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PROFESSIONALS KNOWLEDGE OF STANDARDS REQUIRED FOR LEED CERTIFICATION OF INDOOR RECREATION FACILITIES AT FOUR YEAR PUBLIC UNIVERSITIES

A Thesis
presented in partial fulfillment of requirements
for the degree of Master of Arts in Recreation Administration
in the Department of Health, Exercise Science, and Recreation Management
The University of Mississippi

By

WILLIAM A. JORDAN

December 2016

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ABSTRACT

Bryant (1995), found that students “were at least 20% more likely to take part in recreational activity than in any other listed campus activity”. Campus recreation facilities (CRF)s promote “healthy living” programs and services for students. Leadership in Energy and Environmental Design (LEED) is a certification program housed within the United States Green Building Council and a LEED certification indicates the facility has a “green” status. LEED certification standard measures include Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), and Indoor Environmental Quality (IEQ). Interestingly, southeastern states have the fewest LEED certified CRFs (Kiernan, 2015).

The purpose of this study was to explore LEED certification knowledge among campus recreation associates (CRA) and university architects (UA) at four-year public universities in the Southeastern United States. Data was collected via survey. 119 complete responses were used in this study, and the response rate was 41%. As a control, the survey was sent to 16 universities with a currently LEED certified CRF. Data was analyzed using SPSS software to determine the differences in hypotheses centered on LEED certification awareness among the participants (ANOVA, Paired T-Test, and Independent T-Test) as well as to determine the certification standards met and not met (Means and Standard Deviations).

The main findings revealed that UAs at universities that have a certified CRF are the most knowledgeable about LEED standards. Hypothesis two found that there was a significant difference between the LEED survey scores of UAs and CRAs and the known LEED score of the CRF at the university of which they were employed in the categories of MR ($p=.00$), IEQ ($p=.00$), Total LEED ($p=.01$), and Prerequisite (P) ($p=.00$). CRAs at universities with a CRF that is not certified had the least amount of LEED knowledge about their CRF. This could be true because the CRAs have less to do with LEED certification than UAs. A LEED standard that nobody met was P question 5, which mentioned the use of chlorofluorocarbon-based refrigerants. Results suggest that at universities with a noncertified CRF at least 50% of UAs indicated their facilities met 36 out of 56 standards and CRAs met 32 out of 56 standards. Further research needs to continue to investigate the benefits of LEED certification as it goes through updates, and also, why southeastern states are so far behind when it comes to sustainability.

Keywords: LEED, university, campus recreation, Southeastern USA

DEDICATION

I dedicate this thesis to all of my friends and family who supported and encouraged me during all of my educational pursuits. I am forever grateful for the conversations and the unconditional love they have given me. I also dedicate this thesis to my wife, Audrey. I will forever stand in awe of her ability to listen to me and embolden me in everything. Without her encouragement, this endeavor would have never happened.

ABBREVIATIONS AND SYMBOLS

Campus Recreation Associate (CRA)

University Architect (UA)

Leadership in Energy and Environmental Design (LEED)

United States of America (USA)

Campus Recreation Facility (CRF)

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In addition, I thank all of my Oldies in the Bob and Chat class for reminding me what life is all about. I would also like to thank The Gentlemen for investing their lives in me, and giving me a space to explore my own mind.

Lastly, I acknowledge the collegial support from my fellow graduate school students in Recreation Administration at the University of Mississippi. You made my life enjoyable and enriching.

"Find work, if you can, that does no damage. Enjoy your work. Work well." – Wendell Berry.

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CHAPTER I

INTRODUCTION

The first time the word sustainable development, e.g., "sustainability" is used in dialogue is within the World Commission on Environment and Developments Brundtland Report of 1987. Brundtland (1987, p. 24) defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Building off this definition, Owens (2015) refined the definition of sustainability after surveying students, faculty, and staff on the campus of the University of Hartford, and he found that the participants had a fantastical definition of sustainability. The words the participants most frequently used to define sustainability were "Using a resource without depleting it" and "Not causing damage to the earth". Sustainable development is currently used to describe facility, open area, community, policy, and practice that result in decreased environmental impact.

Currently, the United States Green Building Council defines green building as "the planning, design, construction, and operations of buildings with several central, foremost considerations: energy use, water use, indoor environmental quality, material selection and the building's effects on its site". In this paper, we define sustainability in terms of sustainable building practices (development) or "green building" as established by Leadership in Energy and Environmental Design (LEED) in the v2.2 Building Design and Construction certification guidelines.

Importance of the Study

LEED is a certification program housed within the United States Green Building Council, which certifies green buildings based on the building's performance. LEED's performance standards that relate to sustainability include sustainable site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design. LEED goes into detail in all of these areas, and claims "… certified buildings save money and resources and have a positive impact on the health of occupants, while promoting renewable, clean energy" ("Better buildings are our legacy", 2016). This claim is backed by numerous studies (Fenner, 2007; Jackson, 2009; Lee, 2014; Lee, 2009; "This is LEED", 2016). Although there are other organizations and programs such as the Federal Sustainable Building Cost and Performance Metrics, U.S. Department of Energy, and Federal Energy Management Program (FEMP), which measure sustainable development, for the purpose of this study, LEED standards will be measured as they provide a framework for understanding sustainable "green" development of campus recreation facilities (CRFs). Moreover, meeting LEED certification is the most popular way to "green" a building in the United States of America and is the most pertinent standard to determine sustainability for this study ("Green building facts", 2015).

Previous research highlights the benefits associated with green building design (Kats, 2003; Kats, 2006; Ries, Bilec, Gokhan, & Needy, 2006). Specifically, economic and environmental factors are the most prevalent benefits reported. Because of these, sound fiscal practices and environmental stewardship should be primary facility design and development objectives for CRF (CRF) managers. Ries, Bilec, Gokhan, and Needy (2006) claimed that, on average, people spend 80-90% of their time in buildings. That claim serves as motivation for facility planners and managers to strive toward designing and operating LEED certified buildings. It is important for facility management professionals to be aware of the research on sustainable facility design and operation.

John Kiernan, in particular, among others, made a map of the most and least eco-friendly states, and the states in the Southeastern region of the USA were among the least eco-friendly (2016). Kiernan used data from the U.S. Census Bureau, U.S. Environmental Protection Agency, U.S. Energy Information Administration, U.S. Department of Energy, U.S. Geological Survey, U.S. Green Building Council, American Council for an Energy-Efficient Economy, American Chemistry Council, Environmental Working Group, International Plant Nutrition Institute, and United Health Foundation to determine that the Southeastern states are typically less eco-friendly than other states. Moreover, according to his results the states in the Southeastern USA consistently rank in the bottom half on LEED standard measures including carbon dioxide emissions (or "carbon footprints"), total municipal solid waste, air quality, water quality, soil quality, number of LEED certified buildings, percentage of energy consumption from renewable sources, energy consumption, energy efficiency scorecard, gasoline consumption, water consumption, number of alternative fueled vehicles, green transportation (percentage of the population that walk, bike, carpool, use public transportation or work from home), and percentage of municipal solid waste recycled.

Need for the Study

By their nature, recreation centers and facilities pose a challenge for the green movement. Cohen (2009) stated "These facilities have a massive footprint, requiring tons of steel, concrete, and other material that must be transported during construction". He further states that recreation facilities have the potential to be enormous guzzlers of water and feature large volumes that come with huge air-handling requirements, encompass energy hogs, and utilize large expanses of glass that can add significantly to the building's heat load. Facilities of this nature burn tremendous amounts of energy and create mountains of trash".

In a survey of three 4-year public universities, one 2-year public institution, and one privately supported university, Bryant (1995) found that "95% of students engaged in some form of recreational activity several times per week". Bryant (1995) also found that the students "were at least 20% more likely to take part in recreational activity than in any other listed campus activity".

CRFs are known to promote "healthy living". However, living a "healthy life" shouldn't only include living healthily for yourself; it should mean living healthily so that future generations can benefit from sustainable design that reduce non-green effects. Simply, can we provide campus recreation in facilities to improve future generation's health? It is the premise of this study that campus recreation provides and promotes healthy living for students. Therefore, CRFs should achieve LEED certification and become sustainable through "green" design.

Gonzales (2009) claims that health, fitness, physical activity, recreational, and sports facilities fall behind other types of facilities developed with aforementioned sustainability standards. There is no apparent reason why these facilities have lagged behind others. In the day-to-day operations, there are a number of things that campus recreation directors can do to promote sustainable operations. These operations can help to reduce operating costs, promote air quality, reduce pollutants, and conserve resources. CRF areas where sustainable practices can make a difference include but are not limited to the following: green cleaning, heating/ventilation/air conditioning (HVAC) maintenance, energy conservation, water conservation, green vehicles, recycling programs, food service operations, and green grounds keeping.

Kurland (2011) found that there has been a consistent evolution in sustainability initiatives within the college campus setting. In higher education, most universities have an office of sustainability that helps with developing the university's sustainable practices including LEED certification. The most knowledgeable university official cognizant of LEED standards would most logically be the university architect (UA). Many universities have a certified LEED architect on staff. After reviewing the university websites, the researcher discovered that the majority of the 4-year public universities chosen for this study have either an office of sustainability or a campus sustainability initiative. Included in these campus sustainability initiatives and offices should be UA who would oversee LEED certification for all campus buildings. Importantly, there is a "sustainability" commitment which UAs support, titled the "American College & Presidents' Climate Commitment" (ACUPCC). This commitment includes progression towards becoming a more sustainable (green) campus. Augmenting the need for this study is the fact that Southeastern USA contains states that rank in the bottom half of the country when compared with other eco-friendly states (Kiernan, 2016).

Purpose of Study

The purpose of this study was to determine awareness of LEED certification standards among UAs and campus recreation associates (CRA) at four-year public universities in the Southeastern United States using the main CRF as the norm. The goals of the study were to determine how prepared CRAs are to lead LEED certification efforts, how congruent the facility knowledge of CRAs are compared to the UAs, and how well the CRAs and UAs know their current LEED certification level (Platinum, Gold, Silver, and Certified). Moreover, the study explored the LEED standards most met, and those that were least met, so that recommendations could be made to CRAs for planning future sustainable development of CRFs.

As mentioned, the study is important because the recreation facilities in the Southeastern United States are among the least progressive "eco-friendly" (Kiernan, 2016). Facilities that meet the standards of sustainability set by LEED benefit the environment and protect biodiversity and ecosystems, improve air and water quality, and conserve and restore natural resources. Furthermore, LEED certification commits CRAs to operate facilities that reduce operation costs, improve occupant and patron productivity, enhance asset value and profits, and optimize economic life cycles. Moreover, the quality of life benefits of LEED certified buildings include enhanced occupant health and comfort, improved indoor air quality, minimized strains on local infrastructure, and improved overall quality of life for the individuals who occupy the recreation facilities.

Hypotheses

Several hypotheses related to the purpose of the study were explored. Each hypothesis explored a construct that sustainable CRFs lead to increased quality of life and health for students, faculty, and staff of the university. The following hypotheses were posited:

(Ho^1) There will be no significant difference in LEED scores of UAs and CRAs at universities who's main CRF is currently LEED certified and the UAs and CRAs of universities who's main CRF is not currently LEED certified. The null hypothesis was tested by calculating a One Way ANOVA to determine if significant differences existed among the four groups (CRA

Certified, UA Certified, CRA Not Certified, and UA Not Certified) mean scores for each of the five LEED subcategories, overall LEED score, and the Prerequisite LEED score.

(Ho^2) No significant differences will exist between the current LEED certification scores of the 16 LEED certified CRFs and the scores of UAs and the CRAs from those same universities that complete the survey establishing the knowledge of LEED standards.

(Ho^3) There will be no significant difference in LEED survey scores of UAs and CRAs between CRFs that are currently LEED certified (n=16) and the combined scores of UAs and CRAs of universities who's main CRF is not LEED certified (n=103). The null hypothesis was tested by calculating an independent T-test to determine if significant differences existed between the two groups mean scores for each of the five LEED subcategories, overall LEED score, and the Pre-requisite LEED score.

The sub objective of the study explored the UAs and the CRAs responses to determine the LEED standards that are most and least met among four-year public universities in the Southeastern United States. The means and standard deviations for the subcategories and prerequisites were compared among all four groups (CRA Certified, UA Certified, CRA Not Certified, and UA Not Certified).

Definitions

For the purpose of clarification, the important terms used in this study have been defined. The aforementioned terms are:

Campus Recreation Associate (CRA). A full-time member of the professional staff at a campus recreation department.

CRF. “A building on a college/university campus intended for the general student and campus community that contains a wide variety of exercise and wellness equipment and programs” (Dymecki, McCord, Freedman, & Vitters, 2008, p.55).

Commitment. The state or quality of being dedicated to living healthily via sustainable development through LEED certification.

Green Building. “The practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building’s lifecycle from siting to design, construction, operation, maintenance, renovation and deconstruction” (http://www.epa.gov/greenbuilding/pubs/about.htm).

Green Initiatives. The offsetting of Greenhouse Gases emitted by campus recreation departments using the LEED v2.2 BD+C rating scale.

Greenhouse Gases. Any of the various gaseous compounds (carbon dioxide, chlorofluorocarbons, etc.) that absorb infrared radiation and trap heat in the atmosphere.

LEED Building Design and Construction Version 2.2 (BD+C v2.2). “A certification in the LEED rating system designed to guide and distinguish high-performance commercial and institutional projects including office buildings, government buildings, recreational facilities, hotels, 12 and residential buildings that addresses design and construction activities" ("Better buildings are our legacy", 2016).

Leadership in Energy and Environmental Design (LEED). "an ecology-oriented building certification program run under the auspices of the U.S. Green Building Council (USGBC). LEED concentrates its efforts on improving performance across five key areas of environmental and human health: energy efficiency, indoor environmental quality, materials selection, sustainable site development and water savings." (http://searchdatacenter.techtarget.com/definition/LEED-Leadership-in-Energy-and-Environmental-Design).

LEED Standards. Internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across metrics such as: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. LEED definitions can be found in Appendix A.

Sick Building Syndrome. "An environmentally related condition connected with building characteristics such as poor construction, ventilation system problems, or established toxic exposure" (Laumbach & Kipen, 2005, p.135).

Southeastern States. Based on the United States political geography. The states include Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. ("United States", 2015)

Sustainability. "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987, p.24).

United States Green Building Council. "A 501 (c) (3) non-profit organization, based in Washington, D.C., committed to a prosperous and sustainable future for the United States through cost-efficient and energy-saving green buildings" (http://www.usgbc.org/).

CHAPTER II

LITERATURE REVIEW

The origin of the "green movement" can be traced back to the late nineteenth century with examples such as London's Crystal Palace and Milan's Galleria Vittorio Emanuele II using methods that decreased the impact of the structure on the environment (Marble Institute of America, 2012). From the 1930's through the 1960's, new building technologies facilitated a dramatic shift in construction methods. New technologies, including air conditioning, reflective glass, and structural steel made glass-enclosed and steel buildings popular. These buildings required a massive consumption of energy and made their existence entirely dependent upon energy availability and cost (Building, Design and Construction, 2006).

Since the first Earth Day in 1970, society has been making strides in conserving energy, recycling waste, and preserving the environment for future generations. Until recently, the movement toward sustainability has been marginalized and considered out of the mainstream of political thought. However, with the political and social climate shifting toward more energy efficient strategies, sustainability has been thrust into the forefront. Higher education should be doing its part in contributing to this sustainability movement through education and research, as well as building and landscape design (Turman & Hewitt, 2008).

In 1992, the White House underwent a greening program that was designed to improve energy efficiency and environmental performance of the structure by focusing on reducing waste, lowering energy use, and making an appropriate use of renewable resources.

Additionally, the program aimed at improving air quality and overall building comfort. In 1996, the results of the White House greening project showed more than $150,000 per year in energy and water costs, landscaping expenses, and expenditures associated with solid waste were saved (Marble Institute of America, 2012).

Today, architects and designers are captivated by green building and the potential for cost savings, lower energy usage, a modern look, and the symbolic relationship with green buildings and nature. Architects and designers look toward organizations dedicated to green building and sustainability for guidance on construction or renovation projects. The USGBC has become the foremost leader and educator within the world of green building and was created to promote the design and construction of buildings that are environmentally responsible, profitable, and healthy places to live and work (Marble Institute of American, 2012). Whether the facility is a residence hall, a student union, or a recreational sports facility, it is essential that leaders in higher education understand the strategic and operational considerations in facility management and construction (McClellan & Barr, 2000).

The researcher used the University of Mississippi Libraries and Google Scholar to find the most up to date articles and journals on LEED certifications, CRFs, and green building design. The words used to search for these articles were LEED compliance, green building design, CRFs, barriers to green building, sick building syndrome, green initiatives for healthy persons, and various matches of these words. As LEED has only been around since 1994, there is not much research on, specifically, a LEED certification. However, there are numerous articles on "green" building design and the barriers to them. Williams (2007) provides a conceptual framework for this study.

LEED Compliance

Casper (2012) examined American intercollegiate athletics department personnel in relation to their organization's sustainability practices, organizational strategies, and personal perspectives at National Collegiate Athletic Association (NCAA) Football Bowl Subdivision (FBS) universities. Athletics department members (N = 97) who were most responsible for sustainability initiatives responded to a survey designed to assess awareness levels and concern for environmental issues and the strategies and practices at work in their respective athletics departments. Results of this study showed that, although environmental concern is high, there is disconnect between concern and action perhaps due to a lack of communication between the athletics department and the general university, cost concerns, and a lack of knowledge about sustainability initiatives.

Green Building Design

Akadiri (2015) issued a survey targeting architects and building designers, quantity surveyors, construction managers, and contractors registered with the Nigerian Institute of Building (NIOB) and the Council of Registered Builders of Nigeria (CORBON). They used a 5-point Likert scale from "low" (=1) to "high" (=5), to rank the obstacles that affect their sustainable practices in building material selection, and they found that the top 5 perceived barriers among this group were: 1. Perception of extra cost being incurred, 2. Lack of sustainable material information, 3. Lack of comprehensive tools and data to compare material alternatives, 4. Perception of extra time being incurred, and 5. Maintenance concern. Over half of the respondents said that uncertainty in liability of final work, building code restriction, possible project delay due to sustainability requirement, limited availability of supplier, low flexibility of alternatives or substitutes, and unwilling to change the conventional way of specifying.

AlSanad (2015) issued a survey to local stakeholders in the Kuwait construction industry on perceived barriers of green building. Of the respondents surveyed, 25.2% had between 10-15 years of experience in construction industry, and 24.80% of respondents had more than 20 years of experience. The results revealed that 56% of participants belonged to the private sector, whereas 44% of the participants belonged to the government sector. AlSanad found that the top 5 perceived barriers to barriers of green building were: lack of awareness, lack of government support/no incentives, No existing rule in Kuwait to adopt green building, Lack of qualified staff, and Unwillingness to change. AlSanad also found Economic conditions, Risk associated with implementation of new practices, Green Building is Expensive, Lack of clear benefits of green building, and Fewer developers undertake green building projects as common perceived barriers to green building.

Li (2015) investigated the role of green supply chains in eco-industrial parks (EIPs) towards a green economy in Taiwan. Li assessed the barriers from the perspective of institution, regulation, technology, and finance. A literature review showed that regulatory barriers often prevent institutions from efficiently developing technology and processes that are crucial for green supply chains. Laws regulating intellectual property rights (IPR) frequently make it difficult to share information among the industries because the laws determine who controls information and technology, making the spread of technology dependent on the groups controlling the information. Political issues and an outdated infrastructure act as obstacles to creating an effective green economy. Outdated infrastructure, another institutional barrier, is pervasive in both developed and developing countries. The financial incentive for a particular industry and its associated businesses to invest in green technology or management may not be available at the very beginning. This may be for a variety of reasons: the cost of going green is too high in the developing countries and their industries may not have the financial resources to go green. The upfront, cost of greening supply chains may deter institutions from wanting to make such a transition. The benefits of greening a business may not be apparent or immediate enough to incentivize a business or government. Li proposed several answers to barriers consisting of: implementing national sustainable policy, developing network among central and local governments, providing economic incentives and price supports, and integrating best available technologies for innovation.

Hwang (2012) researched obstacles and solutions to green building in Singapore. He stated that green building is often mentioned together with sustainable construction, and sometimes these two terms are used interchangeably. According to Kibert (2008), sustainable construction focuses on the ecological, social, and economic issues of a building in the context of its community. Therefore, green building can be a subset of sustainable construction and is a stepping stone to sustainable development, which has been defined as being able to meet present needs without the expense of the needs of future generations (CIRIA C571, 2001). Hwang presented rationales behind green building including: legislations and regulations, economic benefits, and better risk management. He also presented obstacles in green building project management including: high cost premium, unequal distribution of benefits, lack of green product information, complex legislation, and lack of awareness. Hwang sent questionnaires via email, to a population size of 101 managers and professionals listed under the BCA's Certified Green GMM and GMP Scheme. They were chosen as the target population as they have a strong foundation and deep knowledge of green building and have the professional capability to advise on designing of environmental friendly buildings (BCA, 2009d). In addition to the survey, interviews with 10 GMPs and GMMs who have managed projects that have received either Green Mark Platinum or Gold Plus award, and who have more than 3 years of experience in the field of green building, were conducted. The respondents were from 19 consultancy (61%) and 12 project management companies (39%). All of the respondents have more than 2 years of experience on green building construction projects and the majority of them (19 out of 31 respondents; 61%) have 3–4 years of experience. In addition, there are five respondents (16%) who have more than 4 years of experience in the area. According to the survey results, the top five obstacles encountered by professionals and managers when managing a green building project are the high premium cost associated with green building construction, the lack of communication and interest between project members, the lack of expressed interest from clients or market demand, the lack of credible research on the benefits of green buildings and green building practices are costly to implement. Surprisingly, none of the respondents feels that there is a lack of expertise and knowledge in green building and its principles. None of the respondents felt that there was a lack in the government's support for sustainable construction, which could be due to the tremendous effort that government-based BCA has put in to actively promote green building and sustainable development. Both obstacles involving high cost premium of green building project and costly green construction practices are cost related and are considered the biggest obstacles a project management team has to overcome. This factor has a very extensive effect on the projects' budgets because in Singapore's profit driven construction industry most projects are awarded based on the lowest tender price. To overcome the problem of high cost involved in green building construction, all of the respondents feel that incentivization of green building projects by the government can help offset the high cost involved. 67.7% of the respondents feel that educating the client on the future benefits of green building could be the solution to this problem as well. 74.2% of the respondents feel that regular toolbox meetings should be conducted to ensure that important information about the project is communicated. 45.2% of them feel that engaging personnel with green building experience could overcome this obstacle as well. From the survey, 80.6% of the respondents felt that a construction tour could be organized for the client and the public to educate them on the benefits of green building to increase their interest and create a higher market demand for green buildings in Singapore. The poor demand for green buildings could also be due to the lack of credible research on their benefits. Knowing the advantages that green buildings could bring about heightened interest, 96.8% of the respondents felt that subsidy from government for research and development of green building systems and management could essentially provide concrete evidence of how beneficial they are to humans and society as well as the economy. Results from the survey and interviews revealed profound obstacles in the project management of green building construction. These obstacles were found to be interrelated but they ultimately boil down to the high cost premium of green building. The lack of R&D on the benefits of green buildings and green technologies are drivers behind the lack of demand for building to go beyond legislative requirements. As such, these green technologies and systems are non-prevalent, leading to the hefty price tags attached to their installation and implementation. A vicious cycle starts, making green building construction practices costly to implement.

Hakkinen (2011) researched barriers and drivers to sustainable building (SB). Hakkinen's research methods were a critical review of the literature (which analyzed barriers and drivers mainly on the basis of academic literature), a web-based enquiry (which studied the viewpoints of Finnish building professionals about the most significant barriers), interviews (which aimed at defining the needs for changes), expert panels and workshops (which described the characteristics, tasks and roles in SB processes), and case studies (which studied the possibilities to improve the SB processes and the impacts and benefits of SB). Hakkinen developed the following outline for the barriers of SB: steering mechanisms, economics, client understanding, process, procurement and tendering, timing, cooperation and networking, underpinning knowledge, knowledge and common language, availability of methods and tools, and innovation. Hakkinen used (Pitt et al 2009) to rank the drivers and barriers to SB

1. Ranking Drivers and Barriers
    - 1 Financial incentives - Affordability
    - 2 Building regulations - Lack of client demand
    - 3 Client awareness - Lack of client awareness
    - 4 Client demand - Lack of proven alternative technologies
    - 5 Planning policy - Lack of business case understanding
    - 6 Taxes/levies - Building regulations
    - 7 Investment - Planning policy
    - 8 Labeling/ measurement - Lack of labeling/ measurement standard

The aim of the study was to ascertain the most important issues considered as barriers and drivers for SB by Finnish building professionals. Forty-eight claims were formulated about the barriers of SB. These claims were formulated with help of the literature study and discussion and with help, Hakkinen and Belloni 246 of SB-related articles and news published in the two trade magazines with the widest circulation among the building professionals (Tekniikka & Talous and Rakennuslehti). The claims described the availability of information, tools and methods, and the roles, awareness and tasks of clients, municipalities, owners, developers, contractors, designers, homebuyers, tenants, facility managers and manufacturers and the quality of services for maintenance, renovation and energy production. Hakkinen found that the following issues are important in Finland to SB: the need to increase the expectations and demands of, and awareness by, end users (both occupants and owners) about the potential of SB, the adoption of methods for SB requirement management, the mobilization of (integrated) SB tools, the development of designers team working, competence and the role of chief designer, and the development of new concepts and services. The increase of demand is important among professional clients but it is also very important to increase the demand among homebuyers.

Williams (2007) is the theoretical construct for this study. Williams noticed that the majority of new developments in England incorporate few sustainability features. Williams study complements previous research on barriers to the implementation of sustainability that take a theoretical and classificatory approach (Trudgill, 1990) and those that investigate current practice (Blair and Evans, 2004; Townsend, 2005; Landman, 1999; Lee, 1998). The outcome of this review was a two part analytical framework to be used in the research. Part one of the framework is a categorization of stakeholders in the development process. Part two of the framework is a 'checklist' of sustainability objectives that potentially can be met in a development project, with examples of how these objectives could be achieved. Group 1 consisted of regulators, statutory consultees, and service providers and councilors (e.g. water companies, building inspectors). Group 2 consisted of non-statutory consultees, interest groups, and individuals (e.g. chamber of commerce, preservation group). Group 3 consisted of property developers and their professional advisors and developer interests (e.g. landowners, valuers). Group 4 consisted of end users (e.g. residents, retailers). Williams found that, by far, the most commonly recorded barrier was stakeholders did not consider sustainability measure. Other notable barriers that were commonly recorded were: sustainability measure was not required by client (includes purchasers, tenants and end users), stakeholder had no power to enforce or require sustainable measure (in some cases Commonly recorded it was the responsibility of the client or the contractor), one sustainability measure was forgone in order to achieve another (traded), sustainable measure was restricted, or not allowed, by regulators, the sustainability measure cost too much (in some cases the investor would not fund), site conditions mitigated against the use of a sustainable measure, inadequate, untested, or unreliable sustainable materials, products or systems, and sustainable measure was not available. Williams's Table 3, which can be found in Appendix B, shows the results from his case studies of barriers to acting sustainably. Stakeholders from groups 1 and 2 were unable to seek 'best practice' in sustainability because policies and regulations on certain issues allow for less sustainable options. This suggests that there is a need for policy and regulations to keep pace with best practice in order to allow more regulatory power where it is desired. The stakeholders involved in development and construction (group 3) are also facing 'knowledge related' barriers. There is a lack of awareness of sustainability in general, and a lack of expertise and experience in building sustainable developments. The stakeholders who ultimately use the developments are key in this achievement of sustainable development (group 4). This 'end user' group could be, for example, residents of new homes or occupants of commercial buildings. They represent demand, and in this research, there was very little evidence of any interest in a sustainable built environment. Williams proposed that until this changes, and developers perceive a demand for a more sustainable option (or they are forced to act more sustainably through regulations and policies), they are unlikely to change their practices.

Green Initiatives for Healthy Persons

Zhang (2014) performed a two-year prospective study and investigated associations between environmental parameters such as room temperature, relative air humidity (RH), carbon dioxide (CO^2), nitrogen dioxide (NO^2), sulphur dioxide (SO^2), ozone (O^3), particulate matter (PM10), and health outcomes including prevalence, incidence, and remission of SBS symptoms in junior high schools in Taiyuan, China. Totally, 2134 pupils participated at baseline, and 1325 students stayed in the same classrooms during the study period. The prevalence of mucosal symptoms, general symptoms, and symptoms improved when away from school (school-related symptoms) was 22.7%, 20.4% and 39.2%, respectively, at baseline, and the prevalence increased during follow-up (P,0.001). At baseline, both indoor and outdoor SO^2 were found positively associated with prevalence of school-related symptoms. Indoor O^3 was shown to be positively associated with prevalence of skin symptoms. At follow-up, indoor PM10 was found to be positively associated with new onset of skin, mucosal and general symptoms. CO^2 and RH were positively associated with new onset of mucosal, general, and school-related symptoms. Outdoor SO^2 was positively associated with new onset of skin symptoms, while outdoor NO^2 was positively associated with new onset of skin, general and mucosal symptoms. Outdoor PM^{10} was found to be positively associated with new onset of skin, general, and mucosal symptoms as well as school-related symptoms. Zhang discovered that symptoms, as described for SBS, were commonly found in school children in Taiyuan City, China, and increased during the two-year follow-up period. Environmental pollution, including PM^{10}, SO^2, and NO^2, could increase the prevalence and incidence of SBS and decrease the remission rate. Moreover, parental asthma and allergy (heredity) and pollen or pet allergy (atopy) can be risk factors for SBS.

Runeson-Broberg (2012) looked at medical symptoms called sick building syndrome (SBS) and sick house syndrome (SHS). Runeson-Broberg investigated the significance of personal factors, perceptions of air quality, and psychosocial work situation in explaining SBS and SHS. A random sample of 1,000 subjects (20–65 year) received a postal questionnaire including questions on personal factors, medical symptoms, and the psychosocial demand-control-support model. The response rate was 70% (n = 695), of which 532 were occupationally active. Results In logistic regression models, atopy, poor air quality at work, and low social support, especially low supervisor support, were associated with both SBS and SHS when age, gender, smoking, and BMI were introduced. The general work-related symptoms (headache, tiredness, nausea, and sensation of a cold) were also related to low control over work. The perception of poor physical environmental conditions is associated with common medical symptoms that are both work and home related. The associations between medical symptoms and poor air quality are still present, even when controlling for the psychosocial environment.

Jung (2014) investigated whether indoor environmental quality (IEQ) influences allostatic load (AL) and whether AL can be a predictor for sick building syndrome (SBS). Jung also assessed and compared the associations between AL and SBS versus 8-hydroxydeoxyguanosine (8-OHdG) and SBS. A total of 115 office workers from 21 offices completed self-reported SBS questionnaires, and provided 11 biomarkers for their AL. Multiple linear regressions and logistic regression analysis were applied to examine the correlations between IEQ and AL or 8-OHdG and between AL or 8-OHdG and SBS, respectively. Our data revealed that the neuroendocrine system was correlated with CO^2, the difference between indoor and outdoor CO^2 levels (dCO^2), and the indoor-outdoor ratio of CO^2 (CO^2 I/O). Metabolic system effects were associated with illumination. The relationships between illumination, CO^2,

dCO^2, CO^2 I/O and 8-OHdG were consistent with those and AL in specific systems. Furthermore, Jung found that risks for SBS syndromes were related with neuroendocrine and metabolic system of the AL. 8- OHdG was associated with eye dryness or irritation, eye tiredness and vomiting. We conclude that IEQ significantly influences AL and that AL can be a predictor for reporting SBS with information on system-specific effects.

Henchy (2011) examined some ways in which participation in campus recreation positively influenced students' lives increasing student retention on college campuses. Researchers have found that nonacademic aspects of campus such as campus recreation can positively influence students' lives (Belch, Gebel, & Maas, 2001; Lindsey & Sessoms, 2006). Students were randomly selected to complete the campus recreation survey. The survey was based on the NIRSA/Student Voice Campus Recreation Impact Study survey. Of the students who answered the demographic questions, 45% were graduate/professional/continuing education students and 55% were undergraduate students; 43% were male, 56% were female, and < 1% transgender; and the majority of the sample was White (78%). The results showed that students reported a variety of benefits including health and social benefits from their participation in CRFs and programs.

Henchy (2013) compared undergraduate and graduate students on the perceived benefits they received from participating in CRFs and programs. Students were randomly selected to complete the campus recreation survey, which was based upon the NIRSA/Student Voice Campus Recreation Impact Study survey. Of the students who answered the demographic questions, 35% were graduate students and 65% were undergraduate students; 43% were male and 57% were female; and the majority of the sample was White (68%). The results showed that participation in campus recreation had an influence on undergraduate and graduate students' decisions to attend and continue to attend the university. Participating in CRFs and programs had a positive influence on a variety of aspects of both undergraduate and graduate students' lives; students reported academic, health, and social benefits.

Lindsey (2009) assessed the impact of campus recreational sports facilities and programs on student recruitment and retention among male and female African American students. A convenience sample of students from classes in the Department of Health and Human Performance at a small, southeastern, private, historically black college and university was used in the study. The instrument consisted of a modified version of the National Intramural-Recreational Sports Association's Quality and Importance of Recreational Services Survey. An independent samples t test was used to test for differences between gender and the recruitment and retention questions, alpha = .05. It was determined that 60% of the male students reported that the availability of recreational sports was important/very important in deciding to attend the college and 68% of the men reported that the availability of recreational sports was important/very important in deciding to continue attending the college. Men scored higher than women when it came to importance of the availability of recreational facilities and programs in deciding to attend the school, the importance of the availability of recreational facilities and programs in deciding to continue at the school, how important sports and fitness activities will be to them after graduation, and the total times per week they participate in active recreational sports pursuits. The results from this study provide further evidence that students report that the availability of recreational sports facilities and programs has an impact on both their decisions to attend and remain at an institution. This finding can only serve to increase the practitioner's understanding of those who use such facilities and programs.

CHAPTER III

METHODOLOGY

Participants

The participants for this study were to include one CRA and one UA from 118 four-year public universities in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee and from 16 LEED certified CRFs in the USA. The 16 LEED certified CRFs were chosen based on Church (2013) who ranked the best campus recreation facilities. LEED certification was one of the scores used in Church's ranking system. CRAs were chosen based on their knowledge about the main CRF and logically assumed to be best to determine whether or not LEED criterion were met. The universities chosen for this survey are listed in Appendix C. The researcher sent an email to the director of each CRF to identify the CRA most knowledgeable on LEED certification standards. Recruitment letters were emailed to both CRAs and UAs for each university. The recruitment letter can be found in Appendix D. If the UAs and CRAs did not respond to the email in within one week, the researcher resent the email every two weeks for the next two months. The researcher identified the participants who should receive an email by checking the survey data to find out the participants from universities who had completed the survey. Therefore, several efforts were made to assure that each university CRA and UA was contacted and invited to participate in the study.

Instrumentation

The questionnaire developed specifically for this study measures the LEED certification knowledge of the participants and identifying information to better describe the data. The measurements used in this survey were operationalized from the LEED v2.2 Building Design and Construction criteria. The LEED certification standards were determined to be reliable and valid measures (Hamilton, 2015). In April 2016, a pilot study was completed by the campus recreation full-time employees at the University of Mississippi, and their comments and observations were used to revise the questionnaire, most notably to include the UAs as participants. Another comment was that the survey was too long, so the survey was shortened to accommodate for the participant. More definitions were included within the survey so that participants could understand the criteria better.

The known LEED certification scores of the 16 LEED certified CRFs served as a control for the study. These scores were previously reported on the LEED website. The LEED certifications for those universities can be found in Table 1.

Table 1. Universities with a LEED certified CRF

University	LEED Certification
California State University, Fullerton	Gold
California State University, Long Beach	Gold
California State University, Northridge	Gold
Colorado State University	Gold
Eastern Washington University	Gold
Georgia College and State University	Silver
Georgia Southern University	Certified
Morehead State University	Silver
Rice University	Silver
University of Arizona	Platinum
University of Central Florida	Gold
University of Colorado at Colorado Springs	Gold
University of Louisville	Gold
University of Maine	Silver
University of North Florida	Silver
Virginia Commonwealth University	Silver

The first section of the survey explored the status of the facility toward meeting criteria for LEED certification based on the v2.2 Building Design and Construction criteria. V2.2 criteria were evaluated when certifying the twelve LEED certified facilities and although not the most current standard they are used for this study to assure valid and reliable comparisons to the university officials completing the survey. This section includes prerequisites for LEED certification. If the facility meets all the prerequisite requirements, then it has the potential to be LEED certified. The survey evaluates the criteria Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. Innovation was left out of the survey because Innovation can only be measured once someone has applied for LEED certification for a building. The LEED criteria can be found in Appendix D.

The final section of the survey collected basic demographic information such as name of university at which the participant was employed, approximate student population, and tenure. This demographic information will help describe the participants. The survey is included in Appendix (F). Responses were scored “1” as Yes and “2” as No. If the respondent marked “I don’t know,” the score was not counted.

Analysis

A null hypothesis was tested by calculating a One Way ANOVA to determine if significant differences existed among the four groups (CRA Certified, UA Certified, CRA Not Certified, and UA Not Certified) mean scores for each of the five LEED subcategories, overall LEED score, and the Prerequisite LEED score. A null hypothesis was tested by calculating a T test to determine if there were differences between the current LEED certification scores and the scores of the UAs and CRAs from those same universities. The null hypothesis was tested by calculating an independent T-test to determine if significant differences existed between the two groups mean scores for each of the five LEED subcategories, overall LEED score, and the Pre-requisite LEED score. The means and standard deviations for the subcategories and prerequisites were compared among all four groups (CRA Certified, UA Certified, CRA Not Certified, and UA Not Certified).

Data was analyzed using SPSS software to determine the differences in hypotheses centered on LEED certification awareness among the participants (ANOVA, Paired T-Test, and Independent T-Test) as well as to determine the certification standards met and not met (Means and Standard Deviations). The data analysis provided insight into whether the CRAs who work at current LEED certified CRFs are knowledgeable about LEED standards, whether these CRAs who work at current LEED certified CRFs are more knowledgeable than CRAs who work at CRFs that are not currently LEED certified, and whether the UAs are significantly more knowledgeable than the CRAs about the facility and LEED standards. Finally, the data analyses provided insight into the standards CRAs and UAs indicate are most and least met by their CRFs.

CHAPTER IV

RESULTS

The primary purpose of the study was to determine awareness of LEED certification standards among UAs and CRAs at four-year public universities in the Southeastern United States using the main CRF as the norm. The goals of the study were to determine how prepared CRAs are to lead LEED certification efforts, how LEED knowledge of CRAs compared to the UAs, and how well the CRAs and UAs LEED certification (Platinum, Gold, Silver, and Certified) compared to LEED knowledge. Moreover, the study explored the LEED standards most met, and those that were least met, so that recommendations can be made to campus officials for planning future sustainable development of CRFs.

Sample Characteristics

The participants for this study consisted of 134 CRAs and UAs from four-year public universities in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee and at LEED certified CRFs in the USA. CRAs were chosen based on their knowledge about the main CRF and LEED criterion. The universities chosen for this survey are listed in Appendix C. One hundred and fifty seven responses were collected, but only 135 (86%) were adequate for analysis. Out of the 135 responses used only 119 (75%) were complete responses. Since there were 119 complete response that could be used out of a potential 268, the response rate was 44%.

Results indicate that participants who self-identified as a UA indicated their affiliations as: facilities management, project manager, utilities director, associate vice chancellor, director of facilities, mechanical engineer, capital projects, project manager, project coordinator, faculty, facilities planning officer, sustainability planner, associate vice president – facilities development, campus architect, capital construction manager, director of architecture, and sustainability. Participants who self-identified as a CRA were titled as: student affairs and associate director – member services. The descriptive statistics for the participants are shown in Tables 2 – 6.

Results from the Age Breakout can be found in Table 2. No responses were collected for individuals under 21 years old. The approximate average age for CRAs was 51 and UAs was 59.

Table 2. Age Breakout By Profession

	CRAs		UAs	
	n	%	n	%
under 21	0	0.0%	0	0.0%
21-30	4	5.5%	2	4.3%
31-40	17	23.3%	7	15.2%
41-50	25	34.2%	8	17.4%
51-60	23	31.5%	16	34.8%
61+	4	5.5%	10	21.7%
Prefer not to answer	0	0.0%	3	6.5%

Results from the Education Breakout can be found in Table 3. Ten percent of CRAs and 39% of UAs had a Bachelors degree. Ninety percent of CRAs and 61% of UAs had an advanced degree.

Table 3. Education Breakout By Profession

	CRAs		UAs	
	n	%	n	%
Bachelor	7	9.6%	18	39.1%
Master	60	82.2%	25	54.3%
Doctorate	6	8.2%	3	6.5%

Results from the Tenure Breakout can be found in Table 4. Forty-seven percent of participants had been working at the university for less than 6 years. The latest version of LEED used in this study came out in 2009.

Table 4. Tenure Breakout By Profession

	CRAs		UAs	
	N	%	N	%
less than a year	5	6.9%	4	8.7%
1-3 years	11	15.3%	10	21.7%
4-6 years	18	25.0%	11	23.9%
7-10 years	8	11.1%	3	6.5%
11-15 years	16	22.2%	9	19.6%
16-20 years	6	8.3%	1	2.2%
21-25 years	5	6.9%	4	8.7%
26 or more years	3	4.2%	4	8.7%

Results from the Age of CRF Breakout can be found in Table 5. LEED began in 1994 with only one standard. Sixty-three percent of participants were at a university with a CRF that was under 20 years old.

Table 5. Age of CRF Breakout By Profession

	CRAs		UAs	
	n	%	n	5
Less than a year	2	2.7%	3	6.5%
1-5	10	13.7%	10	21.7%
6-10	20	27.4%	10	21.7%
11-20	14	19.2%	11	23.9%
21-30	12	16.4%	7	15.2%
31-40	8	11.0%	0	0.0%
41+	7	9.6%	3	6.5%
Do not know	0	0.0%	2	4.3%

Results from the Shared Facility Breakout can be found in Table 6. Forty-six percent of participants had a CRF that was shared with another department at the university.

Table 6. Shared Facility Breakout By Profession

	CRAs		UAs	
	n	%	n	%
Only Campus recreation	39	54.2%	24	52.2%
Campus recreation and Athletics	11	15.3%	5	10.9%
Campus recreation and Education programs	22	30.6%	17	37.0%

Additional results exploring covariates of the study were also calculated. The covariate Land Grant Institution results indicated that 30% (40) indicated they were from a land grant university, 53% (72) indicated they were not from a land grant university, and 17% (23)

indicated that they did not know.

The covariate Office of Sustainability results indicated that 67% (90) indicated they had an office of sustainability, 26% (35) indicated they did not have an office of sustainability, and 7% (10) indicated that they did not know. The covariate Licensed LEED Associate results indicated that 14% (19) were a licensed LEED associate. Seventy-four percent (14) of these Licensed LEED Associates identified as being a UA.

Hypotheses Testing

Three hypotheses were tested to address the purpose of the study; to determine awareness of LEED certification standards among UAs and CRAs at four-year public universities in the Southeastern United States using the main CRF as the norm. The hypotheses tested scores of LEED awareness. The statistical analyses and results of the T-test for LEED scores are presented in Table 7.

Hypothesis One

The first hypothesis stated that there would be no significant difference in the combined LEED knowledge scores of UAs and CRAs at universities whose main CRF is LEED certified and the combined scores of UAs and CRAs of universities whose main CRF is not LEED certified. The null hypothesis was tested by calculating a One Way ANOVA to determine if significant differences existed among the four groups (CRA Certified, UA Certified, CRA Not Certified, and UA Not Certified) mean scores for each of the five LEED subcategories, overall LEED score, and the Prerequisite LEED score.

The One-Way ANOVA determined significant differences existed among the four groups LEED knowledge scores prompting calculation of Bonferroni post-hoc tests to determine where the significant differences ($p > .05$) occurred for Total LEED score, the 5 LEED subcategory scores, and prerequisite LEED scores. The Bonferroni Post Hoc results are presented for each measure in the in Table 9.

Sustainable Sites

One-way ANOVA analysis revealed that there was a significant difference at the $p < .05$ level for Sustainable Site scores among the four participant groups [$F(3, 115) = 5.22$, $p=.002$]. Bonferroni post-hoc tests revealed the mean scores for the UA Certified (M=1.39, SD=.20) and UA Not Certified (M=1.47, SD=.19) were significantly different from the CRA Not Certified scores (M=1.58, SD=.19). There was no significant difference in the LEED knowledge scores of CRA Certified and the other three professional groups.

Water Efficiency

One-way ANOVA analysis revealed that there was a significant difference at the $p < .05$ level for Water Efficiency scores among the four participant groups [$F_{(3, 104)} = 4.96$, $p=.003$]. Bonferroni post-hoc tests revealed the mean scores for the CRA Not Certified (M=1.72, S D=.37) and the UA Not Certified (M=1.66, S D=.32) were significantly higher than the UA Certified (M=1.29, S D=.21). There was no significant difference in the LEED knowledge scores of CRA Certified and the other three professional groups.

Energy and Atmosphere

One-way ANOVA analysis revealed that there was a significant difference at the $p < .05$ level for Energy and Atmosphere scores among the four participant groups [$F(3, 106) = 6.06$, $p=.001$]. Bonferroni post-hoc tests revealed the mean scores for the UA Certified (M=1.26, SD=.16) were significantly lower than the CRA Not Certified (M=1.69, SD=.32). There was no significant difference in the LEED knowledge scores of CRA Certified and the other three professional groups or UA Not Certified and the other three professional groups.

Materials and Resources

One-way ANOVA analysis revealed that there was a significant difference at the $p < .05$ level for Materials and Resources scores among the four participant groups [$F(3, 102) = 4.34$, $p=.006$]. Bonferroni post-hoc tests revealed the mean scores for the CRA Certified group (M=1.12, SD=.20) were significantly lower than the UA Not Certified group (M=1.55, SD=.31). There was no significant difference in the LEED knowledge scores of CRA Not Certified and the other three professional groups or UA Certified and the other three professional groups.

Indoor Environmental Quality

One-way ANOVA analysis revealed that there was no significant difference at the $p < .05$ level for Indoor Environmental Quality scores among the four participant groups [$F(3, 108) = 2.91$, $p=.038$].

Total LEED Score

One-way ANOVA analysis revealed that there was a significant difference at the $p < .05$ level for Total LEED Score scores among the four participant groups [$F(3, 115) = 7.00$, $p=.00$]. Bonferroni post-hoc tests revealed the mean scores for the CRA Certified (M=1.31, SD=.14) and the UA Certified (M=1.26, SD=.13) were significantly lower than the CRA Not Certified (M=1.53, SD=.21). The Bonferroni post-hoc tests also revealed the mean scores for the UA Certified (M=1.26, SD=.13) were significantly lower than the UA Not Certified (M=1.47, SD=.19).

Prerequisites

One-way ANOVA analysis revealed that there was no significant difference at the $p < .05$ level for Prerequisite scores among the four participant groups [$F(3, 115) = 2.12$, $p=.10$].

Table 7. Mean LEED Scores

	University Certification by profession			
	CRA Certified	UA Certified	CRA Not Certified	UA Not Certified
	Mean	Mean	Mean	Mean
Sustainable Sites	$1.42_{a,c,d}$	$1.39_{a,b}$	1.58_{c}	$1.47_{b,d}$
Water Efficiency	$1.40_{a,b}$	1.29_{a}	1.72_{b}	$1.66_{b,c}$
Energy & Atmosphere	$1.48_{a,b}$	1.26_{a}	1.69_{b}	$1.53_{a,b}$
Materials & Resources	1.12_{a}	$1.25_{a,b}$	$1.44_{a,b}$	1.55_{b}
Indoor Environmental Quality	1.09_{a}	1.08_{a}	1.33_{a}	1.30_{a}
Total LEED Score	$1.31_{a,c}$	1.26_{a}	1.53_{b}	$1.47_{b,c}$
LEED Prerequisites	1.12_{a}	1.10_{a}	1.26_{a}	1.21_{a}

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[1]

1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Hypothesis Two

The second hypothesis stated that, within the LEED certified group, there would be no significant difference between the LEED survey scores of UAs and CRAs and the known LEED score of the CRF at the university of which they are employed. The null hypothesis was tested by calculating a paired-samples t-test to compare LEED knowledge scores between LEED Certified CRAs and UAs and the known LEED certification scores of their university CRF. Mean and standard deviation scores are presented in Tables 8 and 9.

There was a significant difference in the scores for LEED measures; Participant: Materials and Resources (M=1.18, SD=.21), Indoor Environmental Quality (M=1.09, SD=.07), Total LEED Score (M=1.29, SD=.14) and the Prerequisites score (M=1.11, SD=.08) and Actual: Materials and Resources (M=1.59, SD=.06), Indoor Environmental Quality (M=1.38, SD=.12), Total LEED Score (M=1.46, SD=.09) and the Prerequisites score (M=1.00, SD=.00). There were no significant differences in the LEED scores; Sustainable Sites, Water Efficiency and Energy and Atmosphere. The means and standard deviations of all of the LEED standard criteria can be found in Table 8. The results from the paired sample t-test can be found in Table 9.

Table 8. Means and standard deviations

	Mean	N	Std. Deviation
Sustainable Sites	1.40	14	.19
Sustainable Sites Actual	1.43	14	.14
Water Efficiency	1.33	13	.29
Water Efficiency Actual	1.50	13	.18
Energy & Atmosphere	1.37	14	.28
Energy & Atmosphere Actual	1.42	14	.19
Materials & Resources	1.18	14	.21
Materials & Resources Actual	1.59	14	.06
Indoor Environmental Quality	1.09	12	.07
Indoor Environmental Quality Actual	1.38	12	.12
Total LEED Score	1.29	14	.14
Total LEED Score Actual	1.46	14	.09
LEED Prerequisites	1.11	16	.08
LEED Prerequisites Actual	1.00	16	.00

Table 9. Paired Sample t-test

	Paired Differences		t	df	Sig.
	Mean	Std. Deviation			
Sustainable Sites	-.04	.20	-.65	13	.53
Water Efficiency	-.17	.31	-1.93	12	.08
Energy Atmosphere	-.05	.35	-.52	13	.61
Materials Resources	-.40	.21	-7.06	13	.00
Indoor Environmental Quality	-.29	.15	-6.85	11	.00
Total LEED Score	-.17	.20	-3.25	13	.01
LEED Prerequisites	.11	.08	5.16	15	.00

Hypothesis Three

The third hypothesis stated that there would be no significant difference in the combined LEED knowledge scores of UAs and CRAs at universities whose main CRF is LEED certified (n=16) and the combined scores of UAs and CRAs of universities whose main CRF is not LEED certified (n=103). The null hypothesis was tested by calculating multiple independent T-tests to determine if significant differences existed between the two groups mean scores for each of the five LEED subcategories, overall LEED score, and the Pre-requisite LEED score.

Results indicated that there was a significant difference ($p > .05$) between all LEED scores including subcategories, overall and prerequisite scores between the CRAs and UAs from LEED certified universities and those from universities without LEED certification. The mean and standard deviation scores are presented in Tables 10 and 11.

Table 10. LEED Certification Mean and Standard Deviation Scores

	LEED Certified Recreation Facility	M	SD
Sustainable Sites	Yes	1.40	.18
	No	1.54	.20
Water Efficiency	Yes	1.34	.28
	No	1.70	.35
Energy Atmosphere	Yes	1.37	.26
	No	1.62	.32
Materials Resources	Yes	1.19	.21
	No	1.48	.36
Indoor Environmental Quality	Yes	1.08	.07
	No	1.32	.29
Total LEED Score	Yes	1.28	.14
	No	1.51	.21
LEED Prerequisites	Yes	1.11	.08
	No	1.24	.23

The results of independent-sample t-test are presented in Table 11. Degrees of freedom (df) fluctuated due to some respondents indicating "I don't know" and did not respond "Yes" or "No".

Table 11. Hypothesis Three. Results of Independent-sample T-Test

	t	df	Sig. (2-tailed)
Sustainable Sites	-2.64	117	.01
Water Efficiency	-3.71	106	.00
Energy Atmosphere	-2.99	108	.00
Materials Resources	-3.22	104	.00
Indoor Environmental Quality	-2.94	110	.00
Total LEED Score	-4.21	117	.00
LEED Prerequisites	-2.24	117	.03

The LEED certified respondents scored significantly higher in all categories. There were significant difference in Sustainable Site scores for the LEED Certified group (M=1.40, SD=.178) and the non LEED certified group (M=1.54, SD=.187); t(117)= -2.64, p=.01. Water Efficiency scores for the LEED Certified group were (M=1.34, SD=.276) and the non-LEED certified group (M=1.70, SD=.349); t(106)= -3.71, p=.000. Energy Atmosphere scores for the LEED Certified group (M=1.37, SD=.259) and the non-LEED certified group (M=1.62, SD=.318); t(08)= -2.99, p=.000. Materials and Resources scores for the LEED Certified group (M=1.186, SD=.207) and the non-LEED certified group (M=1.48, SD=.359); t(117)= -3.22, p=.002. Indoor Environmental Quality scores for the LEED Certified group (M=1.08, SD=.069) and the non-LEED certified group (M=1.31, SD=.291); t(110)= -2.94, p=.004. Total LEED

Scores for the LEED Certified group (M=1.28, SD=.135) and the non-LEED certified group (M=1.51, SD=.206); t(117)= -4.21, p=.000. The Pre-requisite score, necessary to qualify to be LEED qualified for the LEED Certified group (M=1.11, SD=.084) and the non LEED certified group (M=1.24, SD=.225); t(117)= -2.24, p=.027.

Sub-objective

The sub objective of the study explored the UAs and the CRAs responses to determine the LEED standards that were most and least likely to be met among four-year public universities in the Southeastern United States. Responses were scored "1" as Yes and "2" as No. If the respondent marked "I don't know," the score was not counted. The means and standard deviations for the subcategories and prerequisites were compared among all four groups (CRA Certified, UA Certified, CRA Not Certified, and UA Not Certified). The results of the mean scores and standard deviations are presented in Tables 12-17.

Sustainable Sites

Table 12 represents the scores for the subcategory Sustainable Sites (SS). This measure included fifteen questions. The mean and standard deviation scores of the four groups are presented in Table 12. Each question can be found in Appendix F. Nobody met the SS3 standard, which included whether or not the building was built on a brownfield.

Table 12. Sub objective. Sustainable Sites Mean and Standard Deviation

	University Certification by profession							
	CRA Certified		UA Certified		CRA Not Certified		UA Not Certified	
	M	SD	M	SD	M	SD	M	SD
SS1	1.88_a	.35	1.88_a	.35	1.91_a	.30	1.94_a	.23
SS2	1.50_a	.53	1.29_a	.49	1.61_a	.49	1.54_a	.51
SS3	2.00[1]	.00	2.00[1]	.00	2.00[1]	.00	2.00[1]	.00
SS4	1.14_a	.38	1.13_a	.35	1.26_a	.44	1.08_a	.27
SS5	1.00_a	.00	1.00_a	.00	1.05_a	.21	1.00_a	.00
SS6	1.63_a	.52	1.71_a	.49	1.81_a	.39	1.67_a	.48
SS7	1.57_a	.53	1.75_a	.50	1.75_a	.44	1.63_a	.49
SS8	1.57_a	.53	2.00_a	.00	1.77_a	.42	1.64_a	.49
SS9	$1.29_{a,b}$	.49	$1.13_{a,b}$	.35	1.45_a	.50	1.12_b	.33
SS10	1.29_a	.49	1.25_a	.46	1.45_a	.50	1.29_a	.46
SS11	1.17_a	.41	1.13_a	.35	1.39_a	.50	1.33_a	.48
SS12	1.29_a	.49	1.13_a	.35	1.39_a	.49	1.26_a	.44
SS13	1.67_a	.52	1.83_a	.41	1.76_a	.43	1.66_a	.48
SS14	1.00_a	.00	1.25_a	.46	1.72_a	.46	1.64_a	.49
SS15	1.00_a	.00	1.13_a	.35	1.54_a	.51	1.44_a	.50

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p< .05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[2,3]

1. This category is not used in comparisons because there are no other valid categories to compare
2. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.
3. Pairwise comparisons are not performed for some subtables because of numerical problems.

Water Efficiency

Table 13 represents the scores for the subcategory Water Efficiency (WE). This measure included four questions. The mean and standard deviation scores of the four groups are presented in Table 13. Each question can be found in Appendix F. CRA and UA certified both met the WE3 standard, which included the use of water-conserving fixtures.

Table 13. Sub objective. Water Efficiency Mean and Standard Deviation

	University Certification by profession							
	CRA Certified		UA Certified		CRA Not Certified		UA Not Certified	
	M	SD	M	SD	M	SD	M	SD
WE1	$1.33_{a,b}$	.58	1.14_{a}	.38	1.76_{b}	.44	$1.71_{b,c}$	.46
WE2	1.57_{a}	.53	$1.75_{a,b}$	.46	1.92_{b}	.27	$1.92_{b,c}$	.27
WE3	1.00_{a}	.00	1.00_{a}	.00	1.68_{b}	.47	$1.47_{a,b}$	.51
WE4	1.00_{a}	.00	1.14_{a}	.38	1.58_{a}	.50	1.39_{a}	.50

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[1]

1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Energy and Atmosphere

Table 14 represents the scores for the subcategory Energy and Atmosphere. This measure included seven questions. The mean and standard deviation scores of the four groups are presented in Table 14. Each question can be found in Appendix F. CRA and UA Certified met the EA3 standard, which included the commissioning process.

Table 14. Sub objective. Energy & Atmosphere Mean and Standard Deviation

	University Certification by profession							
	CRA Certified		UA Certified		CRA Not Certified		UA Not Certified	
	M	SD	M	SD	M	SD	M	SD
EA1	2.00_a	.00	$1.33_{a,b}$	.52	1.70_a	.46	1.36_b	.49
EA2	1.38_a	.52	$1.50_{a,b}$	.53	$1.79_{a,b}$	.41	1.84_b	.37
EA3	1.00_a	.00	1.00_a	.00	1.73_b	.45	1.41_a	.50
EA4	1.00_a	.00	1.00_a	.00	1.35_a	.49	1.41_a	.50
EA5	2.00[1]	.	1.14_a	.38	1.38_a	.49	1.36_a	.49
EA6	1.00_a	.00	1.14_a	.38	1.36_a	.49	1.30_a	.47
EA7	1.80_a	.45	1.86_a	.38	1.91_a	.28	1.97_a	.17

Note: Values in the same row and subtable not sharing the same subscript are significantly different at p< .05 in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[2]

1. This category is not used in comparisons because the sum of case weights is less than two.

2. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Materials and Resources

Table 15 represents the scores for the subcategory Materials and Resources. This measure included eight questions. The mean and standard deviation scores of the four groups are presented in Table 15. Each question can be found in Appendix F. UA and CRA Certified met the MR3 standard, which included recycling non-hazardous construction and demolition debris.

Table 15. Sub objective. Materials & Resources Mean and Standard Deviation

	University Certification by profession							
	CRA Certified		UA Certified		CRA Not Certified		UA Not Certified	
	M	SD	M	SD	M	SD	M	SD
MR1	1.00_a	.00	1.60_a	.55	1.26_a	.45	1.47_a	.51
MR2	1.00_a	.00	1.60_a	.55	1.27_a	.45	1.59_a	.50
MR3	1.00_a	.00	1.00_a	.00	$1.38_{a,b}$	.50	1.52_b	.51
MR4	1.43_a	.53	1.25_a	.46	1.47_a	.50	1.73_a	.45
MR5	1.13_a	.35	1.00_a	.00	1.26_a	.44	1.16_a	.37
MR6	1.25_a	.50	1.00_a	.00	1.50_a	.51	1.19_a	.40
MR7	1.00_a	.00	$1.40_{a,b}$	.55	$1.75_{b,c}$	.44	1.96_c	.19
MR8	1.20_a	.45	1.67_a	.52	1.65_a	.49	1.69_a	.47

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p< .05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[1]

1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Indoor Environmental Quality

Table 16 represents the scores for the subcategory Indoor Environmental Quality. This measure included thirteen questions. The mean and standard deviation scores of the four groups are presented in Table 16. Each question can be found in Appendix F. CRA and UA certified met the standards IEQ 4, 5, 6, 8, 9, 11, and 12.

Table 16. Sub objective. Indoor Environmental Quality Mean and Standard Deviation

	University Certification by profession							
	CRA Certified		UA Certified		CRA Not Certified		UA Not Certified	
	M	SD	M	SD	M	SD	M	SD
IEQ1	1.00_a	.00	1.17_a	.41	1.39_a	.49	1.26_a	.45
IEQ2	1.25_a	.50	1.00_a	.00	1.25_a	.44	1.26_a	.45
IEQ3	1.33_a	.58	1.14_a	.38	1.63_a	.50	1.57_a	.50
IEQ4	1.00_a	.00	1.00_a	.00	1.33_a	.48	1.39_a	.50
IEQ5	1.00_a	.00	1.00_a	.00	1.22_a	.42	1.36_a	.49
IEQ6	1.00_a	.00	1.00_a	.00	1.36_a	.49	1.46_a	.51
IEQ7	1.00_a	.00	1.14_a	.38	1.24_a	.44	1.31_a	.47
IEQ8	1.00_a	.00	1.00_a	.00	1.07_a	.26	1.15_a	.36
IEQ9	1.00_a	.00	1.00_a	.00	1.31_a	.47	1.34_a	.48
IEQ10	1.33_a	.52	1.17_a	.41	1.50_a	.51	1.42_a	.50
IEQ11	1.00_a	.00	1.00_a	.00	1.24_a	.43	1.08_a	.28
IEQ12	1.00_a	.00	1.00_a	.00	1.24_a	.43	1.17_a	.38
IEQ13	1.20_a	.45	1.57_a	.53	1.36_a	.49	1.37_a	.49

Note: Values in the same row and subtable not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[1]

1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Prerequisites

Table 17 represents the scores for the subcategory Prerequisites. This measure included nine questions. The mean and standard deviation scores of the four groups are presented in Table 17. Each question can be found in Appendix F. CRA and UA Certified both met P 2, 3, and 6. UA Certified did not meet the P5 standard, which included whether or not the building used chlorofluorocarbon-based refrigerants.

Table 17. Sub objective. Prerequisites Mean and Standard Deviation

	University Certification by profession							
	CRA Certified		UA Certified		CRA Not Certified		UA Not Certified	
	M	SD	M	SD	M	SD	M	SD
P1	$1.33_{a,b}$	.52	$1.13_{a,b}$	.35	1.58_{a}	.50	1.18_{b}	.39
P2	1.00_{a}	.00	1.00_{a}	.00	1.39_{a}	.49	1.22_{a}	.42
P3	1.00_{a}	.00	1.00_{a}	.00	1.12_{a}	.33	1.06_{a}	.25
P4	1.20_{a}	.45	1.14_{a}	.38	1.17_{a}	.38	1.15_{a}	.36
P5	1.00[1]	.00	2.00_{a}	.00	1.62_{a}	.50	1.86_{a}	.36
P6	1.00_{a}	.00	1.00_{a}	.00	1.10_{a}	.30	1.11_{a}	.31
P7	1.38_{a}	.52	1.00_{a}	.00	1.30_{a}	.46	1.21_{a}	.42
P8	1.20_{a}	.45	1.00_{a}	.00	1.24_{a}	.43	1.33_{a}	.48
P9	$1.29_{a,b}$	.49	$1.00_{a,b}$	.00	1.23_{a}	.43	1.03_{b}	.17

Note: Values in the same row and subtable not sharing the same subscript are significantly different at p< .05 in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[2]

1. This category is not used in comparisons because the sum of case weights is less than two.

2. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

CHAPTER V

CONCLUSIONS, DISCUSSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine awareness of LEED certification standards among UAs and campus recreation associates (CRA) at four-year public universities in the Southeastern United States using the main CRF as the norm. The goals of the study were to determine how prepared CRAs are to lead LEED certification efforts, how congruent the facility knowledge of CRAs are compared to the UAs, and how well the CRAs and UAs know their current LEED certification level (Platinum, Gold, Silver, and Certified). Moreover, the study explored the LEED standards most met, and those that were least met, so that recommendations could be made to CRAs for planning future sustainable development of CRFs. Data was collected and analyzed to find if there were significant differences between multiple groups. A post-hoc Bonferroni test was done to compare differences among groups. The objective of this chapter is to elaborate on the results and discuss conclusions with respect to the sample population, research questions, and sub-objectives of the study. Implications for future research will conclude this chapter.

<u>Conclusions and Discussion of Findings</u>

Hypothesis One

The first hypothesis stated that there would be no significant difference in the combined LEED knowledge scores of UAs and CRAs at universities whose main CRF is LEED certified and the combined scores of UAs and CRAs of universities whose main CRF is not LEED certified. The null hypothesis was tested by calculating a One-Way ANOVA to determine if significant differences existed among the mean scores of the four groups (CRA Certified, UA Certified, CRA Not Certified, and UA Not Certified) for each of the five LEED subcategories, overall LEED score, and the Prerequisite LEED score.

The results of the Bonferroni Post Hoc Test can be found in Table 7. The ANOVA indicated there was significant difference among the groups. Overall, the results reported that the UA certified group had a higher LEED knowledge score in all of the categories except Materials & Resources. Within the four groups, the CRA Certified group had the highest LEED knowledge score in the Materials & Resources category. This could be affected by the fact that the Materials & Resources category contains questions about recycling, materials used in facility, and interior and exterior structures. The CRAs would be in direct contact with these elements. The post hoc test indicated there was no significant difference in the Indoor Environmental Quality group. Indoor Environmental Quality had questions about thermal comfort, lighting, ventilation, and chemicals used. These elements are typically campus wide standards, so it would make sense that everyone would be knowledgeable about these standards. There was no significant difference in the Prerequisites scores. These results suggest that CRAs and UAs know significantly more about the LEED standards required to qualify to become a LEED certified CRF. Therefore, the null hypothesis was rejected.

The results suggest that architects from universities with a currently LEED certified recreation facility are more knowledgeable about LEED standards than CRAs from certified universities and CRAs and UAs from noncertified universities. This was expected. These results may be explained considering several findings particular to this study. Nineteen of the participants were Licensed LEED Associates, and fourteen of those Licensed LEED Associates were UAs. The participants at these universities probably have more LEED certified facilities, which would improve their knowledge. If they have more LEED certified facilities, then they have been through the process with having the licensed LEED associate visit. Also, they have feedback on the facility through the process of gaining certifications in the past.

Hypothesis Two

The second hypothesis stated that, within the LEED certified group, there would be no significant difference between the LEED survey scores of UAs and CRAs and the known LEED score earned by the university CRF when evaluated using the v2.1, v2.2, or v(2009) LEED certification standards. The null hypothesis was tested by calculating a paired-samples t-test to compare LEED knowledge scores between LEED Certified CRAs and UAs paired to the known LEED certification scores of their university CRF.

There was a significant difference in the scores for LEED measures; Material and Resources ($M=1.18$, $SD=.21$), Indoor Environmental Quality ($M=1.09$, $SD=.07$), Total LEED Score ($M=1.29$, $SD=.14$) and the Pre-requisite score ($M=1.11$, $SD=.08$). There were no significant differences in the LEED scores; Sustainable Sites, Water Efficiency and Energy and Atmosphere. Therefore, the null hypothesis was rejected for Materials and Resources, Indoor Environmental Quality, Total LEED Score, and Prerequisite. The null hypothesis was accepted for Sustainable Sites, Water Efficiency, and Energy and Atmosphere.

The reason for these results could be the low response rate from the CRAs and UAs from the universities that had a known LEED certified CRF. These participants were chosen to provide evidence of knowledge retention among professionals involved with LEED certification.

It also could have been that a team of people filled the survey out. It was assumed that CRAs and UAs at the certified facilities should be the most knowledgeable, and this may not be the case. For example, UAs may not know the recycling process in the CRF since they are not always in the CRF like the CRAs are. We assumed that people could recall accurately the knowledge earned. The oldest LEED certification in this study was from 2009. From the time the CRF was certified until the participant completed the survey, several changes may have occurred. For example, the CRF staff could be different. This could include the CRA that completed the study as well as the UA may not have served in a capacity that would provide LEED certification answers.

Hypothesis Three

The third hypothesis stated that there would be no significant difference in the combined LEED knowledge scores of UAs and CRAs at universities whose main CRF is LEED certified (n=16) and the combined scores of UAs and CRAs of universities whose main CRF is not LEED certified (n=103). The null hypothesis was tested by calculating an independent T-test to determine if significant differences existed between the two groups mean scores for each of the five LEED subcategories, overall LEED score, and the Pre-requisite LEED score.

Results indicate that there was a significant difference ($p>, .05$) between all LEED scores including subcategories, total, and prerequisite scores between the CRAs and UAs from LEED certified universities and those from universities without LEED certification. Therefore, the null hypothesis was rejected.

The results revealed that the participants who work at a university with a LEED certified CRF had significantly greater knowledge of LEED certification standards than the CRAs and

UAs from the group who work at a university with a CRF that is not LEED certified. The participants at universities with LEED certified CRFs more than likely have more LEED certified buildings than the universities without a LEED certified CRF. This means that participants at universities with LEED certified CRFs have likely been through the process of LEED certifying buildings before. Every time they go through a LEED certification, they learn more about all of the standards, and it starts to become engrained in the culture.

Sub-objective

The sub objective of the study explored the UAs and the CRAs responses to determine the LEED standards that were most and least likely to be met among four-year public universities in the Southeastern United States.

Sustainable Sites (SS)

There were 15 measurements used to determine an overall SS score. These results were presented in Table 11. None of the participants met the SS3 standard. SS3 included the defined word brownfield, which is a site documented as contaminated by a local, state, or federal government agency. While it is possible that none of the universities met this standard, it is also possible that participants were not aware of whether or not they met or did not meet this standard because of misunderstanding the technical jargon. They also might not have been the appropriate university official with knowledge of brownfield contamination. All except CRA Not Certified met the SS5 standard. SS5 included storage of bicycle racks within 200 yards of the facility.

Water Efficiency (WE)

There were four measurements used to determine an overall WE score. These results were presented in Table 12. UA Certified and CRA Certified all met WE3 standard. WE3 included reducing potable water by 50% using water conserving fixtures. Potable water was defined, and examples of water conserving fixtures were given. UAs and CRAs Not Certified might not regulate their water at all as some universities leave that to the physical plant. CRA Certified all marked Met for WE4. WE4 included using 20% less water than required in the Energy Policy Act of 1992. The respondents may have no knowledge of the Energy Policy Act of 1992.

Energy and Atmosphere (EA)

There were seven measurements used to determine an overall EA score. These results were presented in Table 13. None of the CRA Certified participants met EA1. EA1 included establishing a target to reduce the amount of energy used per fiscal year. Most recreation facilities do not monitor their energy use. Both CRA Certified and UA Certified completely met EA3 and EA4. EA3 included beginning the commissioning process early, and EA4 included if the facility used no refrigerants or low-impact refrigerants. This could be a result of the fact that CRA and UA Certified have been through the LEED process, and they know what goes into the facility. CRA Certified all met EA6. EA6 included if the facility provided for ongoing accountability of building energy consumption over time.

Materials and Resources (MR)

There were eight measurements used to determine an overall MR score. These results were presented in Table 14. CRA Certified all met MR1, MR2, MR3, and MR7. UA Certified all met MR3, MR5, and MR6. MR1 included if the facility maintained at least 75% of existing building structure. MR2 included if the facility used existing interior non-structural elements in at least 50% of the completed building. MR3 included if the facility recycled and/or salvaged non-hazardous construction or demolition debris when it was built. MR5 included if the facility used materials with recycled content. MR6 included if the building materials were extracted, harvested, or recovered as well as manufactured within 500 miles of the facility. MR7 includes if the facility used rapidly renewable buildings and products. CRA Certified were more than likely involved in the construction process of their facility. This would give them more knowledge on MR1, MR2, MR3, and MR7. UA Certified would be more aware of the materials that went into the building.

Indoor Environmental Quality (IEQ)

There were 13 measurements used to determine an overall IEQ score. These results were presented in Table 16. All of CRA Certified met IEQ1, IEQ4, IEQ5, IEQ6, IEQ7, IEQ8, IEQ9, IEQ11, and IEQ12. UA Certified all met IEQ2, IEQ4, IEQ5, IEQ6, IEQ8, IEQ9, IEQ11, and IEQ12. IEQ1 included if the facility had permanent monitoring systems that provide feedback on HVAC system performance. IEQ2 included if the facility took measures to provide additional outdoor air ventilation. IEQ4 included if the facility required that all adhesives and sealants to increase indoor air quality were used. IEQ5 included if the facility required that all paints and coatings to increase indoor air quality were used. IEQ6 included if the facility required that all carpets increased indoor air quality. IEQ7 included if the facility required that all wood and agrifiber products on the interior of the building to increase indoor air quality were used. IEQ8 included if the facility took measure to minimize exposure of building occupants to potentially hazardous particulants and chemical pollutants. IEQ9 included if the facility provided lighting control to increase productivity, comfort, and well being of building occupants. IEQ11 included if the facility provided a comfortable thermal environment that supported the well-being and productivity of building occupants. IEQ12 included if the building provided a connection between indoor spaces and outdoors.

Prerequisites (P)

There were 11 measurements used to determine an overall P score. These results were presented in Table 17. CRA Certified met P2, P3, and P6. UA Certified all met P2, P3, P6, P7, P8, and P9, however, they did not meet P5. P2 included if the facility had low water usage fixtures installed. P3 included if the facility's HVAC system performed to the owner's project requirements. P6 included if the facility recycled. P7 included if the facility had a current facilities requirements and operations and maintenance plan. P8 included if the facility was using building level energy meters or sub-meters. P9 included if the facility safely collected, stored, and disposed of batteries, mercury containing lamps, and electronic waste. P5 included if the facility used chlorofluorocarbon based refrigerants.

Limitations

This study was limited by the survey method and the results may have some cognitive response and survey bias. When possible, steps were included to reduce this bias. For example, the researcher made sure the most LEED knowledgeable CRA completed the survey. The study was also limited to participants' knowledge of their institution's specific environmental strategies and plan. It may be possible that those universities who are currently LEED certified may not have shared the compliance with the campus recreation department. To minimize these possibilities, CRAs were recruited with the most likelihood to have knowledge of LEED standards.

The participants were also limited to four-year public universities in the Southeast; sustainability efforts at other institutions in the Southeast may be better known. Another limitation of this study was that some of the facilities were certified in 2009. They could have changed in 7 years.

The unequal n could effect the homogeneity of this study. There is a possibility that there was a Type 2 Error in Ho1. The researcher ran a Kruskal-Wallis test for Ho1 to see if there was a difference in significance and found no differences. The researcher also did not assume homogeneity of variances.

Delimitations and Assumptions

This study was delimitated to the CRA who identified as the most likely to have LEED knowledge of their CRF. This study assumed that the researcher identified the best CRA to fill out the survey. The researcher controlled for this by sending an email to the campus recreation director at each identified university explaining which CRA should be the chosen as the participant for the survey. The study also assumed that the UAs and CRAs understand the LEED criteria in the survey as they are defined, and that only one CRA and UA completes the survey. The study was also delimited to the UA assigned to design and development of the CRFs; this individual may not have directly designed the facility.

Implications and Recommendations

Based on the results of hypotheses testing and exploration of the sub-objective goal, there are several implications and recommendations to be made that may improve LEED knowledge and aid LEED certification preparations. First, the CRA Not Certified group was the least knowledgeable about LEED certification standards, and if they would like to be more knowledgeable about LEED standards, they need to increase their knowledge in Sustainable Sites, Water Efficiency, and Energy and Atmosphere. If the UA Not Certified Group would like to be more knowledgeable about LEED standards, they need to increase their knowledge in Water Efficiency and Materials and Resources. UA and CRA Certified group need to know their facilities better in the areas of Materials and Resources, Indoor Environmental Quality, and Pre-requisite. They can do this by making LEED certification more a culture in their department than simply a snapshot of what it looks like.

CRAs can use this information to know that, if they increase their knowledge about LEED certification, they can make a positive long term economical and environmental impact for their university, which in turn impacts the world around them. There needs to be more research done on the constantly updated LEED certification standards and its validity and reliability. There also needs to be more research done on why meeting sustainable standards is good for the participants in recreation facilities. Finally, there needs to be more research on why the Southeast is so far behind when it comes to knowledge of sustainability standards. There should also be more research on the benefits of LEED certification in recreation facilities. Future research can also focus on comparing the performance of LEED certified recreational facilities against non-LEED certified buildings. If sustainability does benefit an organization fiscally and it improves the performance of those within the building, then efforts should be made by universities to move in this direction. This study could serve as a model to be used in areas other than campus recreation.

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LIST OF APPENDICES

APPENDIX A

Definitions

A

adjacent site

a site having at least a continuous 25% of its boundary bordering parcels that are previously developed sites. Only consider bordering parcels, not intervening rights-of-way. Any fraction of the boundary that borders a water body is excluded from the calculation.

alternative fuel

low-polluting, nongasoline fuels such as electricity, hydrogen, propane, compressed natural gas, liquid natural gas, methanol, and ethanol

annual sunlight exposure (ASE)

a metric that describes the potential for visual discomfort in interior work environments. It is defined as the percentage of an analysis area that exceeds a specified direct sunlight illuminance level more than a specified number of hours per year.

B

baseline building performance

the annual energy cost for a building design, used as a baseline for comparison with above-standard design

brownfield

real property or the expansion, redevelopment, or reuse of which may be complicated by the presence or possible presence of a hazardous substance, pollutant, or contaminant.

building exterior

a structure's primary and secondary weatherproofing system, including waterproofing membranes and air- and water-resistant barrier materials, and all building elements outside that system

building interior

everything inside a structure's weatherproofing membrane

C

chlorofluorocarbon (CFC)-based refrigerant

a fluid, containing hydrocarbons, that absorbs heat from a reservoir at low temperatures and rejects heat at higher temperatures. When emitted into the atmosphere, CFCs cause depletion of the stratospheric ozone layer.

commissioning (Cx)

the process of verifying and documenting that a building and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements

commissioning authority (CxA)

the individual designated to organize, lead, and review the completion of commissioning process activities. The CxA facilitates communication among the owner, designer, and contractor to ensure that complex systems are installed and function in accordance with the owner's project requirements.

D

density

a measure of the total building floor area or dwelling units on a parcel of land relative to the buildable land of that parcel. Units for measuring density may differ according to credit requirements. Does not include structured parking.

development footprint

the total land area of a project site covered by buildings, streets, parking areas, and other typically impermeable surfaces constructed as part of the project

direct sunlight

an interior horizontal measurement of 1,000 lux or more of direct beam sunlight that accounts for window transmittance and angular effects, and excludes the effect of any operable blinds, with no contribution from reflected light (i.e., a zero bounce analysis) and no contribution from the diffuse sky component (Adapted from IES)

E

electric vehicle supply equipment

the conductors, including the ungrounded, grounded, and equipment grounding conductors, the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle. (National Electric Codes and California Article 625)

electronic waste

discarded office equipment (computers, monitors, copiers, printers, scanners, fax machines), appliances (refrigerators, dishwashers, water coolers), external power adapters, and televisions and other audiovisual equipment

G

graywater

"untreated household waste water which has not come into contact with toilet waste. Graywater includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washers and laundry tubs. It must not include waste water from kitchen sinks or dishwashers" (Uniform Plumbing Code, Appendix F, Gray Water Systems for Single-Family Dwellings); "waste water discharged from lavatories, bathtubs, showers, clothes washers and laundry sinks" (International Plumbing Code, Appendix C, Gray Water Recycling Systems). Some states and local authorities allow kitchen sink wastewater to be included in graywater. Other differences can likely be found in state and local codes. Project teams should comply with the graywater definition established by the authority having jurisdiction in the project area.

green power

a subset of renewable energy composed of grid-based electricity produced from renewable energy sources

green vehicles

vehicles achieving a minimum green score of 45 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide (or a local equivalent for projects outside the U.S.).

greenfield

area that has not been graded, compacted, cleared, or disturbed and that supports (or could support) open space, habitat, or natural hydrology.

See also: previously disturbed

H

hardscape

the inanimate elements of the building landscaping. It includes pavement, roadways, stonewalls, wood and synthetic decking, concrete paths and sidewalks, and concrete, brick, and tile patios.

hazardous material

any item or agent (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors

heat island effect

the thermal absorption by hardscape, such as dark, nonreflective pavement and buildings, and its subsequent radiation to surrounding areas. Other contributing factors may include vehicle exhaust, air-conditioners, and street equipment. Tall buildings and narrow streets reduce airflow and exacerbate the effect.

M

mixed paper

white and colored paper, envelopes, forms, file folders, tablets, flyers, cereal boxes, wrapping paper, catalogs, magazines, phone books, and photos

N

natural refrigerant

a compound that is not manmade and is used for cooling. Such substances generally have much lower potential for atmospheric damage than manufactured chemical refrigerants. Examples include water, carbon dioxide, and ammonia.

nonpotable water

water that does not meet drinking water standards

O

occupiable space

an enclosed space intended for human activities, excluding those spaces that are intended primarily for other purposes, such as storage rooms and equipment rooms, and that are occupied only occasionally and for short periods of time (ASHRAE 62.1–2010)

occupied space

enclosed space intended for human activities, excluding those spaces that are intended primarily for other purposes, such as storage rooms and equipment rooms, and that are only occupied occasionally and for short periods of time. Occupied spaces are further classified as regularly occupied or nonregularly occupied spaces based on the duration of the occupancy, individual or multioccupant based on the quantity of occupants, and densely or nondensely occupied spaces based on the concentration of occupants in the space.

owner's project requirements (OPR)

a written document that details the ideas, concepts, and criteria determined by the owner to be important to the success of the project

P

postconsumer recycled content

waste generated by households or commercial, industrial, and institutional facilities in their role as end users of a product that can no longer be used for its intended purpose

potable water

water that meets or exceeds U.S. Environmental Protection Agency drinking water quality standards (or a local equivalent outside the U.S.) and is approved for human consumption by the state or local authorities having jurisdiction; it may be supplied from wells or municipal water systems

preconsumer recycled content

matter diverted from the waste stream during the manufacturing process, determined as the percentage of material, by weight. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. The designation excludes rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them (ISO 14021). Formerly known as postindustrial content.

preferred parking

the parking spots closest to the main entrance of a building (exclusive of spaces designated for handicapped persons). For employee parking, it refers to the spots that are closest to the entrance used by employees.

previously developed

altered by paving, construction, and/or land use that would typically have required regulatory permitting to have been initiated (alterations may exist now or in the past). Land that is not previously developed and landscapes altered by current or historical clearing or filling, agricultural or forestry use, or preserved natural area use are considered undeveloped land. The date of previous development permit issuance constitutes the date of previous development, but permit issuance in itself does not constitute previous development.

previously developed site

a site that, prior to the project, consisted of at least 75% previously developed land

prime farmland

land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses, as determined by the U.S. Department of Agriculture's Natural Resources Conservation Service (a U.S.-based methodology that sets criteria for highly productive soil). For a complete description of what qualifies as prime farmland, see U.S. Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5.

R

recycled content

defined in accordance with the International Organization of Standards document ISO 14021 – Environmental labels and declarations – Self-declared environmental claims (Type II environmental labeling)

regularly occupied space

an area where one or more individuals normally spend time (more than one hour per person per day on average) seated or standing as they work, study, or perform other focused activities inside a building. The one-hour timeframe is continuous and should be based on the time a typical occupant uses the space. For spaces that are not used daily, the one-hour timeframe should be based on the time a typical occupant spends in the space when it is in use.

renewable energy

energy sources that are not depleted by use. Examples include energy from the sun, wind, and small (low-impact) hydropower, plus geothermal energy and wave and tidal systems.

renewable energy credit (REC)

a tradable commodity representing proof that a unit of electricity was generated from a renewable resource. RECs are sold separately from electricity itself and thus allow the purchase of green power by a user of conventionally generated electricity.

reuse

the reemployment of materials in the same or a related capacity as their original application, thus extending the lifetime of materials that would otherwise be discarded.

Reuse includes the recovery and reemployment of materials recovered from existing building or construction sites. Also known as salvage.

S

salvaged material

a construction component recovered from existing buildings or construction sites and reused. Common salvaged materials include structural beams and posts, flooring, doors, cabinetry, brick, and decorative items.

short-term bicycle storage

non-enclosed bicycle parking typically used by visitors for a period of two hours or less.

solar reflectance (SR)

the fraction of solar energy that is reflected by a surface on a scale of 0 to 1. Black paint has a solar reflectance of 0; white paint (titanium dioxide) has a solar reflectance of 1. The standard technique for its determination uses spectrophotometric measurements, with an integrating sphere to determine the reflectance at each wavelength. Determine the SR of a material by using the Cool Roof Rating Council Standard (CRRC-1).

solar reflectance index (SRI)

a measure of the constructed surface's ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. It is defined such that a standard black surface (initial solar reflectance 0.05, initial thermal emittance 0.90) has an initial SRI of 0, and a standard white surface (initial solar reflectance 0.80, initial thermal emittance 0.90) has an initial SRI of 100. To calculate the SRI for a given material, obtain its solar reflectance and thermal emittance via the Cool Roof Rating Council Standard (CRRC-1). SRI is calculated according to ASTM E 1980. Calculation of the aged SRI is based on the aged tested values of solar reflectance and thermal emittance.

sustainability

green building measures according to LEED certification BD+C v2.2

systems manual

provides the information needed to understand, operate, and maintain the systems and assemblies within a building. It expands the scope of the traditional operating and maintenance documentation and is compiled of multiple documents developed during the commissioning process, such as the owner's project requirements, operation and maintenance manuals, and sequences of operation.

T

thermal emittance

the ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody radiator at the same temperature (adapted from Cool Roof Rating Council)

U

unoccupied space

an area designed for equipment, machinery, or storage rather than for human activities. An equipment area is considered unoccupied only if retrieval of equipment is occasional.

V

vertical illuminance

illuminance levels calculated at a point on a vertical surface, or that occur on a vertical plane

W

walking distance

the distance that a pedestrian must travel between origins and destinations without obstruction, in a safe and comfortable environment on a continuous network of sidewalks, all weather-surface footpaths, crosswalks, or equivalent pedestrian facilities. The walking distance must be drawn from an entrance that is accessible to all building users.

wastewater

water that has been used for a purpose and conveyed by building plumbing systems toward a point of treatment and disposal. Wastewater from buildings can be classified as graywater, blackwater, or process wastewater.

wetland

an area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas, but exclude irrigation ditches unless delineated as part of an adjacent wetland.

wood

plant-based materials that are eligible for certification under the Forest Stewardship Council. Examples include bamboo and palm (monocots) as well as hardwoods (angiosperms) and softwoods (gymnosperms)

APPENDIX B

Barriers to Acting Sustainably

Barriers to acting sustainably	Incidence of barrier
Sustainability measure was not considered by stakeholders	By far the most commonly
Sustainability measure was not required by client (includes purchasers, tenants and end users)	Commonly recorded
Stakeholder had no power to enforce or require sustainable measure (in some cases it was the responsibility of the client or the contractor)	Commonly recorded
One sustainability measure was forgone in order to achieve another (traded)	Commonly recorded
Sustainable measure was restricted, or not allowed, by regulators	Commonly recorded
The sustainability measure cost too much (in some cases the investor would not fund)	Commonly recorded
Site conditions mitigated against the use of a sustainable measure	Commonly recorded
Inadequate, untested or unreliable sustainable materials, products or systems (including long term management problems)	Commonly recorded
Sustainable measure was not available	Commonly recorded
An unsustainable measure was allowed by the regulator or statutory undertaker (so no impetus for a sustainable alternative to be used)	Infrequently recorded
Stakeholder was not included, or was included too late, in the development process to implement sustainability measure	Infrequently recorded
Stakeholder lacked information, unawareness or expertise to achieve sustainable measure	Infrequently recorded

Table 3

APPENDIX C

Universities with top LEED certified CRF in USA

California State University, Fullerton
California State University, Long Beach
California State University, Northridge
Colorado State University
Eastern Washington University
Georgia College & State University (GCSU or Georgia College)
Georgia Southern University (GASO)
Morehead State University
Rice University
University of Arizona
University of Central Florida
University of Colorado at Colorado Springs
University of Louisville
University of Maine
University of North Florida
Virginia Commonwealth University

Four-year public universities with CRFs in the Southeastern USA

Alabama
Alabama A&M University
Alabama State University
Auburn University
Auburn University at Montgomery
Jacksonville State University
The University of Alabama
Troy University
University of Alabama at Birmingham
University of Alabama at Huntsville
University of Montevallo
University of North Alabama
University of South Alabama

University of West Alabama
Arkansas
Arkansas State University, Jonesboro
Arkansas Tech University, Russellville
Henderson State University, Arkadelphia
Southern Arkansas University, Magnolia
University of Arkansas at Fayetteville
University of Arkansas at Fort Smith
University of Arkansas at Little Rock
University of Arkansas at Monticello
University of Central Arkansas, Conway
Florida
Florida Agricultural and Mechanical University
Florida Atlantic University
Florida Gulf Coast University
Florida International University
Florida State University
New College of Florida
University of Florida
University of South Florida
University of West Florida
Georgia
Abraham Baldwin Agricultural College
Armstrong State University
Augusta University (formerly Medical College of Georgia)
Bainbridge State College
Clayton State University
College of Coastal Georgia
Columbus State University
Dalton State College
Darton State College
East Georgia State College
Georgia Gwinnett College

Georgia Institute of Technology (Georgia Tech)
Georgia Southwestern State University
Georgia State University (GAST)
Gordon State College
Kennesaw State University (KSU)
Middle Georgia State University (formerly Macon State College and Middle Georgia College)
Savannah State University
South Georgia State College (formerly South Georgia College and Waycross College)
University of Georgia (UGA)
University of North Georgia (formerly North Georgia College and State University and Gainesville State College)
University of West Georgia
Valdosta State University
Kentucky
Eastern Kentucky University
Kentucky State University
Murray State University
North Kentucky University
University of Kentucky
Western Kentucky University
Louisiana
Grambling State University, Grambling
Louisiana State University and A&M College, Baton Rouge (main campus)
Louisiana State University at Alexandria
Louisiana State University at Eunice†
Louisiana State University in Shreveport
Louisiana Tech University, Ruston
McNeese State University, Lake Charles
Nicholls State University, Thibodaux
Northwestern State University, Natchitoches
Southeastern Louisiana University, Hammond
Southern University and A&M College, Baton Rouge (main campus)
Southern University at New Orleans
Southern University at Shreveport†

University of Louisiana at Lafayette
University of Louisiana at Monroe
University of New Orleans
Mississippi
Delta State University, Cleveland
Jackson State University, Jackson
Mississippi State University Starkville Campus
Mississippi University for Women, Columbus
Mississippi Valley State University, Itta Bena
The University of Southern Mississippi Hattiesburg (main campus)
University of Mississippi Oxford Campus
North Carolina
Appalachian State University
East Carolina University
Elizabeth City State University
Fayetteville State University
North Carolina Agricultural and Technical State University
North Carolina Central University
North Carolina State University
University of North Carolina at Asheville
University of North Carolina at Chapel Hill
University of North Carolina at Charlotte
University of North Carolina at Greensboro
University of North Carolina at Pembroke
University of North Carolina at Wilmington
University of North Carolina School of the Arts
Western Carolina University
Winston-Salem State University
South Carolina
The Citadel
Clemson University
Coastal Carolina University
College of Charleston

Francis Marion University
Lander University
Medical University of South Carolina
South Carolina State University
University of South Carolina (Aiken, Beaufort, Columbia, Lancaster, Salkehatchie, Sumter, Union, Upstate
Winthrop University
Tennessee
Austin Peay State University
East Tennessee State University
Middle Tennessee State University
Tennessee State University (HBCU)
Tennessee Technological University
University of Memphis
University of Tennessee (Flagship University)
University of Tennessee at Chattanooga
University of Tennessee at Martin

APPENDIX D

Hello,

My name is Will Jordan and I am a Masters student working under the supervisions of Dr. Kim Beason at the University of Mississippi. I am contacting you to encourage your participation in research on awareness of Leadership in Energy and Environmental Design (LEED) certification status among campus recreation associates (CRAs). I am currently seeking the CRA, within your campus recreation department, who has the most knowledge about your facility, sustainable development, "green" initiatives and/or LEED certification.

Please fill out the attached survey to confirm who the appropriate CRA to fill out the survey is. Also, please forward them this email, so they will know about the research I am doing before they receive a follow up email from me. The attached survey should take you less than 1 minute.

I will be emailing out the survey on May 6, 2016. If I do not collect a response within two days of sending the email, I will call you to make sure I have the correct email address and to ask if I need to send the survey to them again. Participation in this study involves filling out an online survey, which will take approximately 15 minutes to complete.

I will then send a confirmation email indicating that he/she will be participating in my survey, and provide him/her with further information concerning the survey. If you feel that no CRAs at your CRF meet these criteria, please complete it yourself wajordan@go.olemiss.edu.

Sincerely,

Will Jordan

APPENDIX E

Standards of LEED certification (taken from LEED BD+C: New Construction (v2.2))

Criteria	Total Points
SUSTAINABLE SITES	**12**
SSp1 Construction Activity Pollution Prevention	Required
SSc1 Site selection	1
SSc2 Development density and community connectivity	1
SSc3 Brownfield redevelopment	1
SSc4.1 Alternative transportation - public transportation access	1
SSc4.2 Alternative transportation - bicycle storage and changing rooms	1
SSc4.3 Alternative transportation - low emitting and fuel efficient vehicles	1
SSc4.4 Alternative transportation - parking capacity	1
SSc5.1 Site development - protect or restore habitat	1
SSc5.2 Site development - maximize open space	1
SSc6.1 Stormwater design - quantity control	1
SSc6.2 Stormwater design - quality control	1
SSc7.1 Heat island effect - non-roof	1
SSc7.2 Heat island effect - roof	1
SSc8 Light pollution reduction	1
WATER EFFICIENCY AWARDED:	**5**
WEc1.1 Water efficient landscaping - reduce by 50%	1
WEc1.2 Water efficient landscaping - no potable water use or no irrigation	1

WEc2 Innovative wastewater technologies	1
WEc3.1 Water use reduction - 20% reduction	1
WEc3.2 Water use reduction - 30% reduction	1
ENERGY & ATMOSPHERE	**17**
EAp1 Fundamental Commissioning of Building Energy Systems	Required
EAp2 Minimum Energy Performance	Required
EAp3 Fundamental Refrigerant Management	Required
EAc1 Optimize energy performance	10
EAc2 On-site renewable energy	3
EAc3 Enhanced commissioning	1
EAc4 Enhanced refrigerant Mgmt.	1
EAc5 Measurement and verification	1
EAc6 Green power	1
MATERIAL & RESOURCES	**13**
MRp1 Storage and Collection of Recyclables	Required
MRc1.1 Building reuse - maintain 75% of existing walls, floors & roof	1
MRc1.2 Building reuse - maintain 95% of existing walls, floors & roof	1
MRc1.3 Building reuse - maintain 50% of interior non-structural elements	1
MRc2.1 Construction waste Mgmt. - divert 50% from disposal	1
MRc2.2 Construction waste Mgmt. - divert 75% from disposal	1

MRc3.1 Materials reuse - 5%	1
MRc3.2 Materials reuse - 10%	1
MRc4.1 Recycled content - 10% (post-consumer + 1/2 pre-consumer)	2
MRc4.2 Recycled content - 20% (post-consumer + 1/2 pre-consumer)	1
MRc5.1 Regional materials - 10% extracted, processed and manufactured	1
MRc5.2 Regional materials - 20% extracted, processed and manufactured	1
MRc6 Rapidly renewable materials	1
MRc7 Certified wood	1
INDOOR ENVIRONMENTAL QUALITY	**15**
EQp1 Minimum Indoor Air Quality Performance	Required
EQp2 Environmental Tobacco Smoke (ETS) Control	Required
EQc1 Outdoor air delivery monitoring	1
EQc2 Increased ventilation	1
EQc3.1 Construction IAQ Mgmt. plan - during construction	1
EQc3.2 Construction IAQ Mgmt. plan - before occupancy	1
EQc4.1 Low-emitting materials - adhesives and sealants	1
EQc4.2 Low-emitting materials - paints and coatings	1
EQc4.3 Low-emitting materials - carpet systems	1
EQc4.4 Low-emitting materials - composite wood and agrifiber products	1

EQc5 Indoor chemical and pollutant source control	1
EQc6.1 Controllability of systems - lighting	1
EQc6.2 Controllability of systems - thermal comfort	1
EQc7.1 Thermal comfort – design	1
EQc7.2 Thermal comfort – verification	1
EQc8.1 Daylight and views - daylight 75% of spaces	1
EQc8.2 Daylight and views - views for 90% of spaces	1

APPENDIX F

Green Building Standards

Awareness of green building standards

Please read the following section before continuing the study. Thank you for your time!

Sincerely,
Will Jordan

Dr. Kim Beason, Research Supervisor
University of Mississippi

Description:
This survey is based on the Leadership in Energy and Environmental Design (LEED) Certification version (v) 2.2 Building Design and Construction (BD+C) standards. You will be asked whether or not your main campus indoor recreation facility meets certain LEED criteria based on certification measures. Please answer all questions to the best of your ability.

Benefits:
The results of the survey may benefit administrative associates at campus recreation facilities by providing knowledge of green building practices and LEED certification.

Costs:
Participation in this project will incur no cost to you. At the conclusion of the study, results will be made available to the public through the thesis defense of this study and presentation and/or publication.

Confidentiality:
Any information obtained about you from this research, including data, will be kept confidential. When the study results are published, they will be made anonymous and/or disguised so that identification cannot be made.

Right to Withdraw:
You are free to refuse to complete this study or to withdraw from the study at any time without any penalty. You may leave the survey at any time.

IRB Approval:
The University of Mississippi's Institutional Review Board (IRB) has reviewed this study. The IRB has determined that this study fulfills the human research subject protection obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482.

For further information please feel free to contact the head researcher, Will Jordan by email

at wajordan@go.olemiss.edu.

Voluntary Consent:
By completing this survey you certify that you have read the preceding and understand the content.

Your continuance in the survey process means that you freely agree to participate in this descriptive study. You may leave the survey anytime and return to complete the survey as long as you use the same computer from which you started the survey.

Green Building Standards

Basic Information

Please complete the following this first section.

* 1. Please enter your age.

- ◯ under 21
- ◯ 21-30
- ◯ 31-40
- ◯ 41-50
- ◯ 51-60
- ◯ 61+
- ◯ Prefer not to answer

* 2. What is your current level of education?

- ◯ Bachelor
- ◯ Master
- ◯ Doctorate

* 3. Are you currently or have you been a licensed LEED associate?

- ◯ Yes
- ◯ No

* 4. Please enter the age of the Campus Recreation Facility you will use as a reference for this study (Main indoor facility only).

- ◯ Less than a year
- ◯ 1-5
- ◯ 6-10
- ◯ 11-20
- ◯ 21-30
- ◯ 31-40
- ◯ 41+
- ◯ Do not know

* 5. Shared facility? Is your main campus recreation facility shared with other on-campus entities?

- ◯ Only Campus recreation
- ◯ Campus recreation and Athletics
- ◯ Campus recreation and Education programs

Other (please specify)

* 6. Which answer most closely matches your professional title?

- ◯ I work within the Campus Recreation Department
- ◯ I am employed/contracted as a University/College Architect
- ◯ Other (please specify)

* 7. Is your university a Land Grant Institution?

- ◯ Yes
- ◯ No
- ◯ I don't know

* 8. Is there an Office of Sustainability at your university?

- Yes
- No
- I don't know

Green Building Standards

Prerequisites

The following questions explore your knowledge of the prerequisites for LEED v2.2 BD+C certification. Please respond to each question indicating whether your facility meets the criteria (yes or no). If you are unaware and/or unable to reasonably estimate if your facility meets a criteria, please select the "I don't know" option.

* 9. Please only select "I don't know" if in your best estimate you cannot reliably answer the question.

	Yes	No	I don't know
Does your facility have an **Erosion and Sedimentation Control Plan** that is regulated by the Environmental Protection Agency OR local erosion and sedimentation control standards and codes, whichever is more stringent?			
Have you taken measures to install **low water use toilets, shower-heads, faucets, and urinals** in your facility?			
Do your facility's heating, ventilating, air conditioning, and refrigeration (**HVAC&R**) systems, lighting and daylighting controls, domestic hot water systems, and renewable energy systems perform according to the owner's project requirements?			
Do you take measures to reduce the environmental and economic harms of excessive energy use by achieving a **minimum level of energy efficiency** for your facility and its systems?			
Do you use chlorofluorocarbon (CFC)-based refrigerants in new HVAC&R systems?			
Do you provide an easily-accessible dedicated area or areas for the **collection** and **storage** of materials for **recycling** for the entire building for all of the following: paper, plastics, corrugated cardboard, metals, and glass?			
Does your facility have a current **facilities requirements and operations and maintenance plan** that contains the information necessary to operate the building efficiently?			
Have you installed new or are you using existing **building-level energy meters, or sub-meters** that can be aggregated to provide building-level data representing total building energy consumption (electricity, natural gas, chilled water, steam, etc.?			
Do you take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste?			
Has your facility established minimum standards for **indoor air quality** in mechanically and/or naturally ventilated spaces?			
Does your university have a "no tobacco" or "no smoking" policy?			

Green Building Standards

SUSTAINABLE SITES

The following questions are designed to test your knowledge of Sustainable Sites criteria for LEED v2.2 BD+C certification. You will be asked to respond to each question to whether your facility meets these criteria. If you are unaware of whether or not your facility meets the criteria, select the "I don't know" option. Please only select "I don't know" if in your best estimate you cannot reliably answer the question.

* 10. Definitions:
The following definitions are to help you better understand terms with which you might not be familiar.

brownfield - real property or the expansion, redevelopment, or reuse of which may be complicated by the presence or possible presence of a hazardous substance, pollutant, or contaminant.

density - a measure of the total building floor area or dwelling units on a parcel of land relative to the buildable land of that parcel. Units for measuring density may differ according to credit requirements. Does not include structured parking.

development footprint - the total land area of a project site covered by buildings, streets, parking areas, and other typically impermeable surfaces constructed as part of the project

hardscape - the inanimate elements of the building landscaping. It includes pavement, roadways, stonewalls, wood and synthetic decking, concrete paths and sidewalks, and concrete, brick, and tile patios.

infiltration - (HVAC) uncontrolled inward air leakage to conditioned spaces through unintentional openings in ceilings, floors, and walls from unconditioned spaces or the outdoors caused by the same pressure differences that induce exfiltration.

light rail - transit service using two- or three-car trains in a right-of-way that is often separated from other traffic modes. Spacing between stations tends to be ½ mile or more, and maximum operating speeds are typically 40–55 mph (65–90 kmh). Light-rail corridors typically extend 10 or more miles (16 kilometers).

light trespass - obtrusive illumination that is unwanted because of quantitative, directional, or spectral attributes. Light trespass can cause annoyance, discomfort, distraction, or loss of visibility.

preferred parking - the parking spots closest to the main entrance of a building (exclusive of spaces designated for handicapped persons). For employee parking, it refers to the spots that are closest to the entrance used by employees.

previously developed site - a site that, prior to the project, consisted of at least 75% previously developed land

public transit service - commuter rail, light rail, subway station, bus rapid transit system, commuter ferry terminal, or bus line

water body - the surface water of a stream (first-order and higher, including intermittent streams), arroyo, river, canal, lake, estuary, bay, or ocean. It does not include irrigation ditches.

	Yes	No	I don't know
Is your campus recreation building or hardscape developed on portions of sites that are prime farmland, specifically identified as habitat for any species on Federal or State threatened or endangered lists, or within 100 feet of any wetlands?	◯	◯	◯
Is your campus recreation facility built on a **previously developed** site?	◯	◯	◯
Is your facility developed on a site documented as contaminated or on a site defined as a **brownfield** by a local, state, or federal government agency?	◯	◯	◯
Is your facility located within 1/2 mile of any **public transit service**?	◯	◯	◯
Does your facility provide secure bicycle racks and/or storage within 200 yards of the building entrance and shower and changing facilities in the building?	◯	◯	◯
Does your facility provide **preferred parking** for low-emitting and fuel-efficient vehicles, installed alternative-fuel fueling stations, and provide building occupants access to a low-emitting or fuel-efficient vehicle-sharing program?	◯	◯	◯
Does your facility provide **preferred** parking for less than 5% of full-time equivalent building occupants?	◯	◯	◯
Does your facility size parking capacity to meet but not exceed minimum local zoning requirements and provide preferred parking for carpools or vanpools for 5% of the total parking spaces?	◯	◯	◯
Have you taken measures to conserve existing natural areas to provide habitat and promote biodiversity such as using native vegetation?	◯	◯	◯
Does your facility promote biodiversity by providing a high ratio of open space to **development footprint?**	◯	◯	◯
Does your facility limit disruption of natural water hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff, and eliminating contaminants?	◯	◯	◯
Does your facility limit disruption and pollution of natural water flows by managing stormwater runoff by implementing a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff?	◯	◯	◯
Does your facility provide shade (within 5 years of occupancy) for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots?	◯	◯	◯
Does your facility measure roofing materials' Solar Reflectance Index?	◯	◯	◯
Does your facility minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction, and reduce development impact on nocturnal environments?	◯	◯	◯

Green Building Standards

WATER EFFICIENCY

The following questions are designed to test your knowledge of Water Efficiency criteria for LEED v2.2 BD+C certification. You will be asked to respond to each question to whether your facility meets these criteria. If you are unaware of whether or not your facility meets the criteria, select the "I don't know" option. Please only select "I don't know" if in your best estimate you cannot reliably answer the question.

* 11. Definitions

potable water - water that meets or exceeds U.S. Environmental Protection Agency drinking water quality standards (or a local equivalent outside the U.S.) and is approved for human consumption by the state or local authorities having jurisdiction; it may be supplied from wells or municipal water systems

wastewater - water that has been used for a purpose and conveyed by building plumbing systems toward a point of treatment and disposal. Wastewater from buildings can be classified as graywater, blackwater, or process wastewater.

	Yes	No	I don't know
Does your facility reduce **potable water consumption for irrigation** by 50% from a calculated mid-summer baseline case?	○	○	○
Does your facility use only captured rainwater, recycled wastewater, recycled greywater, or water treated and conveyed by a public agency specifically for non-potable uses for irrigation?	○	○	○
Does your facility reduce potable water use for building sewage conveyance by 50% through the use of **water-conserving fixtures** (water closets, urinals) or non-potable water (captured rainwater, recycled greywater, and treated wastewater?	○	○	○
Does your facility employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements?	○	○	○

Green Building Standards

ENERGY AND ATMOSPHERE

The following questions are designed to test your knowledge of Energy and Atmosphere criteria for LEED v2.2 BD+C certification. You will be asked to respond to each question to whether your facility meets these criteria. If you are unaware of whether or not your facility meets the criteria, select the "I don't know" option. Please only select "I don't know" if in your best estimate you cannot reliably answer the question.

* 12. Defintions:

Low-impact refrigerants have an ozone depletion potential (ODP) of zero and a global warming potential (GWP) of less than 50.

renewable energy - energy sources that are not depleted by use. Examples include energy from the sun, wind, and small (low-impact) hydropower, plus geothermal energy and wave and tidal systems.

	Yes	No	I don't know
Have you established a **target to reduce** the amount of energy used per fiscal year?	○	○	○
Does your facility use **on-site renewable energy systems** to offset building energy cost?	○	○	○
Did your facility begin the commissioning process early during the design process and execute additional activities after systems performance verification is completed?	○	○	○
Does your facility use **no refrigerants or low-impact refrigerants**?	○	○	○
Does your facility **measure and take measures to reduce refrigerants** used in heating, ventilating, air-conditioning, and refrigeration (HVAC&R) equipment?	○	○	○
Does your facility provide for the ongoing accountability of building energy consumption over time?	○	○	○
Does your facility provide at least 35% of the building's electricity from renewable sources by engaging in at least a two-year renewable energy contract?	○	○	○

Green Building Standards

MATERIALS AND RESOURCES

The following questions are designed to test your knowledge of Materials and Resources criteria for LEED v2.2 BD+C certification.. You will be asked to respond to each question to whether your facility meets these criteria. If you are unaware of whether or not your facility meets the criteria, select the "I don't know" option. Please only select "I don't know" if in your best estimate you cannot reliably answer the question.

* 13. Definitions:

recycled content - defined in accordance with the International Organization of Standards document ISO 14021 – Environmental labels and declarations – Self-declared environmental claims (Type II environmental labeling)

structure elements- carrying either vertical or horizontal loads (e.g., walls, roofs, and floors) that are considered structurally sound and nonhazardous

Forest Stewardship Council's (FSC) Principles and Criteria,for wood building components-plant-based materials that are eligible for certification under the Forest Stewardship Council. Examples include bamboo and palm (monocots) as well as hardwoods (angiosperms) and softwoods (gymnosperms)

	Yes	No	I don't know
Does your facility maintain at least 75% (based on surface area) of **existing building structure** (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material)?	◯	◯	◯
Does your facility use **existing interior non-structural elements** (interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building (including additions)?	◯	◯	◯
Did your facility recycle and/or salvage **non-hazardous construction and demolition debris** when it was built?	◯	◯	◯
Does your facility **use salvaged, refurbished or reused materials**?	◯	◯	◯
Does your facility **use materials with recycled content**?	◯	◯	◯
Does your facility use building materials or **products that have been extracted, harvested or recovered** , as well as manufactured, within 500 miles of the project site?	◯	◯	◯
Does your facility **use rapidly renewable building materials and products** (made from plants harvested within a ten-year cycle or shorter)?	◯	◯	◯
Does your facility **use wood-based materials and products** , which are certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria, for wood building components?	◯	◯	◯

Green Building Standards

INDOOR ENVIROMENTAL QUALITY

The following questions are designed to test your knowledge of Indoor Environmental Quality criteria for LEED v2.2 BD+C certification. You will be asked to respond to each question to whether your facility meets these criteria. If you are unaware of whether or not your facility meets the criteria, select the "I don't know" option. Please only select "I don't know" if in your best estimate you cannot reliably answer the question.

* 14. INDOOR ENVIRONMENTAL QUALITY (IAQ)

Definitions:

base building - materials and products that make up the building or are permanently and semi-permanently installed in the project (e.g., flooring, casework, wall coverings)

composite wood and agrifiber products - particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores. Materials considered fit-out, furniture, and equipment (FF&E) are not considered base building elements and are not included.

density - a measure of the total building floor area or dwelling units on a parcel of land relative to the buildable land of that parcel. Units for measuring density may differ according to credit requirements. Does not include structured parking.

vision glazing - the glass portion of an exterior window that permits views to the exterior or interior. Vision glazing must allow a clear image of the exterior and must not be obstructed by frits, fibers, patterned glazing, or added tints that distort color balance.

wood - plant-based materials that are eligible for certification under the Forest Stewardship Council
Examples include bamboo and palm (monocots) as well as hardwoods (angiosperms) and softwoods (gymnosperms)

	Yes	No	I don't know
Has your facility installed **permanent monitoring systems** that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements?	○	○	○
Does your facility take measures to provide additional **outdoor air ventilation** to improve indoor air quality for improved occupant comfort, well-being and productivity?	○	○	○
Did your facility develop and implement an IAQ Management Plan for the construction and pre-occupancy phases of the building?	○	○	○
Does your facility require that all **adhesives and sealants** used on the interior of the building comply with any criteria to reduce the quantity of indoor air contaminants that are irritating to the comfort and well-being of installers and occupants?	○	○	○
Does your facility require that **paints and coatings** used on the interior of the building comply with any criteria to reduce the quantity of indoor air contaminants that are irritating to the comfort and well-being of installers and occupants?	○	○	○
Does your facility require that **all carpet** installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus program?	○	○	○
Does your facility require that composite **wood and agrifiber products** used on the interior of the building (defined as inside of the weatherproofing system) shall contain no added urea-formaldehyde resins?	○	○	○
Does your facility take measures to minimize exposure of building occupants to **potentially hazardous particulates and chemical pollutants**?	○	○	○
Does your facility provide a high level of **lighting system control** by individual occupants or by specific groups in multi-occupant spaces (i.e. classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants?	○	○	○

	Yes	No	I don't know
Does your facility provide a high level of **thermal comfort system control** by individual occupants or by specific groups in multioccupant spaces to promote the productivity, comfort and well-being of building occupants?	◯	◯	◯
Does your facility provide a **comfortable thermal environment** that supports the productivity and well-being of building occupants?	◯	◯	◯
Does your facility provide for the building occupants a **connection between indoor spaces and the outdoors** through the introduction of daylight and views into the regularly occupied areas of the building?	◯	◯	◯
Does your facility achieve **direct line of sight** to the outdoor environment via vision glazing between 2'6" and 7'6" above finish floor for building occupants in 90% of all regularly occupied areas?	◯	◯	◯

Green Building Standards

DEMOGRAPHICS

Thank you for your time and effort. Please feel free to backtrack and andjust any response to the foregoing questions. Please take a few more moments to complete this last section.

* 15. What is the name of the university at which you are employed?

* 16. What was the approximate student population of your university during the last academic year?

* 17. How many years have you been in the current position of which you are employed?

- ◯ less than a year
- ◯ 1-3 years
- ◯ 4-6 years
- ◯ 7-10 years
- ◯ 11-15 years
- ◯ 16-20 years
- ◯ 21-25 years
- ◯ 26 or more years

VITA

Education:

B.B.A., 2012, Mississippi State University, Mississippi State, MS

Honors and Awards:

Lance Duvall Scholarship Recipient, University of Mississippi, 2015

Phi Theta Kappa Scholarship Recipient, Mississippi State University, 2010-2012

Student Body President, Holmes Community College, 2009-2010

Phi Theta Kappa Vice President of Leadership, Holmes Community College, 2009-2010

Association Memberships:

Phi Theta Kappa Honors Society

Sigma Alpha Lambda Leadership and Honors Organization

Association for Outdoor Recreation and Education

National Intramural and Recreational Sports Association

United States Soccer Federation

Wilderness Medical Institute

National Outdoor Leadership School

Association for Challenge Course Technology

American Red Cross

Professional Experience:

Head Trainer, Oxford Soccer Club, 2013-present

Graduate Assistant, Ole Miss Outdoors, University of Mississippi, 2015-2016

Program Director, Cedar Crest Camp, 2015

Adventure Camp Director, Waterfront Director, Counselor, Camp Lake Stephens, 2012-2014

Lifeguard, Mississippi State University, 2012-2013

Ambassador, Holmes Community College, 2008-2010