1968; Baddeley, 2000; Herrmann et al., 2002). Attentional resources are key to the progress of information within the memory system. If attention is not paid to information as it enters, it will not be registered in working memory nor will it progress from working memory to long term memory unless further attention is paid to it, most likely through the process of connecting it to information already in long term memory. And, finally, attentional resources are needed to retrieve information from long-term memory and to work with it within working memory (Chennamsetti, 2008; Ormrod, 1999).

Since the pioneering work on memory by Atkinson and Shiffrin (1968) and Baddeley (2000), much research has been done on questions surrounding the notion of capacity in memory. Is there a limited capacity to the amount of information that moves from working memory to long-term memory? Is there a limited capacity to the amount of information that can be recalled from long-term memory and actively used in working memory? What interferes with this capacity?

Early studies like those conducted by Baddeley and Hitch (1974) recorded the difficulties that adults have in performing reasoning tasks (processing) when they were concurrently trying to add information to memory. This suggested there are limited capacities and further studies have supported this assertion. While the multitude of studies demonstrate a very complex picture of how distinct memory processes are impacted to differing degrees, all agree that the memory system has limited capacity and simultaneous demands degrade memory and learning performance. For example, Baddeley, Lewis, Eldridge, and Thomson (1984) found concurrent tasks have a greater impact on the amount of material that can be learned than on the amount of information that can be recalled, and Mulligan (1998) found dividing attention between storage and recall reduced performance on some, but not all, recall tests and reduced performance on a general knowledge test. Hicks and Marsh (2000), when testing the impact of divided attention on recall and recognition memory, found "performance suffered on both the primary and the secondary tasks when they were performed together" (p. 1495). Fernandes and Moscovitch (2002) found a large interference effect on memory retrieval when the distracting task was verbal-based and a smaller but still significant interference effect when the distracting task was picture-based.

In addition to memory studies showing human memory systems have a limited capacity and storage, retrieval, and manipulation of information can be impaired when this system is overloaded by too many memory tasks, studies have also detailed how anxiety, stress and mental fatigue impact memory. Eysenck and colleagues have spent over thirteen years studying the impact of anxiety on working memory capacity and the ability to complete cognitive tasks (Eysenck, 1979; Eysenck 1982; Eysenck & Calvo, 1992). They have shown that working memory capacity is reduced by anxiety and that the ability to perform cognitive tasks is negatively impacted by a state of worry. More recently, Hayes, Hirsch & Mathews (2008) have shown that worry, in those who are prone to worry, “leads to a reduction in working memory capacity” (p. 715). The impact of stress on memory has also been widely studied with mixed results. While stress may have no impact on implicit memory (memory that allows for the memory of day-to-day, procedural tasks requiring few attentional resources) (Kirschbaum, Wolf, May, Wippich, & Hellhammer, 1996; Lupien & McEwen, 1997) and may actually enhance the memory of negative stimuli (Abercrombie, Speck, & Monticelli, 2006), stress has been shown to cause a pronounced deficit in working memory (Luethi, Meier, & Sandi, 2009). In fact, Sliwinski, Hofer, & Stawski (2006) demonstrated that both younger and older adults performed worse on cognitive tasks on stressful days than on nonstressful days. This study is important because it looked at stress created by “daily hassles.”

Mental fatigue. After an extensive review of definitions by others, van der Linden, Frese, & Meijmar, in their 2003 work, defined “mental fatigue” as the following:

> A change in psychophysiological state due to sustained performance. This change in psychophysiological state has subjective and objective manifestations, which include an increased resistance against further effort, an increased propensity towards less analytic information processing, and changes in mood. Sustained performance, in this definition, does not necessarily involve the same task but can extend over different tasks that require mental effort, such as fatigue because of a day in the office (which often also involves several different tasks). (p. 45)

Cohen (1978) pointed out that mental fatigue is different from stress, although most people when describing mental fatigue may, in fact, use the word stress. This difference is important because stress does not always cause mental fatigue and mental fatigue does not always cause some of the most common symptoms of stress such as rapid heartbeat and increased skin conductance. Mental fatigue, simply put, is a "decrease in total available attentional capacity," which results in "slowness of perception, choice and so on" (Cohen, 1978, p. 13). Kaplan (1995a) pointed out that it is important to note the attentional system will fatigue even when someone is engaged in an activity that he likes but has being doing it for too long.

In a state of mental fatigue, tasks become harder and it is more difficult to see or make sense of the bigger picture. Problem analysis, planning, decision-making and sustaining a line of thought all become more difficult; "interest in a reflective stance declines;" and it becomes "difficult to listen to the opinions of others" (Kaplan, 1995a, p. 102). Numerous studies over the past fifteen years have confirmed both the existence of mental fatigue and its effects. Cohen (1978) noted how sustained time on task and environmental stressors, especially unpredictable ones, caused mental fatigue and how, over time, mental fatigue results in the inability to pay attention to task-relevant cues. Similarly, Csatho, van der Linden, Hernadi, Buzas, and Kalmar (2012) confirmed that time on task could result in mental fatigue that lowered one's ability to ignore distractors, thereby decreasing one's cognitive performance. Mizuno, Tanaka, Yamaguti, Kajimoto, Kuratsune, and Watanabe (2011) found that eight hours of mental tasks, simulating a workday, caused negative physiological changes while eight hours of relaxation did not. They went on to point out the restorative value of rest and relaxation, which allowed for the recovery from acute mental fatigue, and thus, reduced the likelihood of acute mental fatigue developing into chronic mental fatigue from which it is harder to recover. Norling, in the introduction to his 2008 dissertation, nicely summarized studies on mental fatigue that directly apply to college students, noting results similar to those just summarized.

Experiential research. Just as cognitive research has provided an understanding of how attention and memory affect one's ability to learn, experiential research has also added to the understanding of the learning process. This research has focused on how students' approaches to learning and the strategies they use impact their academic success. Approaches-to-learning research considers a broad range of strategies, which students may use when they study. The ten subscales in the Learning and Study Strategies Inventory (LASSI) are illustrative of these strategies. These subscales are anxiety, attitude, motivation, concentration, self-testing, scheduling, study aids, information processing, selecting main ideas, and test strategies (Yip, 2009). In Yip's review of the results of the application of this inventory and in his own research, he concluded “high academic achievers do score significantly higher than the low academic achievers in all subscales” (p. 566).

While this statement may not be surprising, it is important to my study because it demonstrates the strategies that lead to success are those that require more attentional resources. Studies have shown when students apply a deep approach to learning, including behaviors that scored high on the subscales of self-testing, study aids, information processing and selecting main ideas, they gain a deeper and more long-lasting understanding of the materials they are studying (Heikkila, Niemivirta, Nieminen, & Lonka, 2011; Marton and Saljo, 1976). Phan (2009) noted how reflective thinking, effort, persistence, and a structured, organized approach to studying all have been positively associated with higher academic success. Greeno, Collins, and Resnick (1996), when explaining the importance of metacognition to learning, noted “Research comparing excellent adult learners with less capable ones also confirmed that the most successful learners elaborate what they read and construct explanations for themselves” (p. 19). They illustrate the point by noting, when students were asked to explain a sample physics problem, the explanations of the better students were more elaborate and included a discussion of the goals of the problem and physics principles, whereas the explanations of the poorer students concentrated solely on the sequence of steps taken to solve the problem.

In conclusion, a survey of applicable literature from cognitive psychology tells us that attention is key to memory and attentional resources have a limited capacity. Voluntary attention, the type needed to direct one’s attention to study, planning, and problem solving, requires more resources than involuntary attention. And, as more resources are used by involuntary attention, fewer resources are available for voluntary attention. Based on the ability to pay attention to information, the memory system also has a limited capacity and can be impaired by competing demands, anxiety, stress, and mental fatigue. Mental fatigue, a common outcome of too much time spent using voluntary attention, makes it more difficult to attend to higher order tasks like problem-solving, decision-making, and reflective thinking. Finally, successful approaches to learning that include elaboration, reflective thinking, effort and persistence require more mental (memory and attention) resources and become impaired when those resources are low.

Educational psychology. A significant amount of research in educational psychology has been conducted on the question of what types of physical spaces are most conducive to learning. While these studies have tended to look at kindergarten through twelfth-grade classroom spaces, their conclusions are also applicable to the question of study spaces outside of the classroom. Weinstein (1981) elucidates four assumptions about educational environments: 1) a physical classroom can facilitate or inhibit learning; 2) effects of the physical environment on learning is moderated by other variables; 3) learning environments should match student learning styles and social setting; and 4) learning is optimized when the physical environment is treated with the same care as curricular materials and teacher preparation.

Two comprehensive literature reviews covering studies on the physical environment and k-12 learning summarize research in this area (Evans, 2006; Woolner, Hall, Higgins, McCaughey & Wall, 2007). While both reviews conclude the body of evidence is strong enough to warrant general conclusions, such as the ones Weinstein noted in 1981, they both call for further empirical research in order to understand more fully the "involved chain of events" that results from "a change in setting" (Woolner et al., 2007, p. 61). Neither literature review found a significant body of research on the impact of greenery-enhanced spaces within learning environments on student learning. Evans (2006) noted a few studies on outdoor learning experiences and on the beneficial impact of natural outdoor spaces on girls living in public housing. Woolner, et al. (2007) mentioned one study, which may indicate that well-designed outdoor spaces contribute to student academic performance.

From educational psychology, it is clear the physical environment does have an impact on student learning. However, similar to the situation in library studies, further research needs to be done to more clearly understand how different physical environments influence student learning.

Environmental psychology. As the field of environmental psychology has developed from the 1960s onward, four overall paradigms have developed for the examination of person-environment relations (Saegert & Winkel, 1990). Two of these paradigms form part of the framework for this study. The first is the "Adaptation Paradigm," which states that individuals, both biologically and psychologically, try to cope with threats and try to restore and expand their own capacities for coping and flourishing. Specific to this study, students see learning as a hurdle (or "threat") and they seek out and use environments they find to be conducive to studying (see Head & Eisenberg, 2011). The second paradigm, which informs this study, is the "Opportunity-Structure Paradigm," which emphasizes the importance of investigating what impact the specific structures of an environment have on individuals' psychological functioning.

This study investigated specific environmental structures present in library study space and their perceived impact on the ability of students to successfully study.

In considering how study spaces, especially those with significant exposure to greenery[1], impact student learning, I adopted the ecological perspective current in environmental psychology as described by Winkel, Saegert, & Evans (2009) in my research. This perspective employs six principles, one of which is the "recognition that psychological processes are embedded in physical, economic, and social contexts" (Winkel, Saegert, & Evans, 2009, p. 318-319). Another of these principles recognizes that individual traits such as age, gender, and prior experiences shape each person's response to the physical environment.

Attention Restoration Theory. This research used the Attention Restoration Theory (ART) for its methodological approach. ART has developed alongside the development of the Reasonable Person Model (RPM) by Stephen and Rachel Kaplan (2009). These two researchers have spent over thirty years examining the profound effect the environment has on human cognition, action, and well-being and developed the RPM to show how environments may or may not support people's core information needs (Kaplan & Kaplan, 2009). In their words, RPM shows how people are "more reasonable, cooperative, helpful and satisfied when the environment supports basic information needs," and how the environment is important in "enhancing human health" (Kaplan & Kaplan, 2003, p. 9). In defining "basic information needs", the Kaplans developed three categories: exploration and understanding, meaningful action, and restoration. Restoration, the subject of this paper, is defined as "maintaining the capacity to focus on, select, and respond appropriately to the information in the environment" (Kaplan & Kaplan, 2003, p. 9).

Attention Restoration Theory (ART), concerned with this third category of human information needs, states "prolonged or intense cognitive effort depletes the ability to direct attention and restorative environments assist in the recovery of directed attention" (Ouellette, Kaplan & Kaplan, 2005, p. 175-176). In addition, it has been shown how attentional resources are not only depleted by prolonged cognitive effort but also by the daily effort of self-regulation, the mechanism used "to behave oneself and resist temptation" that "pit[s] one's intention against one's inclination" (Kaplan & Berman, 2010, p. 43-44). Directed attention is needed for various aspects of learning requiring cognitive functioning, such as studying, writing, and taking exams (Felsten, 2009). One's directed attention can become exhausted and depleted if too much time is spent engaged in activities that require constant cognitive effort or time is spent engaging in a sole activity, which requires great cognitive effort (Ouellette, Kaplan & Kaplan, 2005). Kaplan (1995b), in one of his earliest writings about ART, noted that mental fatigue is evidenced as people become irritable, easily distractible and unable to pay attention to the activity at hand. Based on ART, Kaplan and the others researching in this field believe one's cognitive functioning and directed attention can be restored if time is spent in "restorative environments" (e.g. Kaplan, 1995b; Felsten, 2009).

Ideal restorative settings exhibit all four of the properties characteristic of restorative environments as identified by Stephen Kaplan (1995b) and most succinctly described in a later publication by Ouellette, Kaplan, & Kaplan (2005). These four properties are the sense of being away, fascination, extent (later called coherence), and compatibility. The sense of being away is the idea that a person is "physically or mentally removed from the activities that are attentionally demanding" (Ouellette, et al., 2005, p. 176) by either moving to a different physical environment or by taking a mental break by focusing on another topic or activity. The second property, fascination, means the environment must be "facilitating involuntary attention by the intrinsic interest of the situation" (Ouellette, et al., 2005, p. 176). This form of attention "is compelling without demanding mental exertion" (Ouellette, et al., 2005, p. 176). The third property is coherence/extent or "the sense of being somewhere with sufficient scope that one can dwell there for a while, whether or not the physical place is vast" (Ouellette, et al., 2005, p. 176). According to Herzog, Maguire, and Nebel (2003), extent allows one to "occupy the mind for a period long enough to allow directed attention to rest" (p. 160) and can be small in size, such as Japanese gardens. In addition, coherence/extent includes the concept of connectedness and way-finding (Hartig, Korpela, Evans, & Garling, 1997). Finally, the fourth property of restorative environments is compatibility. Compatibility is the idea that there is a "perceived match between the person's informational needs and what the environment provides" (Ouellette, Kaplan & Kaplan, 2005, p. 176). According to Felsten (2009), a compatible environment "fits what the individual is trying to achieve" spending time in the environment and "provides the information needed by the individual to achieve" his or her intended goal (p. 161).

In numerous studies, using different methods and subjects, multiple researchers have been able to verify the four properties of ART. Hartig and others (Hartig, Mang & Evans, 1991; Hartig, Kaiser, & Bowler, 1997; Hartig, Korpela, Evans & Garling, 1997) and Herzog, Black, Fountaine, and Knotts (1997) began testing the properties and developing instruments in the 1990s with Herzog continuing his research to this day (Herzog, Maguire, & Nebel, 2003; Herzog, Hayes, Applin, & Weatherly, 2011a; Herzog, Hayes, Applin, & Weatherly, 2011b). Two of the instruments used to assess perceived restorativeness, the RPRS, and preference and compatibility, the PCS, which have developed from this research background, are the instruments I use in this study and one of the methods, static simulation, is the method which is used. Many of the empirical studies on restorative environments, which employed the RPRS and/or other similar instruments, have used pictures and videos as main stimuli for survey data collection or laboratory experiments (static simulations) (Hartig, 2004; Stamps, 2010).

Multiple researchers have been able to verify the four properties of ART and show how natural environments and environments with greenery (a view from a window) are more restorative than urban, built environments (Berman, Jonides, & Kaplan, 2008; Berto, 2005; Raanaas, Evensen, Rich, Sjostrom, & Patil, 2011). As Berman, Jonides, and Kaplan (2008) note, natural environments provoke involuntary attention because these environments are "rich with inherently fascinating stimuli" (p. 1207) without demanding directed attention. Berto, Baroni, Zainaghi, & Bettella (2010), when testing the impact of restorative environments on the effort needed to direct one's attention and on one's recall ability, found exposure to a restorative environment significantly lowered the effort needed to direct attention but found a less clear impact on recall.

Few of these studies, however, have touched on natural environments as restorative environments for learners and none look specifically at study spaces on a college campus. The closest studies are 1) an early study by Tennessen & Cimprich (1995) where they tested the ability of students to direct their attention and investigated differences between those with views to nature and those without, 2) a recent dissertation by Szolosi (2011) where she tested the effect of fascination on recognition memory, and 3) research by Felsten (2009) on the restorative qualities of nature views as study breaks. Three other studies include Han's (2009) research on the impact of leafy plants (in classrooms) on junior high students in Taiwan, Matsuoka's (2008) dissertation on outdoor landscaping and student performance in high schools, and the research on the impact of nature on children's wellbeing by Carrus, Pirchio, Passiatore, Mastandrea, Scopelliti, and Bartoli (2012).

In his comparison of ART and the Eastern meditation traditions, Kaplan (2001) found two common mandates for individuals seeking restoration of their ability to direct their attention: Avoid calling on tired cognitive patterns and avoid unnecessary effort. Research in ART demonstrates how restorative environments through their ability to remove someone, either physically or conceptually, from everyday stressors meets mandate one. Additionally, it shows how, through their ability to hold one's attention effortlessly, remain engaged, and support one's information needs, restorative environments meet mandate two (Kaplan, 2001, p 482 & 491).

Summary

For students to employ successful learning strategies they need to use memory and attentional resources, both of which can be depleted through sustained use, stress, and the requirements of everyday life. Their abilities to problem-solve, plan and think reflectively are all negatively impacted when their attentional resources have been depleted. We are only now learning how physical environments outside of the classroom can assist students in restoring their capacities for directed attention and, thus, in using effective learning strategies (see "Experiential Research" on p. 21). At the same time, librarians, space designers, and architects are increasing their research on how students use library spaces, how changing pedagogies impact space needs, and how best to study these issues. Current methods of studying space within libraries concentrate on observations, surveys, and staff perceptions. New methods could assist in the understanding of how library study spaces impact students and their learning. ART has shown that exposure to natural environments, even through window views and interior plants, can decrease mental fatigue and restore the ability to direct attention. Drawing on this foundation, I developed the following research design in order to investigate the applicability of ART to the design of library study spaces.

Chapter Three

Methods

Research Question and Hypotheses

After considering the theoretical framework provided by cognitive, educational and environmental psychology, my original question, "Do students perceive "greenery-enhanced"[1] library spaces to be helpful for the restoration of directed attention and to assist in the attainment of study goals defined as reading a textbook or studying for an exam)" translated into the following hypotheses:

$H1_0$: Including greenery in library study spaces has no perceived effect on the likelihood of restoring directed attention.

H1: Including greenery in library study spaces is perceived to affect the liklihood of restoring directed attention.

$H2_0$: Greenery enhanced library study spaces are not perceived to be conducive to the successful attainment of study goals.

H2: Greenery enhanced library study spaces are perceived to be conducive to the successful attainment of study goals.

Research Strategy

To gain a deeper understanding of the impact of greenery in study spaces on students' ability to recover from mental fatigue and accomplish their study goals, I chose to use two different instruments. The first, the Revised Perceived Restorativeness Scale (RPRS; see Appendix A), has been designed to measure whether or not a particular setting is perceived as restorative and thus likely to provide those in that setting the opportunity to restore their ability to direct their attention (Hartig, Kaiser, & Bowler, 1997). However, the RPRS is designed to distinguish the level of restorativeness among different types of environments for non-specific activities. For example, one of the four properties of a restorative environment is compatibility or the fit between what the environment provides and what the person in that environment needs at that time. The Compatibility section of the scale asks participants to respond to general statements like "I have a sense that I belong here" and "I could easily form a mental map of this place."

It is unclear how compatibility would be rated in an everyday situation where participants have a very specific goal in mind. Herzog et al. (2011a) noted that the RPRS basically looks at compatibility with external variables in mind, asking what the particular scene affords or supports, rather than considering specific internal variables like goals, inclinations, or purposes. Therefore, I decided to also use the Preference and Compatibility Scale (PCS; see Appendix B), developed by Herzog and his fellow researchers (2011a), which measures how supportive participants find various environments to be for achieving their study goals and how appealing they find the environments. These two components of the PCS combine a "direct rating of compatibility" with a preference rating that is an "indirect indicator of compatibility" (Herzog et al., 2011a, p. 99). Two questions that I added to this scale measures whether or not each environment encourages students to go more often and/or linger longer in the study spaces depicted.

Administering both scales to separate groups of undergraduate students on two different university campuses provided insight into the complex issue of the impact of greenery on the effectiveness of study spaces in providing supportive study environments.

Method

To test both hypotheses I used a primarily quantitative, laboratory approach employing static simulations. Participants viewed a set of slides, projected onto a screen, depicting a variety of library study spaces (see Appendix E). Participants answered a series of questions about each slide. The slide show was timed to advance automatically from one slide to the next.

Pilot Tests. Preliminary testing of photographs conducted with IRB approval during the spring of 2012 on the Washington State University Vancouver campus allowed for the development of guidelines for the slide show and the selection of photographs. One test was designed to determine which photos best depicted each of the four types of spaces that would be used in the final research:

Photos of study spaces with windows looking out onto green spaces (Green);

Photos of study spaces with windows looking out onto built environments (Built);

Photos of study spaces without windows (No View); and,

Photos of study spaces that include indoor plants (Plant).

Another pilot test was designed to determine correct timing of the slideshow for each instrument used. An unexpected result of this test demonstrated the need to reorganize the questions for the one instrument, which has four different sets of questions, to make the transition from one set of questions to another easier for the participants to follow. The order of the slides for each instrument was randomized and four slides that were not part of the study were added to attempt to obscure what features were being studied.

After preliminary testing determined the views that were needed, a professional photographer was hired to take the photographs that would be used in this study. Care was taken so that all photos contained similar furniture and lighting levels, displayed the same expanse of space, and were devoid of people. All photos came from libraries unaffiliated with the participants' institutions.

Research Participants and Data Collection Procedures. For Hypothesis 1, I administered the Revised Perceived Restorativeness Scale (RPRS) (Hartig, Kaiser & Bowler, 1997) to participants from two universities who viewed a set of slides depicting a variety of library study spaces (see Appendix A). Two different scenes for each type of space (Green, Built, No View, Plant) were used to minimize the likelihood that results are dependent on a specific scene (see Appendix E).

Participants were undergraduate students from two campuses, Emporia State University (Kansas) and Washington State University Vancouver (Washington) and data were collected between September and December 2013. Participants from Kansas were students drawn from the Psychology Participant Pool who were required to participate in research studies as part of their assigned coursework. I asked each student to respond to all four components of the RPRS (Coherence, Compatibility, Being Away, and Fascination) during the session. Because there was no participant pool in Washington, participants were drawn from students enrolled in specific undergraduate courses and from volunteers answering campus advertisements for study participants. A two-pronged approach was used in Washington because of the general difficulty in recruiting participants on that campus.

For Hypothesis 2, I administered the Preference and Compatibility Scale (PCS) (Herzog et al., 2011a) to participants from two universities who viewed a similar set of slides as described above (see Appendix B). Data were collected between September

2013 and February 2014. Three different scenes for each type were used to minimize the likelihood that results are dependent on a specific scene (see Appendix E). Participants were undergraduate students from two campuses, Kansas and Washington. Kansas participants were from the Psychology Participant Pool and Washington participants, for reasons stated above, were recruited through announcements in courses and campus advertisements. I conducted all sessions except for two Kansas sessions that were conducted by a psychology graduate student who had observed earlier sessions which I had conducted.

Although the populations from which both the RPRS and PCS samples were drawn were undergraduate students at ESU and WSUV, the samples were made up of different students. This was in order to minimize fatigue (the RPRS took 40 minutes to complete) and reduce the exposure effect from one instrument to the other. Because this study is a requirement of the PhD program at Emporia State University and was administered at Emporia State and at Washington State University Vancouver, IRB approval was obtained from both institutions and included instruments and scripts found in the appendices (see Appendices A - H).

Population and Sampling

Hypothesis 1. The population for Hypothesis 1 was the undergraduate students at Emporia State University (Kansas) and Washington State University Vancouver (Washington) and representativeness was determined based on the following strata: age, gender, major, and transfer vs. 4-year. Although the distinction between four-year and transfer students is not significant in Kansas, the undergraduate population on the Washington campus is bifurcated into two distinct types of students. The students who enroll as freshmen, intending to be 4-year students, compose about 16% of the undergraduate study body and are much more like the traditional college student: younger, unmarried, having no children, and enrolled full-time. The transfer students who compose about 84% of the undergraduate study body are mostly non-traditional students: older, married or divorced, having children, and enrolled part-time. The sampling frame for students in Kansas was undergraduate students who were in the Psychology Participant Pool and who volunteered to participate.

No clear guidelines exist for the minimum sample size needed to obtain adequate power for ordinal-level data. However, Blaikie (2003) noted that the requirements are less than for nominal-level data. His recommendation for nominal-level data is to strive for a sample size of 10 for each cell of a cross-tabulation. With the four factors (Coherence, Compatibility, Being Away, Fascination) of ART and four situations depicted in the photos, I have 16 cells, and therefore, wanted and obtained an *N* of 160 participants.

The sample consisted of 160 undergraduate students from two universities, one being a larger, residential teaching institution in Kansas (n = 105) and one being a small, commuter, research-driven campus in Washington (n = 55). In Kansas, participation fulfilled a course requirement in a variety of psychology courses and in Washington, participation was part of an in-class exercise or an extra-curricular, voluntary exercise for extra credit. A total of 8 sessions with the number of participants for each session ranging from 2 to 18 were held in Kansas. In Washington, two in-class sessions were held with the number of participants being 40 and seven. In addition, there were seven individually scheduled sessions with attendance of one or two participants per session (see Table 3.1). Numerous sessions for a small number of participants were held on the Washington campus because it is difficult to finds times when a larger number of students is available on a small, commuter campus.

Table 3.1

Demographic Characteristics of Participants in the RPRS

Kansas (*n* = 105)			Washington (*n* = 55)		
Characteristic	*n*	%	Characteristic	*n*	%
Age			Age		
24 or under	99	94%	24 or under	33	60%
Over 24	6	6%	Over 24	22	40%
Gender			Gender		
Female	87	83%	Female	38	69%
Male	16	15%	Male	17	31%
Transfer Status			Transfer Status		
Start as freshman	95	91%	Start as freshman	11	20%
Transfer	10	10%	Transfer	44	80%
Library Use			Library Use		
4 times/semester or less	23	22%	4 times/semester or less	16	29%
1-4 times/month	62	59%	1-4 times/month	21	38%
More than 1 time/week	19	18%	More than 1 time/week	18	33%
Study Space Preference*			Study Space Preference*		
Dorm room	86	82%	At home	36	66%
ESU Library	45	43%	WSUV Library	25	46%
Coffee shop	15	14%	Coffee shop	5	9%
Campus Social Area	5	5%	Campus Social Area	1	2%

*Multiple answers allowed.

Hypothesis 2. The population for Hypothesis 2 was the undergraduate students in Kansas and Washington and representativeness was determined based on the following strata: age, gender, major, and transfer vs. four-year. The sampling frame for students in Kansas was undergraduate students who were in the Psychology Participant Pool and who volunteered to participate. The number of students asked to participate exceeded 50 participants with the final *n* being 50. The sampling frame for students in Washington was the students who volunteered to participate as recruited through campus advertisements and students enrolled in specific courses.

Using the same guidelines for sample size as I used for Hypothesis 1, I have eight cells and therefore wanted an *N* of at least 80. Students were only allowed to participate in either the RPRS study or the PCS study but not both for two reasons. The first reason was possible fatigue since both experiments are lengthy and the second was to eliminate the effect that the first experiment could have on the responses of the one that follows.

The sample consisted of 83 undergraduate students from the same two universities with an *n* of 50 in Kansas and an *n* of 33 in Washington. In Kansas, participation fulfilled a course requirement in a variety of psychology courses, and in Washington, participation was part of an in-class exercise or an extra-curricular, voluntary exercise for extra credit. In Kansas, a total of four sessions were held with the number of participants ranging from three to 25. One in-class session was held in Vancouver with 20 participants and four other sessions were scheduled with one or two participants per session (see Table 3.2).

Table 3.2

Demographic Characteristics of Participants in the PCS

Kansas (*n* = 50)			Washington (*n* = 33)		
Characteristic	*n*	%	Characteristic	*n*	%
Age			Age		
24 or under	50	100%	24 or under	19	58%
Over 24	0		Over 24	14	42%
Gender			Gender		
Female	36	72%	Female	15	55%
Male	14	28%	Male	18	46%
Transfer Status			Transfer Status		
Start as freshman	44	88%	Start as freshman	3	9%
Transfer	6	12%	Transfer	30	91%
Library Use			Library Use		
4 times/semester or less	14	28%	4 times/semester or less	18	55%
1-4 times/month	20	40%	1-4 times/month	9	27%
More than 1 time/week	16	32%	More than 1 time/week	6	18%
Study Space Preference*			Study Space Preference*		
Dorm room	33	66%	At home	27	82%
ESU Library	23	46%	WSUV Library	9	27%
Coffee shop	7	14%	Coffee shop	7	21%
Campus Social Area	5	10%	Campus Social Area	0	

*Multiple answers allowed.

Instruments

RPRS. The RPRS (Hartig, Kaiser, & Bowler, 1997) is designed to measure whether or not a particular setting is perceived as restorative (see Appendix A). As such it has four separate components, Coherence, Compatibility, Being Away, and Fascination that work together to determine the restorativeness of any setting. The measure is made up of four separate 5-point Likert subscales, one each for Coherence, Compatibility, Being Away, and Fascination. The number of questions for each subscale varies from subscale to subscale with the minimum of four to the maximum of nine questions. Each participant completed all four subscales for slides depicting each of the four different types of library study spaces (Green, Built, No View, Plant). Based on the results of preliminary tests, I designed the instrument so that participants completed one subscale for all slides before moving to the next subscale and viewing the same slides in a different order.

PCS. The version of the PCS (see Appendix B) used in this research is slightly revised from the version used by Herzog and his fellow researchers (2011a). In addition to the two subscales they used, eight questions to measure preference and eight questions to measure compatibility with goals, I added two questions to make a total of eighteen questions. These questions were to measure whether or not each environment encourages students to go more often and/or linger longer in the study spaces depicted. Each participant completed the eighteen 7-point Likert scale questions for each of the fifteen slides that depicted the four different types of library study spaces (Green, Built, No View, Plant).

Demographic survey. Participants in both studies also answered a nine question demographic survey (See Appendices C and D). Eight of the nine questions were designed to elicit basic information such as age, major, and frequency of library use. The last question was an open-ended question asking participants to describe the main features of their favorite study spaces. All questions were analyzed quantitatively. However, the first steps in the analysis of the data from the open-ended question followed procedures for qualitative data analysis. After reading all responses several times, I developed categories that represented main themes derived from the data itself. I then read all responses again to insure that the categories were representative of all of the main themes. After I was confident of the categories, I chose those that related to this research and coded the responses based on these categories. Categories not related to this research (e.g., A small number of participants mentioned access to food as a feature) were discarded. I then analyzed these coded responses statistically.

Reliability and Validity

Reliability of quantitative tools. According to Bryman (2008), reliability in quantitative research involves stability, internal reliability, and inter-observer consistency. For this research, inter-observer consistency did not apply. The stability and internal reliability of the Revised Perceived Restorativeness Scale (RPRS) can be found in the numerous studies that were conducted to develop the scale and the studies that have been conducted using the scale, results of which support each other. Kaplan and Talbot (1983) began developing the four concepts of ART, which the RPRS is based on in early psychological tests on students participating in wilderness experiences. Hartig and others (Hartig, Mang & Evans, 1991; Hartig, Korpela, Evans & Garling, 1997) then went on to develop and test the original version of the scale in four experiments. They also tested both the measurement and construct validity of ART and correlated the Perceived Restorativeness Scale results with other types of tests. Hartig, Kaiser, & Bowler (1997) revised the scale based on reliability and validity concerns that came up in the four studies and then tested the revised scale. Since then, the RPRS has been used successfully by other researchers including White & Gatersleben (2011) and Han (2010). Internal reliability can be measured using either the split-half or the Cronbach's Alpha test. For this study, I performed the Cronbach's Alpha test to determine the internal consistency of each of the subscales. The Cronbach's alphas for all four subscales exceed .90, which indicates a high level of internal consistency for each subscale (see Table 3.3).

The reliability of the PSC is not as well documented as it is with the RPRS since it was developed in 2009 and has only been used once previously. However, the researchers did test for internal reliability by computing coefficient alpha for Preference and Compatibility separately. Coefficients for Preference "ranged from .92 to .96." Coefficients for Compatibility "ranged from .88 to .98 in seven" of the eight conditions of the experiment. The researchers could find "no apparent reason for the one discrepant reliability coefficient" (Herzog et al., 2011a, p. 97). For this study, I performed the Cronbach's Alpha test to determine the internal consistency of each of the subscales. The Cronbach's alphas for both subscales exceed .90, which indicates a high level of internal consistency for each subscale (see Table 3.4).

Table 3.3

Internal Consistency for the Subscales of the RPRS using Cronbach's Alpha

Coherence (*n* = 4 and α = .92)		Being Away (*n* = 5 and α = .91)	
Item	Cronbach's Alpha if Item Deleted	Item	Cronbach's Alpha if Item Deleted
Question 1	.88	Question 1	.89
Question 2	.91	Question 2	.89
Question 3	.90	Question 3	.87
Question 4	.87	Question 4	.91
		Question 5	.89
Compatibility (*n* = 9 and α = .92)		Fascination (*n* = 8 and α = .94)	
Item	Cronbach's Alpha if Item Deleted	Item	Cronbach's Alpha if Item Deleted
Question 1	.91	Question 1	.92
Question 2	.90	Question 2	.92
Question 3	.90	Question 3	.93
Question 4	.91	Question 4	.92
Question 5	.91	Question 5	.93
Question 6	.91	Question 6	.94
Question 7	.91	Question 7	.93
Question 8	.91	Question 8	.94
Question 9	.92		

Table 3.4

Internal Consistency for the Subscales of the PCS using Cronbach's Alpha

Preference (n = 8 and α = .95)		Compatibility (n = 8 and α = .97)	
Item	Cronbach's Alpha if Item Deleted	Item	Cronbach's Alpha if Item Deleted
Question 1	.94	Question 1	.96
Question 2	.94	Question 2	.97
Question 3	.94	Question 3	.96
Question 4	.94	Question 4	.96
Question 5	.95	Question 5	.96
Question 6	.95	Question 6	.96
Question 7	.95	Question 7	.96
Question 8	.94	Question 8	.96

Validity of quantitative tools. Validity in research can be examined in general and then examined specifically in reference to the measurement used. In general, both external and ecological validity should be considered (Powell, 2004; Bryman, 2008). Whether the results of my study will be generalizable, and thus have external validity, is not clear. Through the sampling methods as described above, I will be able to support my results being generalizable to the entire undergraduate population at WSUV and, potentially, to the undergraduate population at ESU. It may be true that the results will also be generalizable to other institutions with populations similar to those at WSUV and ESU. However, more testing may be needed to establish external validity beyond these specific populations (see chapter 5).

Ecological validity, the question of whether laboratory results are applicable to real-life settings, is also very important to the external validity of this study. It is important to note common vocabulary used in environmental psychology. Three terms are essential: static simulations, dynamic simulations, and onsite. Static simulations refer to laboratory settings using slides or pictures to simulate a particular environment, dynamic simulations refer to laboratory settings using video or computer-enhanced 3-D simulations, and onsite refers to the actual, real-life environments (Bosselmann, Craik & Craik, 1987). An early collection of studies has shown that static simulations, using color slides, have strong congruence (+.70 to +.95) with onsite findings (Bosselmann, Craik & Craik, 1987). In a 2010 systematic review on how well static and dynamic simulations compare to onsite findings, the validity of simulations, both static and dynamic, were so high the researcher reached the conclusion that there is no significant differences among the three (Stamps, 2010). Stamps concluded that the mode (type of simulation or onsite) is not as important as such factors as the participants' prior familiarity with a setting and the personal characteristics and socio-demographic factors of participants. Amedeo, Golledge, and Stimson (2009), Bosselmann, Craik and Craik (1987), and Stamps (2010) all agree that the biggest advantage of simulations is the minimization of many confounding variables found onsite.

The validity of a specific instrument can be determined by face, construct, concurrent, and predictive validity. Is there reason to believe that the RPRS is internally valid and will measure a causal relationship between the presence or absence of greenery and directed attention? Within the environmental psychology literature the answer is yes. ART has been developed over a thirty-year span and the RPRS has been used multiple times with positive results. Face validity is found in the fact that major researchers (e.g. Stephen Kaplan, Rachel Kaplan, Terry Hartig, T.R. Herzog) in the field of environmental psychology respect the scale.

Concerning construct and concurrent validity, Hartig, et al. (1991) tested a preliminary version of a perceived restorative scale. They found that the scale "differentiated in the expected manner between the environments under study" and that the scores "reliably correlated with self-reported emotions and proofreading performance" (Hartig, Korpela, Evans & Garling, 1997, p. 176). While the RPRS has only been under development since 1991, the fact that multiple researchers have successfully used the scale with predictable outcomes from 1991 to as recently as 2011 is strong evidence of its predictive validity (Han, 2010; Hartig, et al., 1991; Hartig, Kaiser & Bowler, 1997; Hartig, Korpela, Evans & Garling, 1997; White & Gatersleben, 2011). Although the Perceived Restorativeness Scale has been the most used scale in ART research, other researchers have developed their own scales for measuring the restorativeness of environments (see Han, 2003; Herzog et al., 2003; Laumann, Garling, & Stormark, 2001; Ouellette, Kaplan, & Kaplan, 2005). While these studies point out some specific issues with scale development, none of the results lead to questioning the causal relationship between environments and directed attention.

The validity of the PCS is, once again, less assured than it is for the RPRS because of its shorter history. Concerning face validity, PCS was developed by an experienced researcher, Thomas Herzog, who has spent the last fifteen years defining restorative environments (see entries under Herzog in References). Construct validity of the PCS can be inferred from Herzog's et al. results. When the participant's goal (i.e., entertainment) fit the setting (i.e. a nightclub), the preference rating was always higher than when the goal did not fit the setting (Herzog, et al., 2011a). My research has assisted in the determination of the concurrent validity of this scale by comparing the results of the RPRS and the PCS (see chapter 5).

Static Simulation

RPRS. All sessions began with the mandatory explanation of the research and the voluntary nature of participation. All attendees decided to continue, signed consent forms, and received a 42-page booklet consisting of a title page, 36 pages of scales (one for each slide they would be shown), and a two-page demographic survey. The booklet also contained three section dividers to provide a distinguishable break for participants when subscales changed. Because I was concerned about fatigue due to the length and repetitiveness of this instrument, I created two different sets of booklets. I reversed the order of the scales in half of the booklets so that I could compare the results to see if results differed based on whether that particular scale was administered at the beginning or the end of the session. There were no statistically significant ($p < .05$) differences between the two groups in terms of the RPRS scores (see Table 3.5).

Table 3.5

Kruskal Wallis Test: Significance of Differences based on Question Order.

View	Chi-Square	*df*	*p*
Green	0.03	1	.87
Built	0.00	1	.97
No View	0.17	1	.69
Plant	0.37	1	.54

Booklets were distributed so that half of the participants in each session received one order and half the other. I verbally reviewed the prompt, which was located on each page of the booklet, with all participants. This prompt provided the scenario that participants should have had in mind as they answered the questions for each slide:

> Think about class work that you have to do – reading your textbook or reviewing your notes for an exam. You have time between your classes to do this and you decide to go to the Library. For each picture imagine that you are sitting in that area to do your work.

Once all participants indicated that they were ready to begin, I started the slideshow. Based on results of instrument testing, the first slide for each section of the instrument displayed for a longer period of time and depicted a scene that was not part of the study. The timing for all remaining slides in each section varied from section to section depending on the number of questions for each subscale. For example, slides with four questions per slide displayed for 45 seconds while slides with nine questions per slide displayed for 60 seconds. In each section, slides depicting each of the four types of library study areas (Green, Built, No View, Plant) were randomly ordered with the exception of the first slides that were not used in the study. Each type of library study area was represented by two slides depicting two different spaces to limit the possibility that responses were dependent on one particular space. The last slide instructed participants to complete the demographic survey at the end of the booklet.

PCS. All sessions began with the mandatory explanation of the research and the voluntary nature of participation. All attendees decided to continue, signed consent forms, and received a 19-page booklet consisting of a title page, a page providing the prompt for all slides, 15 pages of scales (one for each slide they would be shown), and a two-page demographic survey. The page containing the prompt was yellow or green (depending on the campus) so that participants could easily refer back to it if needed. I verbally went over the prompt. This prompt provided the scenario that participants should have in mind as they answered the questions for each slide:

> Think about class work that you have to do – reading your textbook or reviewing your notes for an exam. You have time between your classes to do this and you decide to go to the Library. For each picture imagine that you are sitting in that area to do your work.

Once all participants indicated that they were ready to begin, I started the slideshow. Based on results of instrument testing, each slide displayed for 75 seconds. The first slide was not used in the study. All other slides depicting the four types of library study areas (Green, Built, No View, Plant) and two slides of no interest to the study were displayed in random order. Each type of library study area was represented by three slides depicting three different spaces to limit the possibility that responses were dependent on one particular space. Two slides for each type of study area were the same slides as used in the RPRS study. An additional slide for each type of space was added to this study since the instrument was shorter. The last slide instructed participants to complete the demographic survey that made up the last two pages of the booklet.

Data Analysis

Ordinal-level data. The RPRS and PCS are Likert scale instruments. As such, I have treated the data gathered as ordinal-level data even though this may not be the standard for much attitude-based Likert scale research (Gob, McCollin, & Ramalhoto, 2007). Ordinal-level data recognizes that response categories can be ranked but the interval between categories is of unknown size and, thus, cannot be assumed to be equal (as interval level data would require). Several good arguments exist for treating Likert scale data as ordinal-level data. In an experiment by Hart (1996), when students were asked to assign magnitudes to attitudes about TV programs that were interpreted on a Likert scale as *atrocious, very bad, bad, so-so, good, very good,* and *excellent,* the distances between weights were not consistent. For example, there was a .6 difference between atrocious to very bad and a 1.9 difference between so-so and good. This is a good example of how the intervals between categories are not necessarily consistent.

Another good reason for treating Likert scale data as ordinal-level data is to strengthen the interpersonal comparability of attitude-based measures. Gob et al. (2007) provides an illustrative example. If Likert scale data is treated as interval data, when a participant reports a satisfaction of two on the first round of testing and a four on the second round of testing, then one must conclude that this participant's satisfaction has doubled. However, treating the data as ordinal-level data, one concludes that the participant's satisfaction has increased from the second to the fourth position. In attitude-based research, it is easier to argue the comparability of this conclusion across participants than it is to argue the comparability of the former conclusion. As appropriate for ordinal-level data, I used the median as the measure of central tendency and frequencies of response in each category to describe the data (Blaikie, 2003).

Scoring. Since each subscale of both the RPRS and PCS contain multiple questions, I added the scores provided by each participant together to determine the composite score for each subscale. I used this composite score (sum of all question scores for each subscale) in all subsequent calculations. For example, if participant one answered 2, 3, 2, 1 on the four questions that make up the composite Coherence subscale for the first slide depicting a Green view and 3, 3, 3, 2 for the second slide depicting a Green view, then that participant's Coherence score for Green views is 19 (2+3+2+1+3+3+3+2).

Some questions within both instruments are negatively worded. Therefore I reversed the scores for those questions.

Qualitative data. The last question on the Demographic Survey (see Appendices C and D) was an open-ended question asking participants to describe the main features of their favorite space for studying. The first steps in the analysis of this data followed procedures for qualitative data analysis. After reading all responses several times, I developed categories that represented main themes derived from the data itself. I then read all responses again to insure that the categories were representative of all of the main themes. After I was confident of the categories, I coded the responses based on these categories. I then analyzed these coded responses statistically.

Chapter Four

Results

Introduction

The findings from this study are primarily quantitative, derived from data collected through the use of two measures and a demographic survey. The participants were undergraduate students at a small metropolitan commuter campus predominately comprised of non-traditional students and traditional-aged undergraduate students at a larger midwestern regional institution. The following hypotheses evolved from my research question:

$H1_0$: Including greenery in library study spaces has no perceived effect on the likelihood of restoring directed attention.

H1: Including greenery in library study spaces is perceived to affect the liklihood of restoring directed attention.

$H2_0$: Greenery enhanced library study spaces are not perceived to be conducive to the successful attainment of study goals.

H2: Greenery enhanced library study spaces are perceived to be conducive to the successful attainment of study goals.

To test these hypotheses I used a quantitative, laboratory approach employing static simulations. The participants viewed slides, projected on a large screen, of various library study spaces and either completed the Revised Perceived Restorativeness Scale (RPRS) or the Perception and Compatibility Scale (PCS) for each slide (see Appendices A and B). Each participant also completed a short demographic survey (see Appendices C and D). Scenarios depicted in the slides represented four types of library study areas (see Appendix E for examples):

Areas with a window view to green spaces (Green),

Areas with indoor plants (Plant),

Areas with a window view to man-made structures (buildings, parking lots, etc.) (Built), and

Areas with no windows and no indoor plants (No View).

Analysis

Correlations of RPRS subscales. As discussed in chapter 3, I decided to treat the data derived from both of the Likert scale instruments as ordinal-level data. Therefore, I used Spearman's rho to test the relationship between the subscales in each of the instruments to see if they related to each other as expected. In other words, I investigated the question: Is there a relationship between the four subscales or variables in the RPRS and, if so, what direction is this relationship? Results indicate a moderate positive relationship that is statistically significant ($p < .001$) between the three subscales Compatibility, Being Away, and Fascination for all four types of views (see Table 4.1). The way in which the Coherence subscale relates to the other three is less clear. Most relationships are low to moderate, negative, and statistically significant ($p < .05$; see Table 4.2).

Table 4.1

Spearman's rho: Correlations between 3 Subscales of the RPRS

Subscales	Compatibility	Being Away	Fascination
Green			
Compatibility	-	.50	.47
Being Away	.50	-	.42
Fascination	.47	.42	-
Built			
Compatibility	-	.41	.42
Being Away	.41	-	.31
Fascination	.42	.31	-
No View			
Compatibility	-	.40	.34
Being Away	.40	-	.34
Fascination	.34	.34	-
Plant			
Compatibility	-	.62	.49
Being Away	.62	-	.45
Fascination	.49	.45	-

Note. All are significant at $p < .001$

Table 4.2

Spearman's rho: Correlations for the Coherence Subscale of the RPRS

Subscale	Compatibility		Being Away		Fascination	
	Coefficient	*p*	Coefficient	*p*	Coefficient	*p*
Green Coherence	-.26	.001	-.29	.001	-.04	.63
Built Coherence	-.07	.37	-.27	.001	.00	.98
No View Coherence	-.27	.001	-.32	.001	.13	.11
Plant Coherence	-.27	.001	-.28	.001	.12	.14

Correlations of PCS subscales. The PCS is also a Likert scale instrument, and therefore, I used Spearman's rho to test the relationship between its subscales. Again I asked the question: Is there a relationship between the two subscales and the two additional questions and, if so, what direction is this relationship? Results indicate a strong positive relationship that is statistically significant ($p < .001$) between the two subscales, Preference and Compatiblity, and between theses subscales and the additional questions for all four types of views (see Table 4.3).

Table 4.3

Spearman's rho: Correlations for the Subscales of the PCS

Subscales	Preference	Compatibility	Come More Often	Stay Longer
Green				
Preference	-	.90	.89	.86
Compatibility	.90	-	.81	.80
Come More Often	.89	.81	-	.97
Stay Longer	.86	.80	.97	-
Built				
Preference	-	.86	.84	.77
Compatibility	.86	-	.79	.72
Come More Often	.84	.79	-	.95
Stay Longer	.77	.72	.95	-
No View				
Preference	-	.87	.81	.84
Compatibility	.87	-	.72	.73
Come More Often	.81	.72	-	.95
Stay Longer	.84	.73	.95	-
Plant				
Preference	-	.87	.79	.76
Compatibility	.87	-	.67	.59
Come More Often	.79	.67	-	.91
Stay Longer	.76	.59	.91	-

Note. All are significant at $p < .001$

Hypothesis testing. Both null hypotheses were tested. The data from the RPRS was used to test the first null hypothesis and the data from the PCS was used to test the second null hypothesis.

Null hypothesis 1. Including greenery in library study spaces has no perceived effect on the likelihood of restoring directed attention. In order to test $H1_0$, I first performed the Friedman ANOVA by Ranks test on data from the RPRS. There was a statistically significant difference between the four types of library study spaces on the overall RPRS and on all four subscales of restoration:

Overall RPRS, $\chi^2(3, n = 160) = 115.97$, $p < .001$,

Coherence, $\chi^2(3, n = 160) = 124.60$, $p < .001$,

Compatibility, $\chi^2(3, n = 160) = 75.46$, $p < .001$,

Being Away, $\chi^2(3, n = 160) = 94.67$, $p < .001$, and

Fascination, $\chi^2(3, n = 160) = 124.79$, $p < .001$.

Since the Friedman test is only able to show that a difference exists but not where that difference is, I calculated the medians and interquartile ranges for the overall RPRS and each subscale and type of view and performed Wilcoxon tests to compare the different pairs of views (see Tables 4.4 - 4.8). The null hypothesis is rejected for 21 of the 24 comparisons ($p < .05$). The null hypothesis is retained for three comparisons ($p > .05$): Green Coherence vs. Built Coherence, No View Compatibility vs. Plant Compatibility, and Built Fascination vs. No View Fascination.

Table 4.4

Differences in Overall RPRS as detailed in Paired Comparisons

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	z	Comparisons (*N* = 160)	*p*
Green	146.00	168.00	189.75			
to				8.04	38 scored Green lower 118 scored Green higher	.001
Built	125.25	144.00	164.00			
Green	146.00	168.00	189.75			
to				7.58	34 scored Green lower 124 scored Green higher	.001
No View	120.00	141.50	162.00			
Green	146.00	168.00	189.75			
to				8.71	26 scored Green lower 133 scored Green higher	.001
Plant	111.00	134.00	156.00			
Built	125.25	144.00	164.00			
to				1.31	73 scored Built lower 86 scored Built higher	.19
No View	120.00	141.50	162.00			
Built	125.25	144.00	164.00			
to				4.26	53 scored Built lower 107 scored Built higher	.001
Plant	111.00	134.00	156.00			
No View	120.00	141.50	162.00			
to				4.32	55 scored NoView lower 100 scored No View higher	.001
Plant	111.00	134.00	156.00			

Table 4.5

Differences in the Coherence Subscale of the RPRS as detailed in Paired Comparisons

	Interquartile Range			**Wilcoxon Tests**		
	25th	Median	75th	*z*	Comparisons (N = 83)	*p*
Coherence						
Green	8	11	16.75			
to				0.08	63 scored Green lower 62 scored Green higher	.94
Built	9	12	16.75			
Green	8	11	16.75			
to				7.85	124 scored Green lower 20 scored Green higher	.001
NoView	11.25	17	24.75			
Green	8	11	16.75			
to				2.42	81 scored Green lower 55 scored Green higher	.02
Plant	10	13	19			
Built	9	12	16.75			
to				8.38	122 scored Built lower 22 scored Built higher	.001
NoView	11.25	17	24.75			
Built	9	12	16.75			
to				3.19	87 scored Built lower 47 scored Built higher	.001
Plant	10	13	19			
NoView	11.25	17	24.75			
to				7.43	30 scored NoView lower 112 scored NoView higher	.001
Plant	10	13	19			

Table 4.6

Differences in the Compatibility Subscale of the RPRS as detailed in Paired Comparisons

	Interquartile Range				**Wilcoxon Tests**	
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Compatibility						
Green	53	66.5	74			
to				6.15	44 scored Green lower 107 scored Green higher	.001
Built	46	58.5	67			
Green	53	66.5	74			
to				7.51	41 scored Green lower 117 scored Green higher	.001
NoView	43	52	62			
Green	53	66.5	74			
to				7.37	35 scored Green lower 121 scored Green higher	.001
Plant	42.25	52	64			
Built	46	58.5	67			
to				3.13	60 scored Built lower 92 scored Built higher	.00
NoView	43	52	62			
Built	46	58.5	67			
to				2.81	56 scored Built lower 96 scored Built higher	.01
Plant	42.25	52	64			
NoView	43	52	62			
to				0.27	75 scored NoView lower 77 scored NoView higher	.79
Plant	42.25	52	64			

Table 4.7

Differences in the Being Away Subscale of the RPRS as detailed in Paired Comparisons

	Interquartile Range			**Wilcoxon Tests**		
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Being Away						
Green	27	33.5	40			
to				3.79	49 scored Green lower 98 scored Green higher	.001
Built	25	30.5	35			
Green	27	33.5	40			
to				8.07	29 scored Green lower 124 scored Green higher	.001
NoView	18	24.5	31			
Green	27	33.5	40			
to				6.07	45 scored Green lower 106 scored Green higher	.001
Plant	20	26.5	33.75			
Built	25	30.5	35			
to				6.21	41 scored Built lower 114 scored Built higher	.001
NoView	18	24.5	31			
Built	25	30.5	35			
to				3.70	53 scored Built lower 97 scored Built higher	.001
Plant	20	26.5	33.75			
NoView	18	24.5	31			
to				3.85	97 scored NoView lower 48 scored NoView higher	.001
Plant	20	26.5	33.75			

Table 4.8

Differences in the Fascination Subscale of the RPRS as detailed in Paired Comparisons

	Interquartile Range				Wilcoxon Tests	
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Fascination						
Green	48	56	67			
to				8.5	33 scored Green lower 123 scored Green higher	.001
Built	37	45	53			
Green	48	56	67			
to				6.57	41 scored Green lower 114 scored Green higher	.001
NoView	36	46	56			
Green	48	56	67			
to				8.99	24 scored Green lower 132 scored Green higher	.001
Plant	29	39	49.75			
Built	37	45	53			
to				0.25	81 scored Built lower 73 scored Built higher	.80
NoView	36	46	56			
Built	37	45	53			
to				4.42	48 scored Built lower 107 scored Built higher	.001
Plant	29	39	49.75			
NoView	36	46	56			
to				6.56	41 scored NoView lower 109 scored NoView higher	.001
Plant	29	39	49.75			

Null hypothesis 2. Greenery enhanced library study spaces are not perceived to be conducive to the successful attainment of study goals. In order to test $H2_0$, I first performed the Friedman ANOVA by Ranks test on data from the PCS. As reported in Tables 4.9 through 4.13, results show a statistically significant difference between the four types of library study spaces on the overall PCS, on the two subscales, and on the two additional questions (Come More Often and Stay Longer):

Overall PCS, $\chi^2(3, n = 83) = 102.51, p < .001$,

Preference, $\chi^2(3, n = 83) = 110.52, p < .001$,

Compatibility, $\chi^2(3, n = 83) = 73.01, p < .001$,

Come More Often, $\chi^2(3, n = 83) = 93.74, p < .001$, and

Stay Longer, $\chi^2(3, n = 83) = 94.69, p < .001$.

Therefore the null hypothesis is rejected.

Since the Friedman test is only able to show that a difference exists but not where that difference is, I calculated the medians and interquartile ranges for both the overall PCS and for each subscale and type of view and performed Wilcoxon tests to compare the different pairs of views (see Tables 4.9 – 4.13). The null hypothesis is rejected for 17 of the 24 comparisons ($p < .05$). The null hypothesis is rejected for all 12 comparisons comparing the Green view to all other views on all subscales. In addition, 5 other comparisons demonstrate significance. The null hypothesis is retained for the 7 other comparisons ($p > .05$; see Tables 4.10 – 4.13).

Table 4.9

Differences on the Overall PCS as detailed in Paired Comparisons

	Interquartile Range				Wilcoxon Tests	
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Green	258	295	326			
to				7.62	5 scored Green lower 78 scored Green higher	.001
Built	202.00	237	266			
Green	258	295	326			
to				6.65	8 scored Green lower 75 scored Green higher	.001
No View	193	233	282			
Green	258	295	326			
to				6.83	10 scored Green lower 73 scored Green higher	.001
Plant	208	243	274			
Built	202.00	237	266			
to				0.25	38 scored Built lower 41 scored Built higher	0.81
No View	193	233	282			
Built	202.00	237	266			
to				1.66	51 scored Built lower 31 scored Built higher	0.1
Plant	208	243	274			
No View	193	233	282			
to				0.95	44 scored No View lower 39 scored No View higher	0.34
Plant	208	243	274			

Table 4.10

Differences in the Preference Subscale of the PCS as detailed in Paired Comparisons

	Interquartile Range			**Wilcoxon Tests**		
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Preference						
Green	117	139	146			
to				7.65	6 scored Green lower 77 scored Green higher	.001
Built	83	107	120			
Green	117	139	146			
to				7.01	7 scored Green lower 76 scored Green higher	.001
No View	83	101	120			
Green	117	139	146			
to				6.72	8 scored Green lower 73 scored Green higher	.001
Plant	97	111	124			
Built	83	107	120			
to				1.02	36 scored Built lower 44 scored Built higher	0.31
No View	83	101	120			
Built	83	107	120			
to				2.3	50 scored Built lower 31 scored Built higher	0.02
Plant	97	111	124			
No View	83	101	120			
to				3.55	57 scored NoView lower 26 scored NoView higher	.001
Plant	97	111	124			

Table 4.11

Differences in the Compatibility Subscale of the PCS as detailed in Paired Comparisons

	Interquartile Range			**Wilcoxon Tests**		
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Compatibility						
Green	112	131	146			
to				7.19	8 scored Green lower 73 scored Green higher	.001
Built	92	110	122			
Green	112	131	146			
to				4.56	22 scored Green lower 57 scored Green higher	.001
No View	95	114	134			
Green	112	131	146			
to				6.24	14 scored Green lower 69 scored Green higher	.001
Plant	96	111	125			
Built	92	110	122			
to				2.48	53 scored Built lower 28 scored Built higher	0.01
No View	95	114	134			
Built	92	110	122			
to				1.13	45 scored Built lower 36 scored Built higher	0.26
Plant	96	111	125			
No View	95	114	134			
to				2.12	26 scored NoView lower 55 scored NoView higher	0.03
Plant	96	111	125			

Table 4.12

Differences in the Come More Often Subscale of the PCS as detailed in Paired Comparisons

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Come More Often						
Green	13	16	18			
to				7.06	6 scored Green lower 71 scored Green higher	.001
Built	8	11	13			
Green	13	16	18			
to				6.87	8 scored Green lower 70 scored Green higher	.001
No View	7	10	13			
Green	13	16	18			
to				6.97	8 scored Green lower 71 scored Green higher	.001
Plant	9	11	13			
Built	8	11	13			
to				1.15	35 scored Built lower 40 scored Built higher	0.25
No View	7	10	13			
Built	8	11	13			
to				0.5	40 scored Built lower 33 scored Built higher	0.62
Plant	9	11	13			
No View	7	10	13			
to				1.95	44 scored NoView lower 29 scored NoView higher	0.05
Plant	9	11	13			

Table 4.13

Differences in the Stay Longer Subscale of the PCS as detailed in Paired Comparisons

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	*z*	Comparisons (*N* = 83)	*p*
Stay Longer						
Green	12.75	15	18			
to				6.92	7 scored Green lower 70 scored Green higher	.001
Built	8	10	13			
Green	12.75	15	18			
to				6.94	8 scored Green lower 72 scored Green higher	.001
No View	7	9	12.25			
Green	12.75	15	18			
to				6.77	8 scored Green lower 69 scored Green higher	.001
Plant	8.75	11	13			
Built	8	10	13			
to				1.42	34 scored Built lower 44 scored Built higher	0.16
No View	7	9	12.25			
Built	8	10	13			
to				0.58	41 scored Built lower 35 scored Built higher	0.56
Plant	8.75	11	13			
No View	7	9	12.25			
to				2.4	49 scored NoView lower 26 scored NoView higher	0.02
Plant	8.75	11	13			

Demographic differences. After hypothesis testing on the sample populations as a whole, I looked for significant differences in the results based on the following demographic variables: campus affiliation, gender, age, transfer status, frequency of library use, and study space preference. Disability, major, and regular use of another library were not analyzed because of insufficient sample sizes within these variables. I used the Kruskal-Wallis test to see if results significantly ($p < .05$) differed based on participant characteristics. There was almost no significant difference based on gender, transfer status, or frequency of library use from either instrument. One exception is the significant difference in the RPRS score in the No View correlation based on Gender with women scoring higher than mean (see Table 4.14). There were statistically significant differences between the RPRS and PCS scores based on campus affiliation and age, but these differences were restricted to specific views (see Tables 4.19 and 4.20). For overall RPRS and PCS scores for each campus see Tables 4.15 through 4.18.

Table 4.14

Kruskal Wallis Tests: Differences based on Gender, Transfer Status, and Frequency of Library Use

RPRS				PCS			
	Chi-Square	*df*	*p*		Chi-Square	*df*	*p*
Gender				Gender			
Green	1.95	1	.16	Green	0.6	1	0.44
Built	0.19	1	.66	Built	0.4	1	0.53
No View*	3.71	1	.05	No View	0.27	1	0.61
Plant	1.48	1	.22	Plant	1.1	1	0.3
Transfer Status				Transfer Status			
Green	0.35	1	.56	Green	1.23	1	0.26
Built	0.06	1	.81	Built	0.06	1	0.81
No View	2.11	1	.15	No View	0.07	1	0.79
Plant	1.30	1	.26	Plant	3.4	1	0.07
Frequency of Library Use				Frequency of Library Use			
Green	1.69	4	.79	Green	1.71	4	0.79
Built	4.88	4	.30	Built	5.05	4	0.28
No View	3.94	4	.41	No View	3.03	4	0.55
Plant	3.52	4	.48	Plant	2.46	4	0.65

* Female (n = 125): 25th percentile = 125.5, Median = 143, 75th percentile = 163.
Male (n = 33): 25th percentile = 112, Median = 132, 75th percentile = 154.5.

Table 4.15

Overall RPRS for Kansas Campus

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	z	Comparisons (*n = 105*)	*p*
Green	152.00	171.00	191.50			
to				6.48	27 scored Green lower 76 scored Green higher	.001
Built	128.50	148.00	168.00			
Green	152.00	171.00	191.50			
to				5.90	24 scored Green lower 79 scored Green higher	.001
No View	127.00	145.00	164.50			
Green	152.00	171.00	191.50			
to				7.07	16 scored Green lower 89 scored Green higher	.001
Plant	116.50	138.00	156.00			
Built	128.50	148.00	168.00			
to				0.22	51 scored Built lower 53 scored Built higher	.83
No View	127.00	145.00	164.50			
Built	128.50	148.00	168.00			
to				2.98	36 scored Built lower 69 scored Built higher	.00
Plant	116.50	138.00	156.00			
No View	127.00	145.00	164.50			
to				3.81	33 scored No View lower 68 scored No View higher	.00
Plant	116.50	138.00	156.00			

Table 4.16

Overall RPRS for Washington Campus

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	*z*	Comparisons (*n* = *55*)	*p*
Green	142.00	161.00	186.00			
to				4.78	11 scored Green lower 42 scored Green higher	.001
Built	121.00	140.00	158.00			
Green	142.00	161.00	186.00			
to				4.84	10 scored Green lower 45 scored Green higher	.001
No View	116.00	134.00	150.00			
Green	142.00	161.00	186.00			
to				5.12	10 scored Green lower 44 scored Green higher	.001
Plant	107.00	125.00	150.00			
Built	121.00	140.00	158.00			
to				1.97	22 scored Built lower 33 scored Built higher	.05
No View	116.00	134.00	150.00			
Built	121.00	140.00	158.00			
to				3.23	17 scored Built lower 38 scored Built higher	.001
Plant	107.00	125.00	150.00			
No View	116.00	134.00	150.00			
to				2.15	22 scored NoView lower 32 scored NoView higher	.03
Plant	107.00	125.00	150.00			

Table 4.17

Overall PCS for Kansas Campus

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	z	Comparisons (n = 50)	p
Green	261.50	308.00	336.75			
to				6.15	0 scored Green lower 50 scored Green higher	.001
Built	206.00	240.50	272.00			
Green	261.50	308.00	336.75			
to				5.64	3 scored Green lower 47 scored Green higher	.001
No View	192.25	232.00	271.25			
Green	261.50	308.00	336.75			
to				5.21	7 scored Green lower 43 scored Green higher	.001
Plant	223.25	251.00	287.75			
Built	206.00	240.50	272.00			
to				0.41	22 scored Built lower 28 scored Built higher	.69
No View	192.25	232.00	271.25			
Built	206.00	240.50	272.00			
to				2.69	35 scored Built lower 14 scored Built higher	.01
Plant	223.25	251.00	287.75			
No View	192.25	232.00	271.25			
to				3.47	36 scored No View lower 13 scored No View higher	.001
Plant	223.25	251.00	287.75			

Table 4.18

Overall PCS for Washington Campus

	Interquartile Range			Wilcoxon Tests		
	25th	Median	75th	z	Comparisons (n = 33)	p
Green	238.00	285.00	313.00			
to				4.34	5 scored Green lower 28 scored Green higher	.001
Built	200.50	233.00	266.00			
Green	238.00	285.00	313.00			
to				3.86	5 scored Green lower 28 scored Green higher	.001
No View	188.50	223.00	282.00			
Green	238.00	285.00	313.00			
to				4.40	3 scored Green lower 30 scored Green higher	.001
Plant	198.00	226.00	254.50			
Built	200.50	233.00	266.00			
to				0.40	13 scored Built lower 19 scored Built higher	.69
No View	188.50	223.00	282.00			
Built	200.50	233.00	266.00			
to				0.85	16 scored Built lower 17 scored Built higher	.40
Plant	198.00	226.00	254.50			
No View	188.50	223.00	282.00			
to				0.89	12 scored No View lower 21 scored No View higher	.38
Plant	198.00	226.00	254.50			

Table 4.19

Kruskal Wallis Tests: Differences in RPRS and PCS Scores based on Campus and Age Category

	RPRS				PCS		
	Chi-Square	*df*	*p*		Chi-Square	*df*	*p*
Campus				Campus			
Green	1.86	1	.17	Green	3	1	0.08
Built	1.84	1	.18	Built	2.3	1	0.59
No View	5.87	1	.02	No View	0.76	1	0.38
Plant	3.42	1	.06	Plant	9.35	1	0
Age Group				Age Group			
Green	6.41	1	.01	Green	0.59	1	0.44
Built	0.85	1	0.36	Built	0.31	1	0.58
No View	3.03	1	0.08	No View	3.05	1	0.08
Plant	2.11	1	0.15	Plant	6.9	1	.01

Table 4.20

Direction of the Significant Differences in RPRS and PCS Scores displayed in Table 4.19

RPRS				PCS			
	Interquartile Range				Interquartile Range		
	25th	Median	75th		25th	Median	75th
No View				Plant			
Kansas (*n* = 105)	127.00	145.00	164.50	Kansas (*n* = 50)	223.25	251.00	287.75
Washington (*n* = 55)	116.00	134.00	150.00	Washington (*n* = 33)	198.00	226.00	254.50
				24 or under (*n* = 66)	212.50	247.00	280.00
				Over 24 (*n* = 17)	175.75	212.00	245.75
Green							
24 or under (*n* = 129)	152.00	171.00	192.00				
Over 24 (*n* = 31)	129.25	154.00	183.00				

Several significant differences ($p < .05$) were detected in the RPRS scores as a function of where participants prefer to study, although the sample for Coffee Shop preference ($n = 20$) and Social Areas preference ($n = 6$) were so small that no definitive conclusions can be drawn (see Tables 4.21 and 4.22).

No significant differences ($p < .05$) in the scores on the view preference component of the PCS emerged as a function of where participants prefer to study, although the sample for Coffee Shop preference ($n = 14$) and Social Areas preference ($n = 5$) were so small that no definitive conclusions can be drawn (see Table 4.23).

Table 4.21

Kruskal Wallis Tests: Differences on the RPRS as a Function of Study Space Preference

	RPRS		
	Chi-Square	*df*	*p*
Home or Dorm			
Green	3.06	1	.08
Built	7.01	1	.01
No View	3.14	1	.08
Plant	1.24	1	.27
Library			
Green	0.71	1	.40
Built	0.09	1	.76
No View	4.92	1	.03
Plant	2.04	1	.15
Coffee Shop			
Green	5.65	1	.02
Built	3.86	1	.05
No View	0.70	1	.41
Plant	0.53	1	.47
Social Area			
Green	0.01	1	.93
Built	0.08	1	.78
No View	0.01	1	.94
Plant	0.52	1	.47

Table 4.22

Direction of the Significant Differences in the RPRS displayed in Table 4.21

RPRS	*n*	Interquartile Range		
		25th	Median	75th
Built				
Prefer Home/Dorm	122	122.00	142.00	161.00
Do not prefer Home/Dorm	38	135.75	158.00	170.00
Prefer Coffee Shop	20	138.50	155.00	172.50
Do no prefer Coffee Shop	140	123.00	142.50	161.75
No View				
Prefer Library	70	129.50	144.00	163.50
Do not prefer Library	90	115.50	138.50	157.00
Green				
Prefer Coffee Shop	20	161.50	179.50	200.00
Do not prefer Coffee Shop	140	142.00	166.50	187.50

Table 4.23

Kruskal Wallis Tests: Differences in the View Preference Component of the PCS as a Function of Study Space Preference

	PCS		
	Chi-Square	*df*	*p*
Home or Dorm			
Green	0.55	1	.46
Built	0.07	1	.79
No View	0.38	1	.54
Plant	0.97	1	.32
Library			
Green	0.10	1	.76
Built	2.50	1	.11
No View	0.87	1	.35
Plant	3.34	1	.07
Coffee Shop			
Green	0.16	1	.69
Built	0.10	1	.76
No View	0.92	1	.34
Plant	0.35	1	.55
Social Area			
Green	1.47	1	.23
Built	0.19	1	.66
No View	0.02	1	.90
Plant	2.58	1	.11

Qualitative analysis. As mentioned in Chapter 3, the last question on the Demographic Survey (see Appendices C and D) asked participants to describe the features of their favorite place to study (defined as reading a textbook or studying for an exam). Two hundred and forty of the 243 total participants in this study provided an answer to this question. Using the method described in Chapter 3, I identified seven main themes, which were germane to this research project, across both sets of participants: Calmness, Coziness, Comfort, Seclusion, Windows, Quietness, and Distraction. I coded both the categories of Calmness and Coziness as either a yes (it was mentioned) or a no (it was not mentioned). Having a calm or relaxing space in which to study was mentioned by 13% of the participants in the RPRS and by 5% of the participants in the PCS. Having a cozy or homey space in which to study was mentioned by 6% of the participants in the RPRS and by 2% of the participants in the PCS. The other five categories found in the qualitative data were mentioned with much more frequency than Calmness and Coziness (see Table 4.24). Table 4.25 shows the answer frequency distribution.

Table 4.24

Frequency of Study Space Features mentioned on the Demographic Survey by Participants in RPRS and PCS

RPRS (N = 160)		PCS (N = 83)	
Feature	Percentage	Feature	Percentage
Windows		Windows	
Window	17%	Window	22%
Nature View	19%	Nature View	15%
Natural Lighting	9%	Natural Lighting	11%
Total	45%	Total	48%
No Window	1%	No Window	1%
Noise Level		Noise Level	
Quiet	31%	Quiet	24%
Quiet with Music	8%	Quiet with Music	5%
Quiet with Background Noise	4%	Quiet with Background Noise	1%
Total	43%	Total	30%
Comfort		Comfort	
Seating	20%	Seating	34%
Space	12%	Space	4%
Both	2%	Both	4%
Total	34%	Total	42%
Distractions		Distractions	
No People	14%	No People	8%
No Books	3%	No Books	2%
No “Distractions”	19%	No “Distractions”	12%
Total	36%	Total	22%
Seclusion		Seclusion	
Secluded	17%	Secluded	15%
Private	14%	Private	8%
Total	31%	Total	23%
Calmness		Calmness	
Yes	13%	Yes	5%
Coziness		Coziness	
Yes	6%	Yes	2%

Table 4.25

Frequency of Study Space Features mentioned on the Demographic Survey by Participants in RPRS and PCS separated by Campus

RPRS (*N* = 160)			PCS (*N* = 83)		
	Kansas (*n* = 105)	Washington (*n* = 55)		Kansas (*n* = 50)	Washington (*n* = 33)
Windows			Windows		
Window	14%	22%	Window	22%	21%
Nature View	18%	22%	Nature View	14%	15%
Natural Lighting	6%	18%	Natural Lighting	10%	12%
No Window	2%	0%	No Window	0%	3%
Noise Level			Noise Level		
Quiet	37%	20%	Quiet	24%	24%
Quiet with Music	10%	4%	Quiet with Music	2%	6%
Quiet with Background Noise	5%	4%	Quiet with Background Noise		3%
Comfort			Comfort		
Seating	23%	15%	Seating	36%	30%
Space	13%	9%	Space	4%	3%
Both	2%	2%	Both	4%	3%
Distractions			Distractions		
No People	17%	7%	No People	10%	6%
No Books	4%	2%	No Books	4%	0%
No “Distractions”	21%	15%	No “Distractions”	10%	15%
Seclusion			Seclusion		
Secluded	16%	18%	Secluded	6%	27%
Private	11%	18%	Private	10%	6%
Calmness			Calmness		
Yes	14%	9%	Yes	8%	0%
Coziness			Coziness		
Yes	5%	7%	Yes	4%	0%

Summary

Results of statistical analysis show how three of the four RPRS subscales work well together but that the Coherence subscale may be problematic. Both subscales and additional questions in the PCS work together as a whole.

Friedman analysis of results from the RPRS data call for the rejection of the first null hypothesis and the majority (21 of 24) of the pairwise comparisons also call for the overall rejection of the first null hypothesis. The same analysis of the PCS resulted in an overall rejection of null hypothesis 2 but the pairwise comparisons displayed significance and consistency only when the comparisons involved the Green View. Several other pairwise comparisons displayed significance but these were not consistent across views or instrument components. In summary, consistent with my expectations, these findings show that the pictures depicting library views characterized by outdoor green views received higher scores on both the RPRS and PCS.

Data analysis showed no significant difference in scores from either instrument based on differences in gender, transfer status or frequency of library use. Differences in scores for particular view types were found based on campus affiliation and age category. On the RPRS, students from Kansas scored the No View higher than did students from Washington. In addition, younger students scored the Green view higher than did older students. On the PCS, younger students and those from Kansas scored the Plant view higher than did older students and those from Washington.

Results from the PCS found no differences in view preference or compatibility based on where participants prefer to study. The RPRS results, however, did show a few significant differences although these differences were restricted to specific views. Those participants preferring to study at home (or in dorm room) scored the Built view higher than those who do not prefer to study at home (or in dorm room) and those participants who prefer to study in the library scored the No View higher than those who do not prefer to study in the library.

The analysis of the answers to the open-ended question about the features present in the participants' favorite place to study indicates strong interest in windows and comfortable seating. In addition participants indicated interest in quiet, secluded spaces with no distractions.

In the next chapter, I will discuss my conclusions from these findings along with the limitations of the samples and methods. I will also discuss remaining questions and areas for further study.

Chapter Five

Discussion

The guiding question in this research is: Do students perceive "greenery-enhanced"[1] library spaces to be helpful for the restoration of directed attention and to assist in the attainment of study goals? This question was further refined into the following objectives:

1. To determine if library study spaces that include greenery are perceived to be more conducive to restoring directed attention than spaces without greenery.
2. To gain an understanding of whether students find "greenery-enhanced" study spaces more conducive to successfully completing their study goals (defined as reading a textbook or studying for an exam) when in the library.

I chose to approach these objectives through the use of two instruments, the Revised Perceived Restorativeness Scale (RPRS) and the Preference and Compatibility Scale (PCS), in a static simulation and a demographic survey. Before going on to examine how the results indicate answers to my research question, it is important to first note the consistency and reliability of the scales themselves.

Instruments

Internal consistency. The internal consistency of each subscale of both instruments was very high (> .90). Most importantly, no subscale would improve with the deletion of any one item making up that subscale. In other words, the overall consistency of a subscale would not increase if any one item was deleted from that subscale (see Tables 3.3 and 3.4).

Correlations. Although the internal consistency of each subscale was straightforwardly high, the correlation between each subscale within each instrument was less straightforwardly high.

RPRS. The RPRS contains four subscales: Coherence, Compatibility, Being Away, and Fascination. Based on Attention Restoration Theory, in order for an environment to be restorative, it needs to be perceived as having these four components (Kaplan & Kaplan, 2009; Ouellette, Kaplan, & Kaplan, 2005). Therefore the expectation for this instrument would be that a participant who perceived a view to be more restorative would score each of the four subscales higher. Spearman's rho correlations indicated that this relationship between the subscales existed for three of the four subscales, Compatibility, Being Away, and Fascination but not for the Coherence subscale (see Table 4.1). The correlations of Coherence to Compatibility and Being Away are negative, although low to moderate, while the relationship of Coherence to Fascination is not significantly different from zero (see Table 4.2). As the scores for Compatibility and Being Away increased, the scores for Coherence decreased.

Before looking in more detail at the Coherence scores, it is important to consider, once again, the definitions of the four components of restorative environments (Ouellette, Kaplan & Kaplan, 2005):

Coherence – elements in view are connected in a way that makes a coherent whole and the scope is sufficient to allow one to stay for a while;

Compatibility – the match between the person's need and what the environment has;

Being Away – the environment is able to remove the person from attentionally-demanding activities; and

Fascination – the environment is interesting enough to engage involuntary attention but not so interesting as to become distracting.

Why did the scores for Coherence relate inversely to Compatibility and Being Away? As stated earlier, the RPRS was designed to measure whether or not a particular setting is perceived as restorative in general but not designed to distinguish between the level of restorativeness among different types of environments for specific activities. In my research, participants were asked to have a specific activity in mind (reading a textbook or studying for an exam) and the views were all from within library spaces rather than views of different overall spaces (e.g. parking garage vs. park). It makes sense that, while the Green views were perceived of as being more restorative overall, views of rows of bookshelves with books in a particular order or a rectangular table next to a rectangular window looking out to a square building would be perceived of as being more coherent than lots of "unorganized" greenery. The Coherence subscale asks about confusion, distraction and chaos (see Appendix A), which are not words generally applied to rows of books in a library. In addition, the Coherence construct from theory includes the idea of cognitive map building (Hartig, Korpela, Evans & Garling, 1997). In other words, a coherent environment makes it easy to find one's way. Once again, rows of books or tables may assist in way-finding (see Appendix E).

The lack of a relationship between Coherence and Fascination is more puzzling. An interesting note here comes from data from the open-ended question on the demographic survey (see Table 4.24). Three percent of those answering this question on the RPRS and two percent of those answering this on the PCS specifically noted that books on bookshelves were a distraction and that they did not want them in their favorite study space. This may help explain the lack of a relationship between Coherence and Fascination. While rows of books are inherently coherent, they may also provide distraction. Since the Fascination construct specifies that an environment needs the right amount of distraction, not too much nor too little, books may be seen as providing too much distraction.

Hartig, Korpela, Evans, and Garling (1997) also found inconsistencies in the results of the RPRS with respect to the Coherence subscale. First they note that the evidence for the Coherence construct is more suggestive than direct, unlike the evidence for the other three constructs, and therefore, may be less understood. Secondly, these researchers, when testing the construct of Coherence by comparing scores on an earlier version of the RPRS to a semantic scale measuring complexity and unity, found negative correlations between Coherence and complexity and no correlation between Coherence and unity. In fact after a series of tests, these researchers concluded that "the relation between coherence and restoration is other than simply linear positive; in each case the site judged to have higher restorative potential in terms of General scores had lower Coherence scores" (Hartig, Korpela, Evans, & Garling, 1997, p. 185).

Before moving on to the results of hypotheses testing, two other minor results should be mentioned concerning the RPRS as an instrument. First is the length of the instrument. I was concerned that fatigue would be an issue because of the length (40 minutes) and the repetitiveness of the instrument and views. As one way to check on this, I reversed the order of the questions on half of the instruments and then tested the significance of the differences in scores based on the order of the questions. No significant differences ($p < .05$) were found. Second is the timing of the slides. The slideshows for both instruments advanced automatically and the timing was determined by preliminary tests (see chapter 3). Based on the fact that only one participant in the RPRS and two participants in the PCS were unable to complete the series of questions for each slide, the timing was appropriate.

PCS. The version of the PCS that I used contained the original two subscales, Preference and Compatibility, along with two additional questions measuring whether an environment would encourage a participant to come more often and whether an environment would encourage a participant to stay longer. My expectation was that if a participant preferred a particular environment (view) for their study, they would also find that view to be compatible with goal completion and would be likely to come more often and stay longer. Spearman's rho correlations confirmed this expectation. In the case of all four views, as scores for one subscale increased so did the scores for each of the other three (see Table 4.3). These findings contribute to the literature on the reliability and validity of the PCS.

Hypotheses Testing

Null hypothesis 1. Including greenery in library study spaces has no perceived effect on the likelihood of restoring directed attention. This hypothesis is rejected. The Green view was perceived to be more restorative than all other views by scoring the highest on the overall RPRS and highest in the Compatibility, Being Away, and Fascination subscales (see Tables 4.4 - 4.8). It scored lower than No View and Plant view and the same as the Built view on the Coherence subscale (see p. 105 for the discussion on Coherence). Participants found window views of nature to be the most restorative.

While most Attention Restoration Theory (ART) research compares various outdoor environments (or window views of outdoor environments) to indoor environments (with no plants) or natural environments to built environments, I was interested in also looking at comparisons that would include indoor plants. Han's (2009) research on the impact of leafy plants in junior high classrooms, and both Raanaas' (Raanaas, et al., 2011) study and Larson's (Larson, Adams, Deal, Kweon, & Tyler, 1998) research on the impact of plants on office productivity made me curious about restoration and preference within a library study setting. Therefore, I included a Plant view in this research with the tentative hypothesis that indoor plants may also be perceived of as restorative. This, however, is not upheld by the data. On the overall RPRS scale, the Plant view was perceived of as the least restorative and no pairwise comparisons within the subscales substantially contradict this (see Tables 4.4 – 4.8). These results do not necessarily contradict the prior studies. Han (2009) found that preference, comfort and friendliness were higher in the classroom with plants but admitted that other factors could have influenced the outcome. Raanaas et al. (2011) found that participants in office settings with plants demonstrated improved performance on attention capacity tests from a first test to a second test but not from the second to the third test. Larson et al. (1998) discovered that as the number of office plants increased (no plants, some plants, many plants), mood, attitude toward the workplace, and comfort increased but productivity decreased. Obviously there is more work to be done on the impact of indoor plants on restoration, preference, and performance.

In this study, one possibility for my results is that my two Plant view pictures were problematic. I had to stage the Plant view photos within a library that had plants but did not have them close to seating areas without windows. Informal feedback from participants in my preliminary studies gave me some cause to think that staged photos, no matter how carefully they are staged, may be seen as "artificial" by participants. In addition, the one Plant view (see Appendix E) contained a rather large blank wall that may have also played a role in the responses. This is an area for further research.

The Built view was perceived as being the second most restorative view on the overall RPRS and in most of the pairwise comparisons for the three subscales (see Tables 4.4 - 4.5). This is not surprising since 45% of those responding to the open-ended question in the demographic survey mentioned windows, nature views, or natural lighting as a feature in their favorite place to study. However, the importance of what is outside of the window cannot be ignored. Nineteen percent of respondents on the open-ended question specifically noted a window with a view to nature. In addition, in comparing the medians of the four views in the overall RPRS (Green = 168; Built = 144; No View = 141.5; Plant = 134), there is a very large drop in the perception of restorativeness between the Green view and the Built view. Both sets of photos had windows, comparable furniture, and similar lighting. If the window itself (or natural lighting) were of prime importance, one would expect the scores to be closer. This is another area to explore further.

Null hypothesis 2. Greenery enhanced library study spaces are not perceived to be conducive to the successful attainment of study goals. This hypothesis is rejected. The Green view was preferred, perceived to be more compatible, and perceived as encouraging participants to come more often and stay longer than all other views by scoring the highest on the overall PCS and highest on all four subscales (see Tables 4.9 - 4.13).

Unlike in the RPRS, the Plant view scored higher than the No View or Built views in the overall PCS. However, there is no consistency or very large differences between the three views in the pairwise comparisons for each component of the scale (see Tables 4.9 – 4.13). In fact, of the 12 pairwise comparisons that do not include the Green view, seven show no significant differences between views. Although the overall PCS scores may indicate a tendency for students to prefer indoor greenery over no greenery, the detailed results are so mixed that further testing is needed to understand the role of indoor plants. Another consideration, as mentioned earlier, is the pictures themselves. The PCS had three pictures representing each view, the same two from the RPRS and one additional picture. If the picture containing the large blank wall was problematic in the RPRS, the additional picture in the PCS may have ameliorated the impact of that picture in the PCS scores.

Similar to the RPRS findings, the comparison of medians of the four views in the overall PCS (Green = 295; Built = 237; No View = 233; Plant = 243) show a very large drop in the preference and perception of compatibility, and the desire to come more often and stay longer between the Green view and the Built view. In fact, the Plant view is preferred over the Built view. This confirms the findings in the RPRS and is suggestive of both the importance of what is outside of the window and, perhaps, of greenery, itself.

Demographic Differences

One of the strengths in the results of this study is that the conclusions I just reviewed are consistent over several demographic differences. The perceived restorativeness of the Green view as opposed to all other views did not differ based on gender, transfer status, campus affiliation or frequency of library use. There was a significant difference seen by age category but only in how high the green view was scored not in its order of restorativeness relative to the other views (see Tables 4.19 and 4.20). Students aged 24 years and younger rated the Green view higher than students over age 24. Only one other minor but significant differences in the RPRS results occurred that were based on demographics. The No View was rated higher by participants in Kansas than by participants in Washington (see Tables 4.19 and 4.20).

The Green view was also preferred, perceived to be compatible with study goals, and perceived as encouraging of coming more often and staying longer than all other views across gender, transfer status, campus affiliation, and frequency of library use. There was only one demographic difference of significance in the PCS results. Younger participants and participants from Kansas scored the Plant view higher than did participants who were older and participants from Washington (see Tables 4.19 and 4.20). Because of the overall demographic differences in these two campuses, these results most likely indicate that younger students scored the Plant view higher than older students.

I examined one other demographic difference based on where participants preferred to study. No conclusions can be drawn based on the preference for study in coffee shops or campus social areas because, for both instruments, the sample sizes were too small. However, the restorativeness, preference, and compatibility of the Green view were perceived to be higher than all other views whether the participants preferred to study at home/in their dorm room or in their campus library (see Tables 4.21 – 4.23).

These results lead me to tentatively conclude that maximizing window views of natural spaces may be one of the more universal and successful design principles to use in academic libraries. While students may disagree on what type of furniture they find comfortable, whether or not they want books or other people around them, and what types of tables work best for them, they may just agree on the fact that views of nature are restorative, preferred, and compatible with their study goals.

Conclusions from Qualitative Data

Perhaps the most surprising result of my study was the fact that 240 of the 243 participants took the time to respond to the open-ended question at the end of the demographic survey. This question asked them to describe the main features of their favorite place to study. A few were brief in their descriptions, “isolation” or “chair, desk,” but most took the time to be very descriptive including the participant who wanted “pretty view, comfy chairs, couches, maroon painted walls, fireplace, pastries, coffee, and a foot massage.” Of the seven categories analyzed, the most common mention by participants in both studies had to do with windows, views, and natural lighting: 45% of those participating in the RPRS and 48% of those participating in the PCS mentioned one of these as a desirable feature (see Tables 4.24 and 4.25). It is impossible to say whether or not this number is inflated because of what participants saw in the pictures that they viewed. However, windows appeared in less than one-half of the pictures viewed and windows with nature views appeared in less than one-quarter of the pictures.

The need for quiet when reading a textbook or studying for an exam was also mentioned by a significant number of participants (RPRS – 43%; PCS – 30%) although quiet was sometimes described as quiet with low background noise or music (see Tables 4.24 and 4.25). Other frequently mentioned features may be associated with quiet. These are distractions, seclusion, and calmness. No distractions was listed by 36% of RPRS participants and 22% of PCS participants. Interestingly, some mentioned specific distractions such as people or books while others just used the term “distractions” (see Tables 4.24 and 4.25). Seclusion and privacy were mentioned by 31% of the RPRS participants and 23% of the PCS participants, while calmness was mentioned by significantly fewer participants (RPRS – 13%, PCS – 5%).

These results are interesting in light of the literature mentioned earlier in this study. First, they are in alarming contrast to what Stewart (2010) found in his survey of recently completed libraries. He found that more than one-half of exclusively undergraduate institutions had either reduced or eliminated their quiet study areas in the new buildings. My results do support his finding that, in post-occupancy studies, quiet study areas were the second busiest areas in the libraries that had them. In addition, the preference for quiet, secluded spaces with few distractions parallel the surveys mentioned by Fister (2011) that note student interest in quiet, solitary study spaces and in the findings by Nitecki and McCarthy (2010) on the post-occupancy use of individual study spaces. Finally, the results from the open-ended question support Woodward’s (2009) guidelines for the "customer-driven" library that provides students with areas to "nest," areas where they have the sense of "belonging" because the spaces are secluded, individualized, and comfortable.

Limitations

There are some limitations and concerns with this study. The main concerns are the generalizability of results, bias as a result of what study spaces participants are accustomed to, the two separate groups of participants, and the validity of static simulations.

Generalizability. Although my samples contain expected variability along some demographic lines, there are some issues that may make the generalizability of my results to the undergraduates at the two institutions questionable. The sample size ($N = 160$) for the RPRS is strong and the rate of participation within the age categories and transfer status are as expected for each institution although there is no direct data for Kansas on transfer status (see Table 5.1). Female participants are over-represented in both samples as are Psychology majors and the Washington sample also over-represents English majors. Finally, Business majors are under-represented in both samples. Having said this, however, it is important to note that a variety of majors are represented.

The sample size ($N = 83$) for the PCS is acceptable but small for the Washington campus ($n = 33$). The Kansas sample is most likely representative of transfer status although there is no institutional data available as a comparison but it is younger and more female than the population as a whole (see Table 5.2). Several majors are accurately represented while Business and Biology majors are under-represented and Nursing and Psychology majors are over-represented. The Washington sample is a better representation of the population, especially in age, gender and transfer status. While representative of some majors, this sample under-represents Business and Computer Science/Engineering majors while vastly over-representing Creative Media/Digital Culture majors.

Table 5.1

Representativeness of RPRS Samples

	RPRS (n = 105)	Kansas		RPRS (n = 55)	Washington
Age			Age		
24 or under	94%	83%	24 or under	60%	63%
Over 24	6%	17%	Over 24	40%	37%
Gender			Gender		
Female	83%	60%	Female	69%	54%
Male	15%	40%	Male	31%	46%
Transfer Status		unknown	Transfer Status		
Start as freshman	91%		Start as freshman	20%	16%
Transfer	10%		Transfer	80%	84%
Major			Major		
Art	3%	unknown	Business	4%	20%
Business	7%	28%	Education	2%	4%
English/ Journalism	3%	unknown	English	11%	5%
Education	35%	37%	History	2%	3%
Physical Sciences	5%	unknown	Humanities	2%	3%
Social Science/ Anthropology/ Sociology	6%	7%	Public Affairs	2%	3%
Biological Sciences	6%	9%	Social Sciences	9%	13%
Communication /Theatre	2%	unknown	Human Development	9%	8%
Math/Computer Science/ Economics	3%	unknown	Psychology	60%	7%
Nursing	16%	11%			
Psychology	11%	7%			
Undecided	2%	unknown			

Note. Campus data is from 2011-2013 reports posted on the web sites of each campus.

Table 5.2

Representativeness of PCS Samples

	PCS (n = 50)	Kansas		PCS (n = 33)	Washington
Age			Age		
24 or under	100%	83%	24 or under	58%	63%
Over 24	0%	17%	Over 24	42%	37%
Gender			Gender		
Female	72%	60%	Female	55%	54%
Male	28%	40%	Male	46%	46%
Transfer Status		unknown	Transfer Status		
Start as freshman	88%		Start as freshman	9%	16%
Transfer	12%		Transfer	91%	84%
Major			Major		
Art	4%	unknown	Business	3%	20%
Business	16%	28%	Creative Media/ Digital Culture	48%	6%
English/ Journalism	2%	unknown	English	9%	5%
Education	32%	37%	Humanities	3%	3%
Social Science/ Anthropology/ Sociology	4%	7%	Biology	9%	11%
Music	2%	unknown	Public Affairs	3%	3%
Biological Sciences	4%	9%	Criminal Justice	3%	unknown
Communication /Theatre	4%	unknown	Human Development	6%	8%
Nursing	18%	11%	Psychology	10%	7%
Psychology	14%	7%	Computer Science/ Engineering	3%	7%

Note. Campus data is from 2011-2013 reports posted on the web sites of each campus.

Although there are obvious drawbacks to the samples, the two institutions are very different, WSUV being a small metropolitan commuter campus with mostly non-traditional students and ESU being a larger midwestern regional institution with mostly traditional undergraduate students. Therefore, the combined results along with the fact that there are no differences based on campus between three of the four views on each of the instruments (see Table 4.19) may indicate that findings are generalizable to some extent. However, without further testing at a wider range of institutions, it will not be clear how generalizable these results will be to institutions that are quite different from the two institutions studied.

Bias. The second concern is one of bias brought on by what study spaces participants have had available to them on a regular basis. To attempt to mitigate this limitation, I have included participants from two very different geographical locations, the Midwest and the Pacific Northwest, and from institutions that have very different libraries, ESU in Kansas, which is a large, multi-story, older building, and WSUV in Washington, which is a small, one-story, newer building. Buildings, parking lots, grass, and some trees surround the Kansas library and a courtyard, buildings, very lush plantings and views of mountains surround the Washington library. In addition, I have included two questions on the demographic survey that will provide additional information about the participants' habits. One asks how often they use their physical campus library and the other asks if there is another library that they regularly use for study. There were no significant differences in the results from either instrument based on frequency of library use and so few participants indicated the use of a library other than their institution's library that the sample was too small to test.

Comparability. The third concern is one of the comparability of findings because, although I drew from the same overall populations (undergraduates at the two institutions), my sample for the RPRS is made up of different individuals than my sample for the PCS (see Tables 5.1 and 5.2). In comparing the final samples from both instruments for each campus, the differences in the demographics are minimal. Although I realized that having two different samples for the instruments could be considered a limitation, I designed the study in this way because of the instruments themselves. Both instruments, most especially the RPRS, are long and it was important to have more than one scene representing each of the four scenarios to reduce the possibility that scores are in response to the specifics of a scene. Therefore, fatigue would be an issue if participants were to complete both measures in one session. The advantage to designing the study in this way is that it removes the possibility of an exposure effect from one to the other if participants were to do both.

Ecological validity. The fourth concern is one of the ecological validity of simulations. Bosselmann, Craik & Craik (1987) noted that simulations mostly judge first impressions of the environment and that little research has been done to determine whether first impressions are an accurate way to judge the ongoing use of or impact of that environment. They also reinforce the importance of samples that represent the actual onsite users. Stamps (2010) noted it is important for simulations to minimize distortions in space by paying attention to vantage points, closeness of views and other details of the photography. In fact, pretesting of a preliminary set of photographs taken for this study by amateur photographers uncovered the importance of these distortions and demonstrated the need to both employ a professional photographer and to develop very specific guidelines for that photographer.

Conclusion

Undergraduate students are more diverse, live more complex lives and have greater demands on their time than ever before. Concurrently, the world of academic libraries is changing radically as they move from being storage spaces to learning spaces and academic institutions are feeling the increasing pressures of economic reality and calls for accountability. The challenge for academic librarians, architects, and campus planners is to create library spaces that answer the needs of the greatest number of users while demonstrating the contributions of these spaces to overall institutional goals while staying within limited budgets.

Librarians and architects have begun to answer this challenge by responding to the calls from such scholars and librarians as Bennett (2003) and Demas (2005) for creating library spaces with learning as the primary activity and from Nitecki (2011) for better research into what makes spaces supportive for student learning. However, this response has been centered on the creation of much needed maker-spaces (learning commons) where students can engage in learning by doing and learning by conversing. While these types of spaces are essential in the twenty-first century academic library, it is critical to not forget about support for learning by reflection, especially in the world of increased stressors and demands for attention that students now occupy.

Cognitive, educational and environmental psychology provide a wealth of information about mental fatigue and how the depletion of attentional resources negatively impact the ability to employ successful learning strategies such as reflective thinking, elaboration, effort, and persistence. Librarians can incorporate this research into and adapt methods from these disciplines for their own studies of library space. This research study is an example. It begins the journey of not only examining how library study spaces can be designed to better support student learning but also understanding the complexities of adapting instruments and methods to new uses. Much remains to be done. The role and importance of coherency in restoration is not yet fully understood; the impact of indoor plants on restoration, preference, and compatibility needs further study and, parsing the complexities around windows, types of views, and natural lighting would be helpful. Additionally, while my study points to the possibility that green views are likely to be restorative to a wide range of undergraduate students, more inclusive studies are needed. What about ethnicity, students with learning disabilities, and students at small, private colleges? Finally, how do perceived restorativeness, compatibility with study goals, and preference translate into real learning? The literature review in this study shows the necessity of attentional resources for the employment of successful learning strategies, the negative impact of mental fatigue on learning, and the restorative power of being in natural spaces. The research shows that students perceive study spaces with green views to be more restorative, prefer study spaces with green views, and find these spaces to be more compatible with their study goals. What remains is to test the direct impact of being in these more restorative and compatible spaces on deep learning, not just on surface learning or short-term memory. The way in which this can be done is a challenge in research design that I hope colleagues in the academic library field are ready to meet.

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Footnote

[1]For this study, “greenery-enhanced” library study spaces is defined as study spaces with either windows looking out toward natural spaces such as fields, forests, parks and gardens that contain substantial amounts of trees and/or plants or study spaces with significant indoor plants.

Appendix A

Revised Perceived Restorativeness Scale

Think about class work that you have to do – reading your textbook or reviewing your notes for an exam. You have time between your classes to do this and you decide to go the Library. For each picture imagine that you are sitting in that area to do your work.

Answer the following questions for each picture.

Being Away	Not at all	A little bit	Neutral	Some-what	Very much
Being here is an escape experience	1	2	3	4	5
Spending time here gives me a break from my day-to-day routine	1	2	3	4	5
It is a place to get away from it all.	1	2	3	4	5
Being here helps me to relax my focus on getting things done	1	2	3	4	5
Coming here helps me to get relief from unwanted demands on my attention	1	2	3	4	5

Fascination	Not at all	A little bit	Neutral	Some-what	Very much
This place has fascinating qualities	1	2	3	4	5
My attention is drawn to many interesting things.	1	2	3	4	5
I want to get to know this place better.	1	2	3	4	5
There is much to explore and discover here.	1	2	3	4	5
I want to spend more time looking at the surroundings.	1	2	3	4	5
This place is boring.	1	2	3	4	5
The setting is fascinating.	1	2	3	4	5
There is nothing worth looking at here.	1	2	3	4	5

Coherence	Not at all	A little bit	Neutral	Some-what	Very much
There is too much going on	1	2	3	4	5
It is a confusing place.	1	2	3	4	5
There is a great deal of distraction.	1	2	3	4	5
It is chaotic here.	1	2	3	4	5

Compatibility	Not at all	A little bit	Neutral	Some-what	Very much
Being here suits my personality.	1	2	3	4	5
I can do things I like here.	1	2	3	4	5
I have a sense that I belong here.	1	2	3	4	5
I can find ways to enjoy myself here.	1	2	3	4	5
I have a sense of oneness with this setting.	1	2	3	4	5
There are landmarks to help me get around.	1	2	3	4	5
I could easily form a mental map of this place.	1	2	3	4	5
It is easy to find my way around here.	1	2	3	4	5
It is easy to see how things are organized.	1	2	3	4	5

Appendix B
Perception and Compatibility Scale

You have just gotten out of class. You have some time before your next class starts. You decide to go to the library to work on your schoolwork. You have your textbook to read and you want to review your notes for a test. You want to find a place to sit that will help you accomplish these tasks.

Rate each environment by responding to each of the following statements. Circle the number that corresponds to how you feel about being in the space depicted in the slide.

Complete all 18 statements for each slide. When the slide changes, go to the next sheet. The slide number on the sheet should correspond to the slide number on the screen.

SLIDE ONE

	Strongly Disagree			Neutral			Strongly Agree
1. This setting looks appealing.	1	2	3	4	5	6	7
2. I would enjoy being in this setting.	1	2	3	4	5	6	7
3. I would be unhappy in this setting.	1	2	3	4	5	6	7
4. I would find this setting pleasant.	1	2	3	4	5	6	7
5. This setting would be annoying.	1	2	3	4	5	6	7
6. I would be miserable in this setting.	1	2	3	4	5	6	7
7. This setting would be attractive.	1	2	3	4	5	6	7
8. I would find this setting irritating.	1	2	3	4	5	6	7
9. This setting would help me reach my goal.	1	2	3	4	5	6	7
10. I would be able to achieve my goal in this setting.	1	2	3	4	5	6	7
11. I would be frustrated in trying to reach my goal in this setting.	1	2	3	4	5	6	7
12. I would find this setting supportive of my goal.	1	2	3	4	5	6	7
13. This setting would make it difficult to achieve my goal.	1	2	3	4	5	6	7
14. I would be unable to reach my goal in this setting.	1	2	3	4	5	6	7
15. This setting would fit nicely with my goal.	1	2	3	4	5	6	7
16. This setting would hold me back from reaching my goal.	1	2	3	4	5	6	7
17. I would like to visit here more often.	1	2	3	4	5	6	7
18. I would like to stay here longer.	1	2	3	4	5	6	7

Appendix C

Demographic Survey, ESU

Please answer the following questions. Thank You!!

1. Gender

MALE FEMALE

2. Age _____

3. When you FIRST started at Emporia:

_____________You started as a first-year (freshman) student
_____________You transferred more than 30 credits from another institution

4. Have you been diagnosed with any of the following (check all that apply):

____ADD
__ Dyslexia
__ Dyscalculia
__ Have not been diagnosed with these
____ ADHD
____ Dysgraphia
____ Other (Please list________________)

5. Which department is your major in?

__ Art
__ Business
__ English/Languages/Journalism
__ Education
__ Music
__ Physical Science
__ Social Sciences
___ Biological Sciences
___ Communication & Theatre
___ Math/Computer Sci./Economics
___ Instructional Design
___ Nursing
___ Psychology
___ Sociology/Anthropology/Crime

6. Where do you prefer to study (when reading your textbook or reviewing notes for an exam)?

___In your dorm room
___At a coffee shop
___At another library
____ At home, off-campus
____ In the ESU Library
____ Social areas such as Memorial Union
___Other. Please describe:____

7. How often do you use the physical library on campus?

_____________Less than 1 time per semester
_____________2-4 times per semester
_____________1-2 times per month
_____________Once per week
_____________More than 1 time per week

8. Do you regularly study in another library (i.e. Emporia Public Library)?

YES NO

If yes, which library? ____

9. Describe the main features of your favorite space to study, when reading your textbook or reviewing notes for an exam. What would it look like? What features would it have?

____

____

____

____

____

Appendix D

Demographic Survey, WSUV

Please answer the following questions. Thank You!!

1. Gender: MALE FEMALE

2. Age _____

3. When you FIRST started at WSU Vancouver:

____________You started as a first-year (freshman) student
____________You transferred more than 30 credits from another institution

4. Have you been diagnosed with any of the following (check all that apply):

__ ADD
____ ADHD
__ Dyslexia
____ Dysgraphia
__ Dyscalculia
____ Other (Please list_______________)
__ Have not been diagnosed with these

5. Which department is your major in?

__ Anthropology
__ Business
__ Creative Media/Digital Culture
__ Education
__ English
__ History
__ Humanities
__ Nursing
__ Public Affairs
__ Social Sciences
___ Biology
___ Computer Science
___ Criminal Justice
___ Engineering
___ Environmental Science
___ Human Development
___ Neuroscience
___ Political Science
___ Psychology
___ Sociology

6. Where do you prefer to study (when reading your textbook or reviewing notes for an exam)?

___At home
___In the WSU Vancouver Library
___At another library
___Other. Please describe:____
____ At a coffee shop
__ Social areas such as Firstenburg Center

7. How often do you use the physical library on campus?

_____________Less than 1 time per semester
_____________2-4 times per semester
_____________1-2 times per month
_____________Once per week
_____________More than 1 time per week

8. Do you regularly study in another academic library (i.e. Clark College's library)?

YES NO

If yes, which library? ____

9. Describe the main features of your favorite space to study, when reading your textbook or reviewing notes for an exam. What would it look like? What features would it have?

____

____

____

____

____

Appendix E

Sample Photos

Library study space with indoor plants.

Library study space with a window view to green spaces.

Library study space with a window view to man-made structures.

Library study space with no window view and no indoor plants

Appendix F

Script Read To Students in Classroom for RPRS

Hello. I am Karen Diller, a PhD student in Library and Information Science. I am conducting a research project as part of my dissertation research on library study space. The results of this study will be published in my dissertation and also, hopefully, as a journal article. I would appreciate your participation in this study but you are not required to participate and leaving will not impact your grade in this course or result in any penalty.

If you choose to stay and participate, it will take about 40 minutes. You will be asked to view approximately 36 pictures and answer questions about each picture. All pictures are of library study spaces. You will also be asked to fill out a brief demographic survey of 7 questions. Your answers are completely anonymous – I will not be asking you to provide your name or any identifiable information on the demographic survey or questionnaire.

There is a permission form, which you need to sign but these forms will be collected and stored separately so that they cannot be connected to your survey or answers.

You may stop and leave at any time.

Do you have any questions?

If you are willing to begin, please read and sign the consent form now and I will collect them.

Your copy of this information also has my contact information on it. If you have any other questions or comments, please feel free to contact me at any time.

Thank you for your participation – I really appreciate it.

Appendix G

Script Read To Students in Lab for RPRS

Hello. I am Karen Diller, a PhD student in Library and Information Science. I am conducting a research project as part of my dissertation research on library study space. The results of this study will be published in my dissertation and also, hopefully, as a journal article. I would appreciate your participation in this study but you are not required to participate and leaving will not result in any penalty.

If you choose to stay and participate, it will take about 40 minutes. You will be asked to view 36 pictures and answer a set of questions about the study area depicted in each of these pictures. All pictures are of library study spaces. You will also be asked to fill out a brief demographic survey of 7 questions. Your answers are completely anonymous – I will not be asking you to provide your name or any identifiable information on the demographic survey or questionnaire.

There is a permission form, which you need to sign but these forms will be collected and stored separately so that they cannot be connected to your survey or answers.

You may stop and leave at any time.

Do you have any questions?

If you are willing to begin, please read and sign the consent form now and I will collect them.

Your copy of this information also has my contact information on it. If you have any other questions or comments, please feel free to contact me at any time.

Thank you for your participation – I really appreciate it.

Appendix H

Script Read To Students in Lab, PCS

Hello. I am Karen Diller, a PhD student in Library and Information Science. I am conducting a research project as part of my dissertation research on library study space. The results of this study will be published in my dissertation and also, hopefully, as a journal article. I would appreciate your participation in this study but you are not required to participate and leaving will not result in any penalty.

If you choose to stay and participate, it will take about 30 minutes. You will be asked to view 15 pictures and answer a set of questions about the study area depicted in each of these pictures. All pictures are of library study spaces. You will also be asked to fill out a brief demographic survey of 7 questions. Your answers are completely anonymous – I will not be asking you to provide your name or any identifiable information on the demographic survey or questionnaire.

There is a permission form, which you need to sign but these forms will be collected and stored separately so that they cannot be connected to your survey or answers.

You may stop and leave at any time.

Do you have any questions?

If you are willing to begin, please read and sign the consent form now and pass them to the back.

Your copy of this information also has my contact information on it. If you have any other questions or comments, please feel free to contact me at any time.

Thank you for your participation – I really appreciate it.

I, Karen R Diller, hereby submit this dissertation to Emporia State University as partial fulfillment of the requirements for a doctoral degree. I agree that the Library of the University may make it available for use in accordance with its regulations governing materials of this type. I further agree that quoting, photocopying, or other reproduction of this document is allowed for private study, scholarship (including teaching) and research purposes of a nonprofit nature. No copying which involves potential financial gain will be allowed without written permission of the author. I also agree to permit the Graduate School at Emporia State University to digitize and place this dissertation in the ESU institutional repository.

Signature of Author

Date

Restorative Library Study Spaces

Title of Dissertation

Signature of Graduate School Staff

Date Received