SUSTAINABILITY IN UNIVERSITY RESIDENCE HALLS: DESIGNING ACCESSIBLE PROGRAMMING AND INFRASTRUCTURE TO PROMOTE ENVIRONMENTALLY RELEVANT BEHAVIOR ON CAMPUS

by

JANE B. DIENER

(Under the Direction of GARY T. GREEN)

ABSTRACT

College and university students living in green residence halls or learning more about environmentally relevant behavior (ERB) may obtain benefits in many ways, including improved health, productivity, and environmental knowledge. Universities may also benefit from the personal growth in their students, cost savings, and positive publicity. This study sought to determine whether living in a Leadership in Energy and Environmental Design-certified residence hall or a residence hall with increased environmental programming would affect students' ERB. Additionally, this study examined any perceived constraints to students seeking to participate in ERB. This study examined data from three treatment groups at the University of Georgia using a pretest and posttest survey, which was tested during a summer 2013 pilot test. The Immersion-based treatment group (1) was in Building 1516, which features sustainable amenities. The Program-based treatment group (2) was in Brumby Hall, where students had additional environmental education programs in their residence hall. The control group was in Reed Hall, which lacks sustainable amenities or programs. A survey was created and implemented, pretest and posttest, electronically (via Qualtrics) and in person. A pretest was

administered during fall 2013 and fall 2014. A posttest was administered during spring 2014 and spring 2015, respectively. Across all treatment groups and semesters, 1,023 unique students took a pretest survey (n = 557), posttest survey (n = 356), or both (n = 110).

Results indicate while initiatives that students are engaged in outside of residence halls may be more influential than campus housing programs in regard to ERB, campus housing departments can provide students with convenient and accessible environmental education initiatives that they will engage in. Overall, this dissertation established a framework for research on environmentally relevant behavior among students living on college or university campuses.

INDEX WORDS: College, Environment, Environmentally Relevant Behavior, Green Buildings, LEED, Residence Life, Residence Hall, Student Affairs, Sustainability, Survey, University

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DEDICATION

Dedicated to Diane, Buddy, Pearl, and Jack, my Grandma, Pop-Pop, Nana, and Poppy who loved me deeply and encouraged me to be exactly who I am. They let this nerdy little girl feel strong, smart, and capable (even if they let me win at board games).

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CHAPTER 1

INTRODUCTION, DISSERTATION FORMAT, AND LITERATURE REVIEW

Introduction

Global climate change presents a major challenge to the planet's natural resources and, if humans do not work to reverse the impact of our consumption, we will be left with a planet in complete turmoil (Intergovernmental, 2014). Ongoing research in climate science consistently suggests our global climate is warming to temperatures that may have long term and permanent impacts on the planet's oceans, and therefore on humanity (Hansen et al., 2016). For example, overfishing of our oceans is creating multiple problems, such as loss of species. Additionally, many remaining populations of fish may be ingesting microplastics as a direct result of human waste, leading to possible threats to human health (Rochman, Kurobe, Flores, & Teh, 2014; Van Cauwenberghe & Janssen, 2014). Research indicates the global climate is warming; that ice caps are melting; and that human behaviors related to transportation, agricultural practices, and power production are contributing to this warming (Carlsson-Kanyama & González, 2009; Intergovernmental, 2014; Pew, 2011).

However, the natural laws of this planet simultaneously protect our natural resources and control their productivity. Yet, significant disturbances in any ecosystem can cause a great shock and negatively impact biodiversity and ecosystem functions (Farley, 2014). When an ecosystem can respond to such a disturbance by absorbing it and returning to its normal functions, that describes resiliency (Farley, 2014). However, such

disturbances are occurring all over the world from human consumption of natural resources. Additionally, while natural resource managers and advocates use practices like adaptive management and resilient city planning to create healthier ecosystems, managers and planners alone cannot be held solely responsible for maintaining ecological resilience and reducing human impact on global climate change (Jabareen, 2013). Scientists recognize that shifts toward a more sustainable planet "require radical, systemic shifts in values and beliefs, patterns of social behavior, and multilevel governance and management regimes" (Olsson, Galaz, & Boonstra, 2014, p. 1). This shift will require the influence of research as a guiding force as well as the leadership of policymakers and cooperation of those who utilize natural resources, especially in sensitive areas such as wetlands and damaged ecosystems.

With heavy human impacts on the environment through the development and use of natural resources, managers need to focus on sustainability transformations that will alter human and environmental interactions and promote positive feedback that will help improve future ecosystem stewardship and global sustainability (Walker, Holling, Carpenter, & Kinzig, 2004). Reduced environmental impacts will also require large-scale changes in behavior that may only occur after implementation of widespread public education about environmental stewardship and environmentally relevant behavior (ERB) (Lutz, Muttarak, & Striessnig, 2014). While these behavior changes may seem small or insignificant, the widespread integration of behaviors such as energy conservation and environmentally responsible purchasing can have a significant and long-term positive impact (Stern, Dietz, Abel, Guagnano, & Kalof, 1999).

Before the modern environmental movement began, Gifford Pinchot defined an approach to resource management that set the tone for future definitions of sustainability. In *The Fight for Conservation* (1910), Pinchot described an approach that "recognizes fully the right of the present generation to use what it needs and all it needs of the natural resources now available, but… recognizes equally our obligation so to use what we need that our descendants shall not be deprived of what they need" (p. 80). This early discussion of sustainable resource management conceptualized the idea of intergenerational fairness and, for some time, has guided the management of United States forest, land, and fishery resources (Howarth, 2007). In addition to considering intergenerational fairness in regard to environmental sustainability, it is vital to consider the diversity of our global community so no key players are excluded from the movement. Social movements ultimately depend on significant public support (Stern et al., 1999). Hence, the need to educate *everyone*, because all humans—policymakers, voting citizens, nonvoting citizens, educated, uneducated, poor, wealthy—are influenced by and influencing the state of our natural resources (Gray & Weigel, 1985).

Sustainability at Institutions of Higher Education

With a global movement toward individual action, many universities have emerged as leaders in research and education that address environmental problems caused by global climate change. For decades, institutions of higher education have incorporated sustainability into various aspects of academic and campus life, including degree requirements, lecture series, integration of sustainability across the curriculum, mission or value statements, departmental majors, minors, and certificate programs (Rowe, 2002; Wolfe, 2001). The specific goals of such measures vary by institution,

however they all contribute to help increase environmental literacy. Environmental literacy has been described as “a basic understanding of the concepts and knowledge of the issues and information relevant to the health and sustainability of the environment as well as environmental issues related to human health” (Wolfe, 2001, p. 2).

Thousands of institutions across the globe are documenting their commitments to environmental education through action. For example, more than 650 schools have joined the American College and University Presidents Climate Commitment, agreeing to join the movement toward climate resistance ("American college & university presidents climate commitment," 2016). Institutions may choose to incorporate sustainability as a course requirement for all students, or throughout the curriculum in a more holistic approach. In any case, institutions that require such environmental literacy across the entire student body are helping graduates become better equipped to enter the world as informed environmental stewards.

After analyzing results from the 2014 *College Hopes and Worries Survey* the Princeton Review noticed an increasing interest among students in attending green colleges, noting that 61% of respondents indicated having information about a school’s commitment to the environment would affect their decision to apply to or attend a school ("Green rating press release," 2014). However, few schools include environmental programming in recruiting students (McIntosh, 2001). Institutions of higher education can simultaneously highlight important achievements, such as a particular campus building’s third party green building certification [e.g., Leadership in Energy and Environmental Design (LEED)]. These schools also use it as a recruiting tool for students

who might be interested in the level of social responsibility of a potential college or university (Konvalinka, 2015).

While some institutions of higher education have excelled in providing students with foundational environmental literacy, there are still thousands of students who graduate each year with little to no environmental literacy or understanding of how to practice environmentally relevant behavior. In one study, only 11.6% of institutions reported that an environmental literacy course was required of students (Wolfe, 2001). This gap in institutional framework for environmental education leaves the non-academic departments with some responsibility to provide students with opportunities to engage in environmental literacy programming or initiatives.

Sustainability within University and College Housing

Outside of academia, some of the most significant efforts to increase environmental literacy and ERB occur in residence halls. Students tend to have a stronger connection to their residence halls than to any other campus building, giving campus housing managers an ideal opportunity to educate students on environmental literacy in a setting where they may feel more comfortable and safe (Devereaux, Fulton, Cunningham, van der Veen, & Schwer, 2011; Samuels, Dukes, & LaCost, 2016). While many of the environmental literacy efforts at institutions of higher education are directed toward students studying biology or environmental studies (McIntosh, 2001), any education that occurs in a residence hall—passive or active—reaches students from all disciplines. Residence halls have enormous educational potential that campus housing staff members can utilize to challenge residents to become more competent in terms of environmental sustainability (Schroeder & Mable, 1994).

Campus housing managers and administrators invest a significant amount of time and money into providing students with opportunities to participate in a wide range of environmentally relevant behavior (ERB). The firsthand knowledge and skills students pick up from engaging in behaviors like recycling and water conservation provides short-term benefits like department- or campus-wide cost savings and long-term learning that may allow students to practice similar ERB in their future careers and personal lives after college (Deninger & Swift, 2009). Studies have shown that incorporating energy-efficient features into buildings like residence halls can contribute to cost savings (Turner & Frankel, 2008). However, few studies have examined how the incorporation of green building design or environmental education in residence halls may lead to increased participation in ERB (Erlene Parece, Younos, Grossman, & Geller, 2013; Parece, Grossman, & Geller, 2013). Hence, this study aims to identify the ERB students living on campus are participating in, common constraints to student participation in ERB, and how managers and administrators at institutions of higher education can best allocate time and resources for infrastructure or programming to support such behaviors.

The University of Georgia (UGA) serves as one location for this study due to its variety in on-campus housing programming, infrastructure, and student demographics. University Housing at UGA has housed students on campus for more than 200 years, beginning with Old College and New College, two of the original buildings at UGA that served as residences and academic buildings (Dyer, 1985). University Housing now houses almost 8,000 students per year in 22 residence halls that vary in capacity, structure, and location on campus (Housing, 2016). The University of Georgia does not have any campus-wide requirements in environmental literacy, however all students—

with few exceptions—do have to meet the first-year live-on requirement. All traditional (i.e., non-transfer or transient) students who attend UGA are required to live on campus for one year, making University Housing a suitable setting for education meant to reach the entire student body, regardless of academic major.

Dissertation Format

This study investigated ERB among students living on college or university campuses. Specifically, this study used a sample of students living on UGA's campus to determine the impact of environmental education and LEED-certified residence halls. This study was guided by several key research objectives:

1. How can quantitative data collection be used to assess the impact of environmental education programming on student ERB?
2. How can a comprehensive research model be implemented to analyze students' self-reported ERB, attitudes toward the environment, and satisfaction with sustainability programming and infrastructure at a particular institution of higher education?
3. How can quantitative data collection be used to assess the impact of exposure to an environmentally efficient campus dwelling on student ERB?
4. How can institutions of higher education design buildings and/or environmental education programming models to promote positive changes in residents' ERB?
5. What are the prevalent constraints to resident participation in environmental behaviors?

6. What are the best practices that institutions of higher education, particularly within departments of campus housing, can employ to promote ERB among students living on campus?

This dissertation is presented in manuscript format. Chapter 1 provides an overview of this study with an introduction and relevant literature review. Chapter 2 provides a detailed overview of the methodology used during this study. Chapter 3 examines the impact of environmental education programming and a LEED-certified building on student ERB, attitudes, ecocentrism, and satisfaction with campus housing and campus housing sustainability initiatives. Chapter 4 investigates perceived constraints to student participation in ERB and how student affairs professionals can make informed decisions to allow students to overcome or reduce those constraints. Finally, Chapter 5 provides a summary and recommendations from each of the three manuscripts.

Chapter titles are listed below:

- Chapter 1: Introduction, Dissertation Format, and Literature Review
- Chapter 2: Comprehensive Quantitative Research in Residence Life: Studying Environmental Attitudes, Behaviors, Ecocentrism, and Satisfaction
- Chapter 3: Providing an Educational Foundation and Effective Learning Environment for University Students' Participation in Environmentally Relevant Behavior
- Chapter 4: Perceived Constraints to Student Participation in Environmentally Relevant Behavior: Creating Accessible Sustainability Initiatives and Programs
- Chapter 5: Summary and Recommendations

Literature Review

Sustainability Research

In addition to research on sustainability and human behavior, interdisciplinary studies are adding to the wide range of areas influenced by negative impacts of global climate change. For example, agricultural practices and human food consumption are large contributors to greenhouse gas emissions, and thus global warming (Pew, 2011). Worldwide, people are over consuming, leading industries to overproduce beyond what the planet may be able to provide in natural resources. Humans are consuming up to 200 grams of red meat per person per day (Bouvard et al., 2015), contributing large amounts of carbon dioxide, nitrous oxide, and methane when compared to other foods like vegetables, dairy products, and poultry (Carlsson-Kanyama & González, 2009). Research shows a reduction in red meat consumption worldwide would contribute to an overall increase in human health and a significant reduction in greenhouse gas emissions due to a reduction in cattle raised to meet the high demand of red meat consumers (Bouvard et al., 2015; Carlsson-Kanyama & González, 2009; Springmann, Godfray, Rayner, & Scarborough, 2016).

Studies have presented the interconnectedness of ERB and topics such as public health (Dietz, 2015; Louv, 2008; Singh, Syal, Grady, & Korkmaz, 2010; Ward, 2015; Wolch, Byrne, & Newell, 2014); work place productivity (Nidumolu, Prahalad, & Rangaswami, 2009); and economics (Nidumolu et al., 2009). A broad theme of all research in climate science and environmental sciences is the need for widespread communication and education. Fortunately, it is not the researchers alone who are working to promote environmental education.

Environmental Education at Institutions of Higher Education

Institutions of higher education provide strong settings for education and programs related to natural resource stewardship (Petersen, Shunturov, Janda, Platt, & Weinberger, 2007; Shriberg, 2002a). Researchers can take advantage of an accessible population of students to include in sustainability or environmental education research. For example, Shriberg (2002b) conducted a study to investigate cross-institutional assessment of sustainability. Parece (2013) used a sample of ten residence halls at Virginia Polytechnic Institute and State University to assess students' response to various communication treatments about water use reduction. Institutions of higher education strive to provide students with a diverse array of activities and programs to facilitate the experiences students are seeking, including efforts to promote a better understanding of the natural environment and environmental stewardship. Fortunately, a vast majority of institutions of higher education have made environmental literacy or environmental education programming a priority (McIntosh, 2001). Institutions of higher education have a distinct opportunity to incorporate sustainability in a wide range of programs and infrastructure to encourage environmental literacy among students.

College or university administrators can also gain a variety of third party certifications for their efforts to educate students on sustainability or incorporate sustainable practices across campus. Institutions may join organizations or associations that help identify them as leaders in environmental education or practices. Many schools have pursued the Association for the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking Assessment and Rating System (STARS) to comprehensively assess their efforts (Swearingen White, 2014). Institutions of higher

education may also choose to get a third party verification of a certain level of building efficiency, such as LEED or the Building Research Establishment Environmental Assessment Method (Gowri, 2004; USGBC, 2011).

Environmental Education in Campus Housing

Opportunities for educating residents during their on-campus living experience are endless—from passive programming (e.g., signs and bulletin boards) and active programming (e.g., documentary viewing, conservation education, guest speakers, etc.) to leadership opportunities (e.g., sustainability-related hall council position, committees, etc.). Residence halls, the physical spaces used for carrying out programming and outreach, have enormous educational potential especially when residents are challenged to become more educated and competent in terms of environmental sustainability and ERB (Schroeder & Mable, 1994).With all the potential programs and services related to sustainability, one efficient way to guarantee an effective educational experience for residents living on campus is to create a comprehensive plan that all efforts—including infrastructure and educational initiatives—fall under (Shriberg, 2002b). Essentially, residence halls can serve as a living laboratory, a space where students begin to understand both their adult living preferences and capacity for daily ERB.

A particularly unique form of education that is specific to residence life and housing at institutions of higher education is the learning community. These communities range from minimal arrangements of linked courses to more elaborate models that are housed in a designated residence hall, provide in-house advising, and function more like a small college (Shapiro & Levine, 1999). Many institutions of higher education have developed learning communities to support the global movement toward conservation

behavior and effective stewardship of natural resources. Elon University hosts a Sustainable Living Learning Community (SLLC) that allows students to explore what it means to live sustainably and learn about sustainability on their campus and in the surrounding area. The SLLC minimum requirements dictate that residents in the learning community must attend and facilitate bi-weekly discussions, attend an off-campus field trip, attend an on-campus experience, and participate in at least two sustainability events per semester ("Sustainable living," 2014). The University of South Carolina hosts an extremely unique living-learning community called the Green Quad where students can live in a sustainably designed environment while learning about green values and issues ("Green quad," 2012; Whiteman, 2009). This community has 14 full time staff members and a range of amenities that include access to study spaces, free yoga classes, and classrooms used for learning community courses ("Green quad," 2012). Living-learning communities specializing in a variety of sustainability topics across the country play a key role in the engagement and education of residents that will not only enhance their on-campus living experience, but also turn them into the leaders that will contribute to efforts to limit, or even reverse, the impact of campus housing on the environment.

Infrastructure, Education, and Students' On Campus Experiences

Universities may realize multiple benefits from enforcing or encouraging high standards for building efficiency with construction, renovation, or retrofitting. Infrastructure improvements (i.e., low flow shower heads and energy monitors) and increased environmental literacy among students living on campus may lead to major cost savings (Trinklein, 2009). At some institutions, campus housing departments have become leaders in green construction, renovation, and retrofitting. Campus housing

departments can tap into existing third party rating systems or create their own high standards for building efficiency. While it is not the only third party green building rating system, LEED is the most prevalent—at least within the United States.

Leadership in Energy and Environmental Design addresses different project types and scopes with separate certification programs, including New Construction and Major Renovations, Core and Shell, Commercial Interiors, Schools, Healthcare, Retail, Existing Buildings: Operations and Maintenance, Homes, and Neighborhood Development. LEED is organized into broad concepts for which a certain amount of points are assigned. Those concepts include: Sustainable Sites, Water, Energy, Materials and Resources, Indoor Environmental Quality, Awareness and Education, Innovation, Regional Priority and three that are specific only to LEED for Neighborhood Design. LEED rating systems generally have 100 points with opportunities to gain up to four Regional Priority points and six Innovation Points. The four levels of LEED certification can be achieved through the assignment of points to the building seeking certification—40 to 49 points to be Certified, 50 to 59 points to be rated Silver, 60 to 79 points to be rated Gold, and 80 or more points to be rated Platinum (USGBC, 2011). The first LEED-certified residence hall in the United States was New House Residence Hall at Carnegie Mellon University, which received a Silver certification (Stegall & Dzombak, 2004). The construction was completed in 2003 and since then hundreds of institutions of higher education across the United States have achieved various LEED certification statuses for campus residence halls ("Leed projects and case studies directory," 2011).

According to one analysis of 100 buildings, LEED buildings use 18-39% less energy per floor area than their conventional counterparts, potentially saving thousands of

dollars per academic year (Newsham, Mancini, & Birt, 2009). Since residence halls are responsible for the most energy and water consumption on campus, the entire university could benefit from cost savings associated with LEED-certified residence halls that feature elements such as efficient plumbing and electricity and contribute to campus-wide reduction in landfill waste or water conservation (Devereaux et al., 2011; Parece et al., 2013; Petersen et al., 2007; USGBC, 2011). As a side effect, yet still incredibly important attribute, green buildings also have a positive influence on occupants' health and productivity (Eichholtz, Kok, & Quigley, 2010; Singh et al., 2010).

While LEED is the most widely recognized third party green building verification system, schools may also achieve certification in others including the Building Research Establishment's Environmental Assessment Method or Green Leaf (Fowler & Rauch, 2006). Berea College houses one of the most environmentally efficient residence halls in the country, as it achieved LEED-certification as well as Petal Recognition from the Living Building Challenge. Berea even seems to emphasize efficient infrastructure for construction and renovation ("Sustainable campus features," 2015). Environmental regulations vary drastically by country, state, region, or even city, forcing some institutions of higher education to center their decision-making around pre-established policies that limit them or encourage them to reach a high standard (Nidumolu et al., 2009).

Students living on campus come from a variety of backgrounds, thus bringing a wide array of knowledge related to ERB. Many students living on campus expect infrastructure for waste management that will allow them to make more environmentally conscious decisions (Dunkel, 2009). Universities are approximately comparable in waste

generation to large complexes like hospitals and hotels and the solid waste can be produced in extremely high volumes in short timespans depending on the time of year and campus events like orientation and athletic events (Alshuwaikhat & Abubakar, 2008). Studies show that students can dramatically decrease their waste production if they are provided with resources like community or in-room recycling bins (Pike et al., 2003). By providing that infrastructure and supplementing the physical aspects with educational signs, campus housing managers and administrators are giving residents the opportunity to reduce their waste production and increase the amount of materials kept in the resource cycle.

Also unique to residence life are programs like electricity or water conservation competitions like the Kukui Cup at the University of Hawaii (Brewer, Lee, & Johnson, 2011) and The One Thing Challenge between The University of Washington and Washington State University (Pursehouse, 2012). During competitions, students are motivated to conserve resources like water or electricity and participate in environmental education programming that emphasizes ERB and conservation practices. While the water and electricity reduction that occurs during these competitions may be minimal in the larger picture of an academic year, the conservation practices students learn can last a lifetime.

Funding

Sufficient funding is essential to the majority of sustainability initiatives, especially those related to construction or installation of new fixtures (Zhang, Williams, Kemp, & Smith, 2011). For instance, sustainability programs need money for their initial support, continuous funding for the maintenance of programs, and replacement funds for

items like recycling bins that are broken or go missing (Pike et al., 2003). Campus housing administration can find funding for projects and initiatives that will enhance from both traditional and nontraditional sources.

Funding for new construction projects, which often include the update of buildings to high environmental standards, traditionally comes from tax exempt revenue bonds, reserve funds, private developer funds, and state appropriations (Balogh, Grimm, & Hardy, 2005). Some institutions have even created Green Revolving Funds based on loans used to pay for sustainability projects ("Campus sustainability revolving loan funds database," 2012; "Green revolving fund," 2015). Additional funds can come from outside sources in the form of grants such as the Coca-Cola Foundation Keep America Beautiful Bin Grant Program that provides new recycling bins for college and universities each year ("The coca-cola foundation kab bin grant program," 2015) or partnerships with local, regional, and national organizations that will provide support for programming or infrastructure. Campus housing sustainability initiatives and projects can also be funded through other departments, most often in the form of small grants such as those from the Office of Sustainability at Western Michigan University ("Student sustainability grants handbook," 2012) and Green Grants at New York University ("Green grants," 2015).

Theoretical Foundation

Social and behavioral psychology both play an important role in determining best practices for widespread environmental education and many educators and researchers have applied certain theories to contribute to a better understanding of human behavior (Gray & Weigel, 1985; Newsome & Alavosius, 2011). By understanding human behavior, advocates of environmental literacy can create literature and educational

models that may actually help people understand how to modify their behavior to prevent negative impacts on the environment. Theory suggests behavior can be predicted by factors such as values, beliefs, attitudes, and social norms (Newsome & Alavosius, 2011). To understand how behavior can change as a result of interventions such as environmental education, we must consider a collection of behavioral theories:

- Theory of Planned Behavior (Ajzen, 1991): places a person's intention at the center of a behavioral model where a person's attitudes can influence his or her intended behavior. Intended behavior can predict actual behavior, and be influenced by a person's attitude toward the behavior, perceived social pressure, and perceived behavioral control. The stronger a person's intention, the more likely he or she is to participate in a certain behavior. This theory is an extension of the Theory of Reasoned Action, which posits that behavior is influenced by a person's attitudes and subjective norms (Fishbein, 1975).
- Cognitive Dissonance (Festinger, 1962): people tend to avoid inconsistencies in their behavior, however if people do not see the connection between certain behaviors, they will fail to experience cogitative dissonance (Thøgersen, 2004). Environmentally relevant behaviors may vary significantly and may not necessarily be reflective of general conservation habits (Pickett, Kangun, & Grove, 1993). For example, someone may not see the shared motivational roots between water conservation and energy conservation, however they both lead to potential cost saving *and* wise stewardship of natural resources. Hence, someone who does not see this connection or other similarities between the two types of conservation may not experience cognitive dissonance, but may choose to only

engage in one ERB. However, even if someone experiences cognitive dissonance, he or she may still choose to deal with that consequence over dealing with the consequences of a particular ERB (Thøgersen, 2004). For example, if a person understands the link between water conservation and energy conservation, but does not want to sacrifice a long shower or washing clothing in separated loads, he or she will likely choose to disregard the cognitive dissonance.

- Value-Belief-Norm (VBN) Theory (Stern, 2000; Stern et al., 1999): (Figure 1.1) combines three earlier theories and draws a connection between a person's values and his or her level of engagement in environmental citizenship behavior (i.e., ERB). The VBN Theory suggests ERB can be influenced by a combination of factors from previous theories such as religious beliefs, beliefs about how society should be organized, and an individual's personal constraints. The VBN Theory draws on the following accounts to create a causal chain connecting values, an environmental paradigm where humans negatively influence a fragile biophysical environment, awareness of consequences, ascription of responsibility, and personal norms for ERB:
    - Norm-Activation Theory (Schwartz, 1977): personal norms, which reflect internal values and feelings of obligation to engage in particular a behavior, influence behavior. Norm-consistent behavior can be activated by increased awareness of consequences (i.e., benefits) and increased acknowledgement or awareness of responsibility for certain consequences.
    - Theory of Personal Values (Stern, Dietz, & Kalof, 1993): there are three value orientations relevant to environmentalism—self-interest, altruism

toward other humans, and altruism toward other species and natural resources.

- New Ecological Paradigm (Dunlap, Van Liere, Mertig, & Jones, 2000): a scale developed to measure the belief that humans have a negative impact on fragile natural resources.

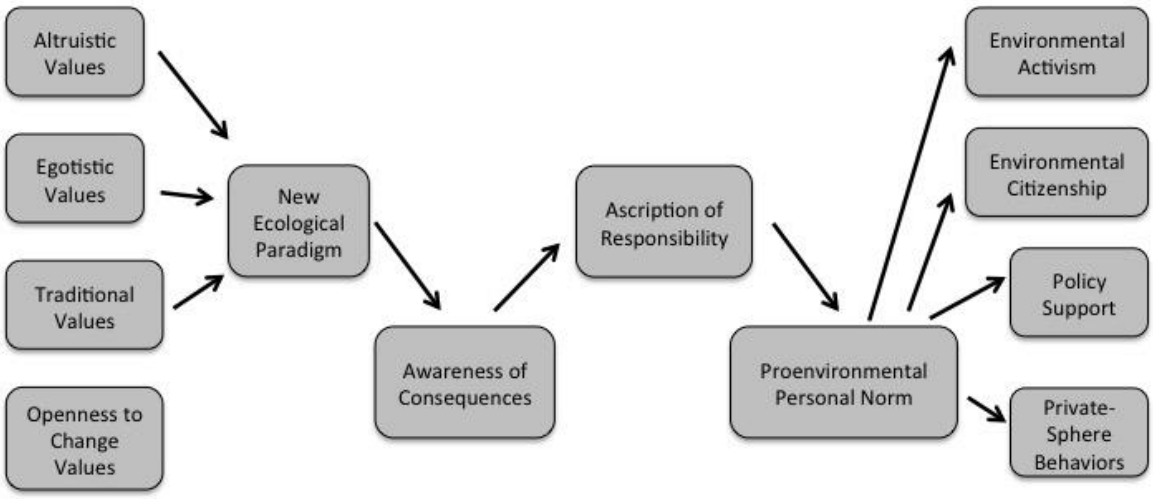


Figure 1.1. Schematic model representing Stern's (1999) Value-Belief-Norm theory, which links the norm-activation theory, the theory of personal values, and the New Ecological Paradigm hypothesis.

Each of these theories contributes to improving the knowledge of environmental educators, however the methods by which environmental educators and researchers assess environmental attitudes, behaviors, etc. are always evolving. Using these theories, researchers can apply them to research on a variety of sustainability and environmental topics.

Gap in Literature

Behavioral theories such as the Theory of Planned Behavior are conditional on Perceived Behavioral Control, or in the case of environmentalism, access to opportunities to engage in ERB (Ajzen, 1991). Without knowing precisely what a student needs in terms of educational resources or programming, it is impossible to guarantee that control. With many students coming from different places around the world, it is a constant challenge to predict what resources students need to be properly informed of opportunities to engage in ERB on a particular university or college campus. Furthermore, students may not feel that one particular conservation habit (e.g., water conservation) is in any way related to another (e.g., energy conservation), when in fact the two are completely interdependent.

This cognitive dissonance may lead students to focus on the behaviors they feel are beneficial and disregard any ERB they feel may not be linked (Thøgersen, 2004). According to Schwartz's Norm-Activation Theory (Schwartz, 1977), people may also choose to engage in certain behaviors only if they are influenced by their internal norms, which may be activated by certain consequences. Since students living on campus may never see any consequences for certain behavior (e.g., water bill or power bill), the chance of them engaging in behavior because of internalized norms seems quite low. Hence, it is essential to assess students' self-reported ERB and their constraints to participation in any ERB in order to determine which behaviors they are truly engaging in or what is preventing them from engaging more effectively or completely.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Alshuwaikhat, H. M., & Abubakar, I. (2008). An integrated approach to achieving campus sustainability: Assessment of the current campus environmental management practices. *Journal of Cleaner Production, 16*, 1777-1785.

American college & university presidents climate commitment. (2016). Retrieved December 18, 2016, from http://ecoamerica.org/programs/american-college-university-presidents-climate-commitment/

Balogh, C. P., Grimm, J., & Hardy, K. (2005). ACUHO-I construction and renovation data: The latest trends in housing construction and renovation. *Journal of College & University Student Housing, 33*(2), 51-56.

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., El Ghissassi, F., Benbrahim-Tallaa, L., . . . Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *Lancet Oncology, 16*(16), 1599 - 1600.

Brewer, R. S., Lee, G. E., & Johnson, P. M. (2011). The kukui cup: A dorm energy competition focused on sustainable behavior change and energy literacy. *System Sciences (HICSS)*, 1-10.

Campus sustainability revolving loan funds database. (2012). Retrieved May 31, 2015, from http://www.aashe.org/resources/campus-sustainability-revolving-loan-funds/

Carlsson-Kanyama, A., & González, A. D. (2009). Potential contributions of food consumption patterns to climate change. *The American Journal of Clinical Nutrition, 89*(5), 1704S-1709S.

The Coca-Cola Foundation KAB bin grant program. (2015). Retrieved May 31, 2015, from http://bingrant.org/

Deninger, L., & Swift, J. (2009). Integrated design: A sustainable mindset for residence halls. *Journal of College and University Student Housing, 36*(1).

Devereaux, J., Fulton, J., Cunningham, M., van der Veen, R., & Schwer, P. (2011). Green living: Why invest in a deep green residence hall? *Sustainability: The Journal of Record, 4*(3), 121-127.

Dietz, W. H. (2015). The response of the us centers for disease control and prevention to the obesity epidemic. *Annual Review of Public Health*. *36*, 575-596.

Dunkel, N. W. (2009). Green residence halls are here: Current trends in sustainable campus housing. *The Journal of College and University Student Housing*, 10.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised nep scale. *Journal of Social Issues, 56*(3), 425-442.

Dyer, T. G. (1985). *The university of georgia: A bicentennial history, 1785-1985*. Athens. GA: University of Georgia Press.

Eichholtz, P., Kok, N., & Quigley, J. M. (2010). Doing well by doing good? Green office buildings. *The American Economic Review, 100*(5), 2492-2509.

Erlene Parece, T., Younos, T., Grossman, L. S., & Geller, E. S. (2013). A study of environmentally relevant behavior in university residence halls. *International Journal of Sustainability in Higher Education, 14*(4), 466-481. doi: 10.1108/ijshe-01-2012-0008

Farley, H. M. (2014). *Sustainability: If it's everything, is it nothing?* NY: Routledge.

Festinger, L. (1962). *A theory of cognitive dissonance* (Vol. 2): Stanford University Press.

Fishbein, M. (1975). Ajzen, I.(1975). *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Boston, MA: Addison-Wesley.

Fowler, K. M., & Rauch, E. M. (2006). *Sustainable building rating systems summary*. Richland, WA: Pacific Northwest National Laboratory (PNNL).

Gowri, K. (2004). Green building rating systems: An overview. *ASHRAE Journal, 46* (11): 56-60, 46.

Gray, D. B., & Weigel, R. H. (1985). *Ecological beliefs and behaviors: Assessment and change* (Vol. 4). Santa Barbara, CA: Praeger Pub Text.

Green grants. (2015). *New York University Sustainability*. Retrieved May 31, 2015, from https://www.nyu.edu/sustainability/campus.projects/greengrants/

Green quad. (2012). *Office of Sustainability*. Retrieved May 28, 2015, from http://www.sc.edu/green/GreenQuad.php

Green rating press release. (2014). [Press release]

Green revolving fund. (2015). *Harvard University*. Retrieved May 31, 2015, from http://green.harvard.edu/programs/green-revolving-fund

Hansen, J., Sato, M., Hearty, P., Ruedy, R., Kelley, M., Masson-Delmotte, V., . . . Rignot, E. (2016). Ice melt, sea level rise and superstorms: Evidence from paleoclimate data, climate modeling, and modern observations that 2 c global warming could be dangerous. *Atmospheric Chemistry and Physics, 16*(6), 3761-3812.

Housing, U. (2016). Mission, values, principles. Retrieved October 22, 2016, from https://housing.uga.edu/site/about - mission

Howarth, R. B. (2007). Towards an operational sustainability criterion. *Ecological Economics, 63*(4), 656-663.

Intergovernmental Panel on Climate Change. (2014). *Climate Change 2014 Synthesis Report, Summary for Policymakers.* Retrieved from https://www.ipcc.ch/pdf/ assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

Jabareen, Y. (2013). Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk. *Cities, 31*, 220-229.

Konvalinka, A. H. (2015). The will to leed: Can a campus be committed to sustainability without leed certification? *Talking Stick: The Authoritative Source for Campus Housing, 32*(5), 43 - 50, 70 - 71.

Leed projects and case studies directory. (2011). *U.S. Green Building Council.* Retrieved May 28, 2015, from http://www.usgbc.org/LEED/Project/RegisteredProjectList.aspx

Louv, R. (2008). *Last child in the woods : Saving our children from nature-deficit disorder*. Chapel Hill, NC: Algonquin Books of Chapel Hill.

Lutz, W., Muttarak, R., & Striessnig, E. (2014). Universal education is key to enhanced climate adaptation. *Science, 346*(6213), 1061-1062.

McIntosh, M. (2001). *State of the campus environment: A national report card on environmental performance and sustainability in higher education.* Reston, VA: National Wildlife Federation.

Newsham, G. R., Mancini, S., & Birt, B. J. (2009). Do leed-certified buildings save energy? Yes, but…. *Energy and Buildings, 41*(8), 897-905.

Newsome, W. D., & Alavosius, M. P. (2011). Toward the prediction and influence of environmentally relevant behavior: Seeking practical utility in research. *Behavior and Social Issues, 20,* 44-71.

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review, 87*(9), 56-64.

Olsson, P., Galaz, V., & Boonstra, W. J. (2014). Sustainability transformations: A resilience perspective. *Ecology & Society, 19*(4), 1-13.

Parece, T. E., Grossman, L., & Geller, E. S. (2013). Reducing carbon footprint of water consumption: A case study of water conservation at a university campus *Climate Change and Water Resources* (pp. 199-218). New York, NY: Springer.

Petersen, J. E., Shunturov, V., Janda, K., Platt, G., & Weinberger, K. (2007). Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives. *International Journal of Sustainability in Higher Education, 8*(1), 16-33.

Pew Center on Global Climate Change. (2011). *Climate change 101: understanding and responding to global climate change*. Retrieved from https://www.c2es.org/docUploads/climate101-overview.pdf

Pickett, G. M., Kangun, N., & Grove, S. J. (1993). Is there a general conserving consumer? A public policy concern. *Journal of Public Policy & Marketing*, 234-243.

Pike, L., Shannon, T., Lawrimore, K., McGee, A., Taylor, M., & Lamoreaux, G. (2003). Science education and sustainability initiatives: A campus recycling case study shows the importance of opportunity. *International Journal of Sustainability in Higher Education, 4*(3), 218-229.

Pinchot, G. (1910). *The fight for conservation. New York, NY*: Doubleday.

Pursehouse, C. (2012). Sustainability in housing and dining operations. *New Directions for Student Services, 2012*(137), 41-52. doi: 10.1002/ss.20013

Rochman, C. M., Kurobe, T., Flores, I., & Teh, S. J. (2014). Early warning signs of endocrine disruption in adult fish from the ingestion of polyethylene with and without sorbed chemical pollutants from the marine environment. *Science of the Total Environment, 493*, 656-661.

Rowe, D. (2002). Environmental literacy and sustainability as core requirements: Success stories and models. *Available at:ncsonline.org/efs/debrarowe.pdf.(Accessed 20 October 2010)*, 3.

Samuels, D. R., Dukes, R. L., & LaCost, M. (2016). Two worlds of university life: Role conflict among residential students and commuters on a newly-residentialized campus. *Free Inquiry in Creative Sociology, 28*(2), 85-93.

Schroeder, C. C., & Mable, P. (1994). *Realizing the educational potential of residence halls.* San Fransisco, CA: Jossey-Bass Inc.

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology, 10*, 221-279.

Shapiro, N. S., & Levine, J. H. (1999). *Creating learning communities: A practical guide to winning support, organizing for change, and implementing programs.* San Fransisco, CA: Jossey-Bass Inc.

Shriberg, M. (2002a). Institutional assessment tools for sustainability in higher education: Strengths, weaknesses, and implications for practice and theory. *Higher Education Policy, 15*(2), 153-167.

Shriberg, M. (2002b). Toward sustainable management: The university of michigan housing division's approach. *Journal of Cleaner Production, 10*(1), 41-45.

Singh, A., Syal, M., Grady, S. C., & Korkmaz, S. (2010). Effects of green buildings on employee health and productivity. *American Journal of Public Health, 100*(9), 1665.

Springmann, M., Godfray, H. C. J., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences, 113*(15), 4146-4151.

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407-424.

Stern, P. C., Dietz, T., Abel, T. D., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*(2), 81-97.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior, 25*(5), 322-348.

Student sustainability grants handbook. (2012). *Western Michigan University*. Retrieved May 31, 2015, from http://wmich.edu/sites/default/files/attachments/120515-SSG-Handbook_0.pdf

Sustainable campus features. (2015). *Quick Facts.* Retrieved December 17, 2016, from https://www.berea.edu/about/quick-facts/

Sustainable living. (2014). *Residence Life*. Retrieved May 28, 2015, from http://www.elon.edu/e-web/students/residence_life/learningcommunities/sustainableliving.xhtml

Swearingen White, S. (2014). Campus sustainability plans in the united states: Where, what, and how to evaluate? *International Journal of Sustainability in Higher Education, 15*(2), 228-241.

Thøgersen, J. (2004). A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *Journal of Environmental Psychology, 24*(1), 93-103.

Trinklein, A. J. (2009). Sustainability and residence hall construction. *Journal of College & University Student Housing, 36*(1), 24-37.

Turner, C., & Frankel, M. (2008). Energy performance of leed for new construction buildings. *New Buildings Institute, 4*, 1-42.

USGBC. (2011). *Green building and leed core concepts: Green building and leed core concepts guide* (Vol. 2). Washington, DC: U.S. Green Building Council.

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social--ecological systems. *Ecology and Society, 9*(2).

Ward, C. (2015, March). *Kids in parks: Partnering for the health of our kids and our parks.* Paper presented at the Southeastern Recreation Research Conference Asheville, NC.

Whiteman, D. (2009). Creating a "green bubble" on campus: A model for programming in a green living-learning community. *Journal of College & University Student Housing, 36*(1), 38-47.

Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and Urban Planning, 125*, 234-244.

Wolfe, V. L. (2001). A survey of the environmental education of students in non-environmental majors at four-year institutions in the USA. *International Journal of Sustainability in Higher Education, 2*(4), 301-315.

Zhang, N., Williams, I. D., Kemp, S., & Smith, N. F. (2011). Greening academia: Developing sustainable waste management at higher education institutions. *Waste Manag, 31*(7), 1606-1616. doi: 10.1016/j.wasman.2011.03.006

CHAPTER 2

COMPREHENSIVE QUANTITATIVE RESEARCH IN RESIDENCE LIFE: STUDYING ENVIRONMENTAL ATTITUDES, BEHAVIORS, ECOCENTRISM, AND SATISFACTION

Introduction

On campus housing is an integral aspect of a student's college or university experience. Residence halls have served as a staple in American universities for decades, contributing to students' satisfaction with their time in school and providing comfortable and safe places for students to live while they pursue their degrees (Samuels et al., 2016). In the United States, the concept of living on campus developed with the introduction of European-style colleges (Brubacher & Rudy, 1997). American college students in the 1700s were typically younger than today's students and thus needed a structured place to dwell while they were miles away from their hometowns (Dyer, 1985). Over the years, college dormitories and residence halls have evolved in function and structure, creating spaces that may enrich student lives while they are on campus and influence them for many years after.

Residence halls often serve as more than four walls and a roof to students who spend one or more years calling these high-occupancy buildings "home." Student affairs professionals work to create a specific environment in each residence hall that goes beyond simply offering a place to live. These staff—including graduate residents, resident assistants, residence hall directors, and resident mentors—spend substantial time

developing programs, building community, and providing resources to help students make the most of their experience at a particular institution. Because students may have a stronger association with their residence hall than any other building at their institution, student affairs professionals have the opportunity to educate students on a range of topics—such as sustainability—while they reside on campus (Devereaux, 2011).

The University of Georgia (UGA), chartered in 1785, has housed students on campus for more than 200 years. Throughout most of the antebellum period, students who were not residing in an approved dwelling off campus lived in Old College or New College, two of the original buildings at UGA that served as residence halls and academic buildings (Dyer, 1985). Since students first started attending classes at UGA in 1801, the university has expanded on campus housing to match the ever-expanding student body (Dyer, 1985). Currently, UGA has eight communities consisting of 22 residence halls that collectively house more than 7,800 students (Housing, 2016a). In 2010, a traditional residence hall called Building 1516 opened as UGA's first "green" residence hall. Building 1516 attained Leadership in Energy and Environmental Design (LEED) Gold certification, which contributed "to higher productivity and improved health and comfort to students and staff" (Housing, 2016b)—a goal that aligns with University Housing's mission of providing students with "comfortable, affordable, and secure on-campus housing options in residential communities where the academic success and personal growth of [students] are encouraged and supported" (Housing, 2016c).

Designating a residence hall as LEED-certified verifies it is approved by the United States Green Building Council as one that achieves "high performance" in the areas of sustainable site development, water savings, energy efficiency, materials

selection, and indoor environmental quality (USBGC, 2011). The first LEED Silver-certified residence hall in the United States was New House Residence Hall at Carnegie Mellon University in Pittsburgh, Pennsylvania (Stegall, 2004). The construction was completed in 2003 and since then hundreds of schools across the United States have achieved various LEED certification statuses for campus residence halls (USBGC, 2011).

Students who live in environmentally friendly residence halls often gain firsthand knowledge of sustainable practices from their time living on campus, which they can later apply to their careers and personal lives after college (Deninger & Swift, 2009). These buildings provide students with new, state-of-the-art green technology, and also with mental and physical health benefits associated with clean air and reduced toxins. LEED-certified buildings have been proven to increase occupant productivity and improve the symptoms of medical conditions like asthma, depression, and respiratory allergies (Singh, 2010). LEED-certified buildings may also increase students' knowledge in water-saving and energy-saving devices and practices, while enhancing his or her ability to act as a responsible citizen and natural resource steward (Dunkel, 2009). Universities that have taken steps toward more sustainability initiatives have been faced with the challenge and privilege of educating students on a lifestyle that may lead to a reduced carbon footprint (Luna, 2002). Universities, in addition to the benefits accrued from student performance improvements (Cidell, 2009), also benefit from the substantial cost savings a green building may provide from their unique sustainable features such as dual flush valves, low flow shower heads, and energy monitors (Trinklein, 2009).

Investing money in an efficient, LEED-certified building is just one way institutions of higher education can make a visible commitment to environmental

sustainability. Managers and directors at a given institution may also choose to invest time and resources into programs that promote environmentally relevant behavior (ERB) among students. Studies have shown that promoting ERB through programming and information posted in residence halls may increase participation in conservation-related activities, such as reduction in water or electricity use (Erlene Parece et al., 2013; Parece et al., 2013).

Some institutions have combined concepts to create a living-learning environment that promotes ERB through both infrastructure and programming. Portland State University's First Year Experience Sustainability Freshman Inquiry program provides students with a unique combination of field experience and course work that builds on what they may learn from their living environment, which features one of the largest green roofs in the city ("The sustainability fye-frinq," 2015). Elon University hosts a Sustainable Living Learning Community (SLLC) that allows students to explore what it means to live sustainably and learn about sustainability on their campus and in the surrounding area. The SLLC minimum requirements dictate that residents in the learning community must attend and facilitate bi-weekly discussions, attend an off-campus field trip, attend an on-campus event, and participate in at least two sustainability events per semester ("Sustainable living," 2014). Though these programs present different information to students, they do share in their missions to provide holistic programs that will enhance student learning and sustainable behavior that will continue on well after their on-campus living experiences (Devereaux et al., 2011).

Assessment of such environmental initiatives—both green infrastructure and educational programs—is essential to justify the continuation of financial or time. While

studies show that energy-efficient buildings may contribute to overall cost savings (Turner & Frankel, 2008), it is difficult to directly connect those savings with long term understanding of environmental stewardship. Likewise, studies have not conclusively determined that increased environmental education leads to increased participation in ERB (Erlene Parece et al., 2013; Parece et al., 2013). Studies initiated by a particular residence life department or by a third party researcher can contribute significantly to the justification of continued financial investment in environmental sustainability initiatives. Without such studies and regular assessment, it is difficult for an institution to maintain or advance any program that utilizes funds provided by student fees.

Problem

Hence, while many qualitative studies have assessed the impact of environmental sustainability in university residence life, very few have found ways to quantitatively measure any impact on students' behaviors, attitudes, and satisfaction. Subsequently, an integrated approach that relies on the collection of both qualitative and quantitative methods could address a variety of research questions from different perspectives (Shulman, 1981; Vaske, 2008). Universities nationwide are investing in LEED-certified buildings and environmental education, however possible effects of these buildings and programs have yet to be fully explored and little research has examined whether universities and colleges are implementing legitimately successful environmental education programming that can influence student behavior. For instance, these programs may contribute to a more holistic understanding of environmental behavior for students who may need a variety of approaches to more fully understand a culture of sustainability (Levy, 2012). With features such as low-flow faucets and energy-efficient air

conditioning units included in many residence hall rooms, students are learning how to use new home appliances, but not necessarily how to apply what they are learning to everyday life outside of the convenience of a residence hall. Comprehensive research is necessary to explore the ERB of students living on campus and potential constraints to their participation in those behaviors. This information may be vital to student affairs professionals and managers at institutions of higher education who decide where funds will be most effective and beneficial to students.

Purpose

This study aimed to identify methods by which researchers and student affairs professionals could assess the impact of various environmental sustainability features and programs (i.e., low-flow water fixture, environmental education workshops, etc.) on students living on campus. Results could provide a comprehensive approach to environmental sustainability assessment in university residence life. Hence, this study aimed to examine how Building 1516, a LEED-certified residence hall at UGA, and increased sustainability and environmental education programming in Brumby Hall, a traditional non-LEED-certified residence hall at UGA, affected students in terms of their environmental attitudes, behavior, and satisfaction. This study also examined common perceived constraints to student's participation in ERB. By comparing student attitudes, behaviors, and satisfaction in Building 1516 and Brumby Hall to those of students in Reed Hall, a traditional residence hall with fewer environmental education programs, this study examined potential differences in students' environmental attitudes, behaviors, and satisfaction.

Methods

Three groups of students—two treatment groups and one control group—were evaluated using a pretest and posttest survey. The Immersion-based treatment group (1) consisted of students in Building 1516, which houses approximately 555 students and features sustainable amenities—such as low-flow faucets and showerheads and energy-saving air conditioning units. Building 1516 is the only LEED-certified residence hall on UGA's campus and, at the time of this study, surpassed all other UGA residence halls in green building design, efficiency, and modern updates (i.e., new fixtures and efficient lighting). The Program-based treatment group (2) consisted of students in Brumby Hall, a traditional, co-ed residence hall, which houses approximately 950 undergraduate students. Students in the Program-based treatment group had more opportunities to attend environmental education programs in their residence halls. Examples of programs facilitated by Brumby Hall staff over the course of this study include an organic versus conventional food taste testing, an "upcycled" craft night, and a sustainability trivia game. The control group consisted of students in Reed Hall, a traditional, co-ed residence hall, which houses approximately 295 undergraduate students. Reed Hall lacks sustainable amenities like Building 1516 and does not have a formal environmental education program.

Brumby Hall resident assistants and other staff members were trained to facilitate one environmental education or sustainable program per semester for the Program-based treatment. A student staff training occurred the first week of August each year to review expectations of staff members during the study. At the hour-long training session, student staff received a Brumby Programming Resources packet to aid in environmental education and sustainability programming throughout the year (Appendix A) and an

annual training session, which provided definitions and a group activity to help staff understand their role in facilitating particular programs (Appendix B). With training and additional resources provided only to staff members in the Program-based treatment group, students in that treatment were exposed to up to 47 more environmental education or sustainability programs than in similar residence halls. Figure 2.1 shows a comparison between the Program-based treatment group and two other buildings. The Program-based treatment group and the two comparison buildings are all high-occupancy, co-ed residence halls with identical programming requirements for staff.

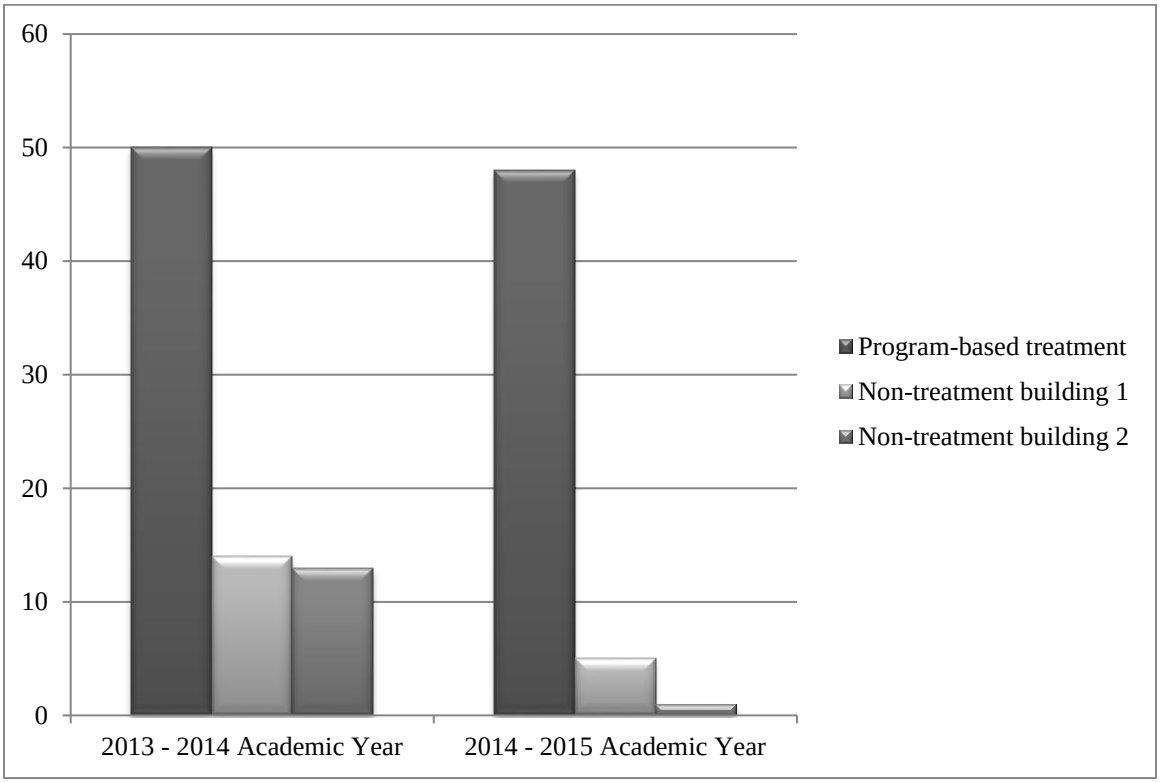


Figure 2.1. Occurrence of environmental education or sustainability programming in Program-based Education treatment compared to similar residence halls at UGA.

Survey Design

The survey (Appendix C) was developed from existing scales, using statements adapted for students living on campus at UGA (Dunlap et al., 2000; L. R. Larson, Green,

& Castleberry, 2009; Needham, 2010; Parker, 2013; Shriberg, 2002). Table 2.1 shows examples of the types of adaptations used to apply existing scales with more appropriate terms or phrasing. Items were arranged into seven distinct sections and students were asked to respond to each statement or question using a likert scale, semantic scale, or multiple response option. For likert scale questions, items ranged from 1 = *Strongly Disagree* to 5 = *Strongly Agree*. Semantic scale questions ranged from *1 = Never* to *5 = Always* or *1 = Not a Reason* to *4 = Major Reason*. The section for self-assessment of levels of ecocentrism contained three scales from one to five where students checked the option that best represented their opinions on the spectrum of statements (Needham, 2010). Two sections allowed students to report how often they participate in ERB, one section referring to their behavior within their residence hall and one section referring to their behavior away from campus (e.g., when visiting their hometown). The survey also included 11 socio-demographic questions and one open-ended question prompting students to share up to three ideas on what they think could be done to make their residence halls more sustainable.

Pilot Test

The survey was administered as a pilot test to 30 students living in the residence halls during summer 2013. This pilot test provided information on the survey's reliability and validity, completion time, issues related to wording of questions, and general formatting issues. A revised survey was created based on verbal feedback from students and analysis of pilot test responses. Revisions included correcting some typographical errors, repetition, and formatting changes. For example, the use of bolding and underlining was used in the perceived constraints section to more clearly emphasize parts

of each statement that could easily change the meaning if overlooked (i.e., **don't** have time). Since many students seemed to forget to mark which residence hall they lived in, a free response question was also added to the beginning of the survey for students to indicate one residence hall.

Survey Administration

The revised survey was distributed in an electronic format using Qualtrics, which allows each student to respond once to the survey. Students in each treatment group received a link to the survey via email and had the opportunity to take the survey in person during up to three random, in-person survey administration occurrences in the lobby of each treatment group (i.e., residence hall). A pretest was administered over the course of one month during fall 2013 and fall 2014. A posttest was administered to the same students during spring 2014 and spring 2015, respectively. Across all treatment groups and semesters, 1,023 unique students took a pretest survey (n = 557), posttest survey (n = 356), or both (n = 110). Partially completed surveys were omitted from data analysis. Responses represented a 28.4% overall response rate.

More accurately, 28.4% of students who had access to the survey responded either on a web-based survey or on a paper survey. It is unknown how many students did not get the survey for one reason or another, including an error with the emails sent with the survey link or absence from campus for one or both of the in-person survey administration dates. Factors such as survey length, incentive, and the way the survey is presented (i.e., with an incentive or providing a specific deadline) can have a significant impact on response rate, potentially increasing the response rate by half (Edwards et al., 2009; Guo, Kopec, Cibere, Li, & Goldsmith, 2016). In this particular case, the survey

took from 7 to 20 minutes to complete, which may have been perceived as too long—the most common reason for response fatigue and lower response rates (Galesic & Bosnjak, 2009; Guo et al., 2016). While a 28.4% response rate falls short of some commonly acceptable ranges (Baruch & Holtom, 2008), this number is only the assumed response rate due to the unknown and unavoidable factors of conducting a web-based and intercept survey in campus residence halls. Collecting responses from 1,023 respondents allowed for all the necessary statistical analyses to address the problem presented in this study.

Data Analysis

All statistical tests were conducted using Statistical Package for Social Science Version 24 ("Statistical package," 2016). The survey was tested for reliability and internal consistency using coefficient alpha and test-retest reliability. The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity were conducted on each section to support the factor analysis (Pallant, 2013). Scores for each section (i.e., Attitudes, Behavior, Perceived Constraints, Ecocentrism, and Satisfaction) were calculated as the mean of all items in the section of interest. These mean scores were used to compare pretest and posttest responses in analyses of variance (ANOVA) and *t*-tests.

Students reported similar ERB within their residence halls when compared to their ERB away from campus (Table 2.2). An exploratory factor analysis (EFA) revealed that the ERB statements represent four different types of behaviors: those that require foresight, those that require additional resources, those that students may consider cost-saving and conservation-minded choices, and those that are accessible to students living on campus at UGA as well as in most American cities (i.e., recycling).

A variable measuring Attitudes was calculated using 15 items measuring students' attitudes toward nature (α = .878). A variable measuring Behavior was calculated using 11 statements about ERB in the residence halls (α = .817). A variable measuring limitations to student participation in ERB (i.e., Perceived Constraints) was calculated using 12 statements about possible constraints relevant to students at UGA (α = .773). A variable measuring self-reported ecocentrism or anthropocentrism (i.e., Ecocentrism) was calculated using three questions that asked students to respond on a scale of one to five to identify their opinions (α = .682). Finally, a variable for Satisfaction was created from 14 statements about satisfaction with various components of environmental sustainability efforts specifically within University Housing at UGA (α = .896).

Results and Discussion

Students in this study represented more than 150 academic majors from across every college within the university. Of the 1,023 unique students, 35.4% were in the Program-based education treatment group while 35.8% were in the Immersion-based education treatment group. The rest of the distribution included the control group (16.4%) and students who did not report a building (12.4%). First year students made up the majority of the study (56.4%), however class standing varied across all treatment groups (21.9% second year; 6.5% third year; 3.1% fourth year; 0.3% fifth year; 0.2% graduate students; 11.6% unreported). Table 2.3 displays additional key demographics of students included in this study compared to demographics of all students attending UGA.

Attitudes, Behavior, Ecocentrism, and Satisfaction

A paired samples *t*-test revealed there was a significant difference in some student responses to "within residence hall" and "away from campus" ERB statements (Table

2.4). There was a significant difference in scores for three out of the five statements in the Accessible category of ERB statements. This result may indicate a different level of accessibility to resources between students' residence halls and locations they may visit away from campus. For example, each residence hall on campus is equipped with at least one recycling location where students can recycle paper, plastic, and glass. Depending on where a student visits away from campus, there may not be a location to recycle one or more of those items. Students seem more likely to donate their own money to help save wild plants or animals away from campus than they would within their residence halls. This result may indicate that students considered some additional factors when responding to this statement. For example, they may interact with "wild plants and animals" and be more connected with natural environments when away from campus.

According to residence hall billing information from 2013, 2014, and 2015 acquired from University Housing at UGA, students in the two treatment groups consumed less water per person on a daily basis. Students in the Program-based treatment group consumed an average of 27.48 gallons per person per day (gppd) and students in the Immersion-based treatment group consumed an average of 36.52 gppd. Meanwhile, students in the control group consumed an average of 41.05 gppd. While all students included in this study consume significantly less water than the average American, the two treatment groups seem to display stronger water conservation habits (EPA, 2016).

Unsurprisingly, these numbers also align with students' responses to the water conservation ERB statement, "I turn off the sink when I am brushing my teeth to save water." Students in the Program-based treatment group self-reported an average of 4.48 (on a scale of one to five, where *1 = Strongly Disagree* and *5 = Strongly Agree*) and

students in the Immersion-based treatment group self-reported an average of 4.34, whereas students in the control group self-reported an average of 4.33. Likewise, as apparent ability to save energy increases, so do students' responses to the energy conservation ERB statement, "I turn off the lights when I leave a room to save energy." Students in in the Program-based treatment group self-reported an average of 4.69 (on a scale of one to five, where *1 = Strongly Disagree* to *5 = Strongly Agree*) and consume approximately 2,326.51 kilowatt hours of electricity per student per year. Students in in the Immersion-based treatment group self-reported an average of 4.52 and consume approximately 3,007.03 kilowatt hours of electricity per student per year. Students in in the control group self-reported an average of 4.60 and consume approximately 2,600.14 kilowatt hours of electricity per student per year. While the numbers for electricity use may not reflect the expected results after exposing students to each treatment, they do reflect the students' self-reported responses. The results in both student water and energy usage and in their self-reported ERB are quite high, not when compared to the overall mean scores for responses to the statements for turning off the lights in the residence halls (M = 4.49) or turning off the sink in the residence halls (M = 4.29), but when compared to other scores (Table 2.2).

The relationship between Behavior and Attitudes, Ecocentrism, and Satisfaction was investigated using Pearson product-moment correlation coefficient (Table 2.5). The most notable correlations occurred in the Program-based treatment group, where there was a small, positive correlation between student satisfaction with residence hall sustainability initiatives and their ERB. There were also medium, positive correlations between both student attitudes toward the environment and self-reported ecocentrism and

ERB. A stronger correlation between Satisfaction and Behavior in the Immersion-based education treatment was expected especially considering the amount of environmentally sustainable features that students interacted with on a daily basis that made ERB accessible (i.e., water saving devices and motion censored lighting). However, it is possible that students were entirely unaware of the particular sustainable features of their residence hall due to a lack of signage or general information about any features specific to Building 1516. Students may even associate sustainable design with negative attributes like higher cost of living, as indicated by the medium, negative correlation between Behavior and Satisfaction.

With the Program-based education treatment, students were exposed to more frequent environmental education within their residence halls. During the first academic year of the study, students in the Program-based education treatment group were offered four times the amount of sustainability or environmental-themed programs when compared to residence halls at UGA with the same amount of staff and the same programming requirements. During the second academic year of the study, students in the Program-based education treatment group were exposed to ten times the amount of sustainability or environmental-themed programs. The frequency of sustainability or environmental-themed programs may have led students in the Program-based education treatment group to become more satisfied with some of the sustainability initiatives offered in their residence hall and more likely to engage in ERB, thus influencing the small, positive correlation between Satisfaction scores and their ERB scores in that treatment.

Perceived Constraints

Students responded to 12 statements that communicated perceived constraints to their participation in ERB. Students self-reported that "lack of knowledge" was not a major constraint to participation in ERB (25% reported as moderate/major reason). Students did report they were constrained by "limited resources" in residence halls (43% reported as moderate/major reason) and "not having enough time to participate due to schoolwork" (50% reported as moderate/major reason). Students also reported that it was "not convenient" to participate in ERB (43% reported as moderate/major reason). This result may indicate that students would participate in more ERB if they had more time and access to simple ways to participate, such as more recycling bins and devices like shower timers that could improve their awareness of water consumption.

Conclusion and Implications

Students living on campus are a captive audience of future leaders who can contribute significantly to conservation and smart environmental stewardship. By investing time and resources into environmental education and green infrastructure, institutions of higher education may be contributing greatly to the way students understand their roles in global sustainability. With comprehensive analysis of environmental education programming and updated infrastructure, higher education administrators can either prove the effectiveness of existing measures or move forward with additional measures that may improve students' understanding of environmental stewardship.

Construction of a green building can cost just two percent more than construction of a conventional building (Kats et al, 2003). However, the cost of a construction project for a residence hall may be up to $65 million, requiring an additional $1.3 million to

invest in green technology (Abramson, 2014). While there are countless benefits to students and staff in terms of health, productivity, and education (Butler, 2008; Devereaux et al., 2011; Singh et al., 2010), any additional features during large scale, multi-million dollar renovations or new construction may have a huge impact on the building budget and therefore on the cost students pay to live on campus. Thus, institutions of higher education could be investing a lot of funds into the construction of a third-party verified green building, when those funds could be better utilized on educational programming. To make a more informed decision that would provide the utmost benefit to students, institutions of higher education have the opportunity to apply a combination of building usage data, financial analysis, and resident feedback in the form of comprehensive research.

Studies that combine quantitative data collection, qualitative data analysis, and building usage data allow managers and staff members in residence life to make the most informed and wise decisions in regard to education and infrastructure updates. In fact, researchers and higher education staff can take an even more in-depth approach by conducting delayed posttest research that will follow-up with students after they have completed their on-campus living experiences. This study may serve as a foundation to future studies that can not only include a follow-up procedure, but also enhance results by providing incentive to allow for even more substantial and widely applicable statistical analyses.

This methodological approach has the potential to display students' long term learning about environmental sustainability and what that means in their careers or home lives. Studying the environmental attitudes, behaviors, and satisfaction of students living

on campus provides the ability to better understand the impact of programs and infrastructure that costs thousands of dollars for the university. Additionally, studying the perceived constraints of participating in ERB can direct residence life staff toward the next best investment of resources.

References

Abramson, P. (2014, May). College housing report. C*ollege Planning and Management Magazine,* 20-31. Retreived from https://webcpm.com/~/media/E69C528079 3C45FC8042F49DA553B77C.pdf

Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human Relations, 61*(8), 1139-1160.

Brubacher, J. S., & Rudy, W. (1997). *Higher education in transition: A history of american colleges and universities*: New Brunswick, NJ. Transaction Publishers.

Butler, J. (2008). The compelling "hard case" for "green" hotel development. *Cornell Hospitality Quarterly, 49*(3), 234-244.

Cidell, J., & Beata, A. (2009). Spatial variation among green building certification categories: Does place matter?. *Landscape and urban planning*, 91(3), 142-151.

Deninger, L., & Swift, J. (2009). Integrated design: A sustainable mindset for residence halls. *Journal of College and University Student Housing, 36*(1).

Devereaux, J., Fulton, J., Cunningham, M., van der Veen, R., & Schwer, P. (2011). Green living: Why invest in a deep green residence hall? *Sustainability: The Journal of Record, 4*(3), 121-127.

Dunkel, N. W. (2009). Green residence halls are here: Current trends in sustainable campus housing. *The Journal of College and University Student Housing*, 10.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised nep scale. *Journal of Social Issues, 56*(3), 425-442.

Dyer, T. G. (1985). *The university of georgia: A bicentennial history, 1785-1985.* Athens, GA: University of Georgia Press.

Edwards, P. J., Roberts, I., Clarke, M. J., DiGuiseppi, C., Wentz, R., Kwan, I., . . . Pratap, S. (2009). Methods to increase response to postal and electronic questionnaires. London School of Hygiene and Tropical Medicine. The Cochrane Database of Systematic Reviews.

EPA. (2016). Indoor water use in the united states. *WaterSense.* Retrieved October 23, 2016, from https://www3.epa.gov/watersense/pubs/indoor.html

Erlene Parece, T., Younos, T., Grossman, L. S., & Geller, E. S. (2013). A study of environmentally relevant behavior in university residence halls. *International Journal of Sustainability in Higher Education, 14*(4), 466-481. doi: 10.1108/ijshe-01-2012-0008

Galesic, M., & Bosnjak, M. (2009). Effects of questionnaire length on participation and indicators of response quality in a web survey. *Public Opinion Quarterly, 73*(2), 349-360.

Guo, Y., Kopec, J. A., Cibere, J., Li, L. C., & Goldsmith, C. H. (2016). Population survey features and response rates: A randomized experiment. *American Journal of Public Health, 106*(8), 1422-1426.

Housing, U. (2016a). Undergraduate housing. *University Housing.* Retrieved October 22, 2016, from https://housing.uga.edu/site/housing_undergraduate

Housing, U. (2016b, October 2016). Building 1516. Retrieved October 22, 2016, from https://housing.uga.edu/site/housing_residence_building1516

Housing, U. (2016c). Mission, values, principles. Retrieved October 22, 2016, from https://housing.uga.edu/site/about - mission

Kats, G., Alevantis, L., Berman, A., Mills, E., & Perlman, J. (2003). The costs and financial benefits of green buildings. *A Report to California's Sustainable Building Task Force*. Retrieved from: http://www.usgbc.org/Docs/Archive/MediaArchive/607_Kats_PA184.pdf

Larson, L. R., Green, G. T., & Castleberry, S. B. (2009). Construction and validation of an instrument to measure environmental orientations in a diverse group of children. *Environment and Behavior*, *43*(1), 72-89.

Larson, L. R., Stedman, R. C., Cooper, C. B., & Decker, D. J. (2015). Understanding the multi-dimensional structure of pro-environmental behavior. *Journal of environmental Psychology*, *43*, 112-124.

Levy, B. L., & Marans, R. W. (2012). Towards a campus culture of environmental sustainability: recommendations for a large university. *International Journal of Sustainability in Higher Education*, 13(4), 365-377.

Luna, G. & Koman, M. (2002). Going green saves green--University of South Carolina's green efforts becoming best practices. Retrieved from http://job24.ilsole24ore.com/documenti/news/Articoli/2007/Novembre/going_green_saves_green%20(carmen).pdf?uuid=41bb1bc2-9903-11dc-adc1 00000e251029&DocRulesView=Libero

Needham, M. D. (2010). Value orientations toward coral reefs in recreation and tourism settings: A conceptual and measurement approach. *Journal of Sustainable Tourism, 18*(6), 757-772.

Pallant, J. (2013). *Spss survival manual*: *a step by step guide to data analysis using SPSS*. New York, NY: McGraw-Hill Education.

Parece, T. E., Grossman, L., & Geller, E. S. (2013). Reducing carbon footprint of water consumption: A case study of water conservation at a university campus *Climate Change and Water Resources* (pp. 199-218). New York, NY: Springer.

Parker, S. E. (2013). *National forest use and outdoor recreation constraints across four ethnic and minority populations in georgia. [electronic resource]*: 2013.

Samuels, D. R., Dukes, R. L., & LaCost, M. (2016). Two worlds of university life: Role conflict among residential students and commuters on a newly-residentialized campus. *Free Inquiry in Creative Sociology, 28*(2), 85-93.

Shriberg, M. (2002a). Toward sustainable management: The university of michigan housing division's approach. *Journal of Cleaner Production, 10*(1), 41-45.

Shriberg, M. (2002b). Institutional assessment tools for sustainability in higher education: Strengths, weaknesses, and implications for practice and theory. *Higher Education Policy, 15*(2), 153-167.

Shulman, L. S. (1981). Disciplines of inquiry in education: An overview. *Educational Researcher*, *10*(6), 5-23.

Singh, A., Syal, M., Grady, S. C., & Korkmaz, S. (2010). Effects of green buildings on employee health and productivity. *American Journal of Public Health, 100*(9), 1665.

Statistical Package for Social Science (Version 24, 2016) [Computer Software]. Armonk, NY: IBM Corporation.

The sustainability fye-frinq. (2015). *Enrollment Management and Student Affairs: Housing and Residence Life.* Retrieved May 28, 2015, from https://www.pdx.edu/housing/fye-sustainability

Sustainable living. (2014). *Residence Life.* Retrieved May 28, 2015, from http://www.elon.edu/e-web/students/residence_life/learningcommunities/sustainableliving.xhtml

Trinklein, A. J. (2009). Sustainability and residence hall construction. *Journal of College & University Student Housing, 36*(1), 24.

Turner, C., & Frankel, M. (2008). Energy performance of leed for new construction buildings. *New Buildings Institute, 4*, 1-42.

USGBC. (2011). *Green building and leed core concepts: Green building and leed core concepts guide* (Vol. 2). Washington, DC: U.S. Green Building Council.

Vaske, J. J. (2008). *Survey research and analysis : Applications in parks, recreation and human dimensions*. State College, PA: Venture Publishing.

Table 2.1
Survey Adaptions by Section

Survey Section	Scale Adapted From	Statements From Existing Study	Adapted Statements
Attitudes	Dunlap, Van Liere, Mertig, & Jones, 2000	The balance of nature is strong enough to cope with the impacts of modern industrial nations.	The balance of nature is strong enough to cope with the impacts of modern industry.
		When humans interfere with nature it often produces disastrous consequences	When humans interfere with nature it often produces negative consequences.
Attitudes	Larson, Green, & Castleberry, 2009	I am interested in learning new ways to protect plants and animals.	I care about protecting plants and animals.
		I would spend time after school working to fix problems in nature.	I want to help fix problems in nature.
Behavior	Larson, Stedman, Cooper, & Decker, 2015	Recycling or reusing products	Recycle paper, plastic or glass
		Energy or water conservation	I turn off the lights when I leave a room to save energy
		Talking to or educating others about environmental issues	Tell my friends or my family about things they can do to help protect nature
Constraints	Parker, 2013	Lack of information about recreation opportunities	I lack the knowledge to participate in sustainable actions.
		Not enough time	I don't have enough time to participate in sustainable actions due to a job.
			I don't have enough time to participate in sustainable actions due to extracurricular activities.
			I don't have enough time to participate in sustainable actions due to schoolwork.

Table 2.1 Continued

Ecocentrism	Needham, 2010	The needs of humans are more important than coral reef areas	Meeting the needs of humans is more important than sustainable practices.
		The value of coral reef areas is to provide for humans.	It is important to use all of the natural resources available to us.
Satisfaction	Shriberg, 2002b	A coordinating person/office for sustainability exits	A coordinating person/office for sustainability exists within UGA Housing.
		An environmental sustainability mission statement is in place	An environmental sustainability mission statement is in place within UGA Housing.
		Multiple courses on sustainability issues are offered	Programs about sustainability or the environment are offered in my residence hall each semester.
		Waste reduction is practiced and encouraged	Waste reduction is practiced and encouraged in my residence hall.
		Water conservation on campus is maximized	Water conservation is practiced and encouraged in my residence hall.

Table 2.2

ERB "Within Residence Halls" Compared to "Away from Campus"

ERB	*N*	Mean Score "Within Residence Hall"*	*N*	Mean Score "Away from Campus"*
Foresight		3.95		3.89
Carpool to work/home/school	461	3.72	447	3.66
Use a reusable water bottle	461	4.18	447	4.11
Cost-saving		4.39		4.39
I turn off the lights when I leave a room to save energy	459	4.49	447	4.45
I turn off the sink when I am brushing my teeth to save water	458	4.29	446	4.32
Additional Resources Required		2.11		2.56
Compost my food waste	458	2.16	444	2.15
Give some of my own money to help save wild plants or animals	460	2.05	446	2.36
Accessible		3.31		3.4
Help to clean up parks and forests in my neighborhood	458	2.45	445	2.72
Recycle paper, plastic or glass	461	3.91	447	3.81
Recycle your paper products	461	3.69	445	3.71
Recycle your plastic products	461	3.79	446	3.85
Tell my friends or my family about things they can do to help protect nature	460	2.72	444	2.91

*Mean score calculated using all posttest scores across all treatment groups over the two rounds of sampling

Table 2.3

Demographics of Students in Study Compared to Demographics of All Students at UGA

Key Demographics	Students from Study Percentage (%)	UGA Percentage[1] (%)
Gender		
Female	43.8	57
Male	44.3	43
Not reported	11.9	<1
Race		
Asian or Pacific Islander	11.3	9
Black (non-Hispanic)	13.6	7
Hispanic	4.6	5
White (non-Hispanic)	53.2	71
Other/not reported	17.3	8

[1]Approximated from information retrieved from http://www.collegeportraits.org/GA/UGA/characteristics

Table 2.4

Paired Samples t-test Between "Within Residence Halls" and "Away from Campus" ERB

ERB	Mean Difference	SD	df	Sig.
Foresight				
Carpool to work/home/school	.054	1.107	443	.304
Use a reusable water bottle	.065	.797	443	.085
Cost-saving				
Turn off the lights when I leave a room to save energy	.052	2.553	441	.668
Turn off the sink when brushing my teeth to save water	.005	.678	439	.888
Additional Resources Required				
Compost my food waste	.027	1.055	438	.588
Give some of my own money	-.290	.879	441	.001*
Accessible				
Help clean up parks and forests in my neighborhood	-.245	.917	439	.001*
Recycle paper, plastic or glass	.124	.983	443	.008*
Recycle your paper products	-.002	1.108	441	.966
Recycle your plastic products	-.036	1.125	442	.500
Tell my friends or my family about things they can do to help protect nature	-.175	.820	440	.001*

*Significant at the $p > .05$ level

Table 2.5
Correlation with Behavior by Residence Hall

	N	**Pearson *r***	
Immersion-based education	175	Attitudes	.50**
		Ecocentrism	-.31**
		Satisfaction	.23**
Program-based education	170	Attitudes	.30**
		Ecocentrism	.34**
		Satisfaction	.25**
Control	84	Attitudes	.44**
		Ecocentrism	-.22*
		Satisfaction	.02

** Correlation is significant at the .01 level
* Correlation is significant at the .05 level

CHAPTER 3

PROVIDING AN EDUCATIONAL FOUNDATION AND EFFECTIVE LEARNING ENVIRONMENT FOR UNIVERSITY STUDENTS' PARTICIPATION IN ENVIRONMENTALLY RELEVANT BEHAVIOR

Introduction

The future of our planet's natural resources may be in jeopardy but wise environmental stewardship and education of the next generation of leaders may ameliorate or substantially reduce present and future impacts to our world (Shreck & Vedlitz, 2016; Stern et al., 1993). Fortunately, environmental education is becoming increasingly prevalent in contexts where people have the opportunity to educate those future leaders, such as grade school classrooms or college lecture halls. For the millions of students who attend colleges and universities worldwide, environmental literacy is increasingly a part of their formal or informal learning. Institutions of higher education may incorporate sustainability into aspects of campus life through campus wide seminars, weekly newspaper columns, or lecture series (Wolfe, 2001). Sustainability becomes a part of academic life in many forms as well, such as degree requirements, integration of sustainability across the curriculum, mission statements, and departmental majors, minors, and certificate programs (Rowe, 2002). The specific goals of such measures vary by institution, however they all contribute in their own respect to increased environmentally relevant behavior (ERB) and environmental literacy, "a basic understanding of the concepts and knowledge of the issues and information relevant to

the health and sustainability of the environment as well as environmental issues related to human health" (Rowe, 2002, p. 2).

University settings are prime targets for education and programs related to natural resource stewardship (Parece et al., 2013; Petersen et al., 2007; Trinklein, 2013). Students enter colleges and universities seeking a wide range of outcomes and the institutions they attend become the environments where they can establish new relationships, test aspects of identity, explore values, interact with people from other cultures and backgrounds, and pursue vocational interests and goals (Banning & Strange, 2001). Fortunately, a vast majority of schools make environmental programs a priority to some extent (McIntosh, 2001). Higher education professionals have a distinct opportunity to customize student programs and strategic plans related to broad topics like sustainability to encourage environmental literacy among students.

Some of the most significant efforts to increase environmental literacy and ERB occur in campus residence halls. And while a significant portion of the environmental literacy efforts at institutions of higher education are directed toward students studying biology or environmental sciences (McIntosh, 2001), any education that occurs in a residence hall—passive or active—reaches students from all disciplines.

At some institutions, campus housing paves the way for green construction and renovation. Many residence halls are built or renovated using third party green building rating systems and have high standards for efficiency, partly because of new trends in building and partly as a cost saving measure. The first Leadership in Energy and Environmental Design Certified (LEED-certified) residence hall in the United States was New House Residence Hall at Carnegie Mellon University, which received a Silver

certification (Stegall & Dzombak, 2004). The construction was completed in 2003 and since then hundreds of institutions of higher education across the United States have achieved various LEED certification statuses for campus residence halls ("Leed projects and case studies directory," 2011). Campus housing can also be seen as a leader in the development of green policies. For example, housing departments at schools like Susquehanna University and Pennsylvania State University have building and construction standards to guarantee a certain amount of consideration is given to building efficiency (Konvalinka, 2015).

Campus housing departments and students living on campus mutually benefit from students' engagement in ERB. Universities may benefit from major cost savings as a result of infrastructure improvements and increased environmental literacy among students living on campus. According to one analysis of 100 buildings, LEED buildings use 18-39% less energy per floor area than their conventional counterparts, potentially leading institutions of higher education that incorporate such standards to save thousands of dollars per academic year (Newsham et al., 2009). Building green can also save universities money through water conservation and reduction in landfill waste (USGBC, 2011). An entire university could benefit from cost savings associated with LEED-certified residence halls that feature efficient plumbing and electricity (Devereaux et al., 2011; Parece et al., 2013; Petersen et al., 2007). Green buildings have been also proven to have a positive effect on occupants' health and productivity, mostly due to the improved indoor environmental quality and minimal use of chemicals in building materials like carpet and paint (Eichholtz et al., 2010; Singh et al., 2010).

Students living on campus are particularly likely to participate in campus and community activities and be influenced by others around them (Erlene Parece et al., 2013; Schroeder & Mable, 1994). A comprehensive approach to increasing environmental literacy may be to use the infrastructure and physical environment in which students dwell to educate them on important concepts in conservation. Engaging students and staff in programming and training related to departmental sustainability initiatives can help further efforts to reduce the impact on the environment, however it is a consistent challenge to engage the community and explore the technology and methodologies that will generate the most interest in sustainability initiatives (Trinklein, 2013).

It is essential to meet the students where they are, literally. Students often feel a stronger connection to their residence hall than to any other building on campus (Devereaux et al., 2011). A student's on-campus residence may be the most influential environmental factor on a student's experience and those who live on campus (Astin, 1984). Students living on campus are consistently exposed to programs that introduce them to new topics and information, including topics in environmental science. By living in built environments that may contribute to their environmental literacy, students can absorb information on how to live in a society where resources may be limited, a reality society may face if climate change models and predictions are accurate (Intergovernmental, 2014). Students living in buildings with third party environmental certifications or high efficiency fixtures may learn how to conserve resources at home, thus influencing how they can conserve resources in all of the built environments they interact with after their on-campus living experience is over.

In fact, many opportunities exist to educate residents during their on-campus living experience—from passive programming (e.g., signs and bulletin boards) and active programming (e.g., documentary viewing, conservation education, guest speakers, etc.) to leadership opportunities (e.g., sustainability-related hall council position, committees, etc.). Residence halls, the physical spaces used for carrying out programming and outreach, have enormous educational potential that can be reached when residents are challenged to become more educated and competent in terms of environmental sustainability and ERB (Schroeder & Mable, 1994).With all the developing programs and services related to sustainability, the most efficient way to guarantee an effective educational experience for residents living on campus is to create a comprehensive plan that all efforts—including infrastructure and educational initiatives—fall under (Shriberg, 2002). Essentially, residence halls can serve as a living laboratory, a space where students begin to understand both their adult living preferences and capacity for daily ERB.

Problem

Students participate in a wide range of ERB and campus housing departments at their universities put forth a significant effort to provide the infrastructure and opportunities for them to do so. However, there is not a common approach to determining what ERB students are legitimately participating in and what campus housing managers and administrators can do to encourage those behaviors.

Purpose

This study aimed to identify the specific behaviors students are engaging in while living on campus at a college or university campus. Understanding which behaviors students are engaging in may lead campus housing managers and administrators to

allocate time and resources more effectively for infrastructure and programming to support specific behaviors. While campus housing managers may speculate about what ERB students are engaging in, confirming the actual types of ERB students are choosing to engage in may lead those managers to even wiser decision making in regard to providing resources for students. For example, managers of a particular campus housing department may try to promote water conservation by providing shower timers in each shower stall of campus residence halls. However, if students are not choosing to engage in water conservation behavior, it may be more economical and advantageous for managers of that department to spend money on an alternative water conservation measure that students will use, such as low-flow shower heads or signs that remind students of how much water each shower uses per minute.

The University of Georgia (UGA) served as an appropriate location for this study due to its variety in on-campus housing. That variety manifests itself in infrastructure, programming models, and student demographics. At the time this study was conducted, UGA did not have any campus-wide requirements in environmental literacy. However, all UGA students—with few exceptions—do have to meet the first-year live-on requirement. University Housing at UGA provides housing for approximately 8,000 students per year. All traditional (i.e., non-transfer or transient) students who attend UGA are required to live on campus for one year, making University Housing an ideal setting for any type of education (e.g., environmental education) meant to reach the entire student body.

Methods

Treatment Groups

Three groups of students—two treatment groups (i.e., Immersion-based, Program-based) and one control group—were evaluated using a pretest and posttest survey. The Immersion-based treatment group (1) consisted of students in a suite-style (i.e., shared space with a bathroom for two to four residence instead of a community bathroom), co-ed residence hall called Building 1516, which houses approximately 555 students. Building 1516 achieved LEED-Gold certification when it opened in fall of 2010 with green building design features such as an energy-efficient heating, ventilating, and air conditioning (HVAC) system. Achieving LEED-Gold certification means a building received between 60 and 79 points in categories such as Water, Energy, Materials and Resources, Indoor Environmental Quality, and Awareness and Education (USGBC, 2011). Students living in Building 1516 may or may not have been aware of living in a LEED-Gold certified building, however they were all able to read some details of the certification on the University Housing website, which references the achievement on the designated Building 1516 webpage.

The Program-based treatment group (2) consisted of students living in Brumby Hall, a traditional, co-ed residence hall, which houses approximately 950 students. Students in the Program-based treatment group had more opportunities to attend environmental education programs in their residence hall. Staff in Brumby Hall were trained to provide one environmental education and one sustainable program per the academic year. For the purpose of this study, an environmental education program was defined as *a program with the intention of educating residents about some environmental concept (recycling, water conservation, upcycling, etc.).* A sustainable program was defined as *a program with minimal environmental impact*.

During summer training before each academic year, almost 200 University Housing staff members are trained to facilitate at least five programs per semester for the students living in their communities. All residence hall staff were directed to conduct programs in categories: social, personal growth/recreation, educational, or diversity. The Program-based treatment group (i.e., Brumby Hall) staff were given one additional programming requirement that directed them to incorporate one environmental education program and one sustainable program into their plans for the year. Staff in the Program-based treatment group were not provided with any additional funds because they were not asked to add an additional program to the five they would typically be facilitating. However, they were given a separate training session that included a full explanation of their expectations (Appendix B) and a resource guide to assist them with implementing their sustainable and environmental education programs (Appendix A). Brumby Hall staff ultimately provided the Program-based treatment group with four times the amount of environmental education and sustainable programs when compared to the other high-occupancy, co-ed, traditional residence halls on UGA's campus for the first year of the study and almost ten times the amount of such programs for the second year of the study.

The control group consisted of students in Reed Hall, a traditional, co-ed, suite-style residence hall, which houses approximately 295 students. Reed Hall lacks sustainable amenities like Building 1516 and does not have any formal environmental education programming. These treatment groups represent two possible components of a comprehensive environmental education plan for a campus housing department. While the treatments were kept separate for the purpose of this study, a comprehensive sustainability initiative would ideally combine environmentally-friendly and efficient

infrastructure with an integrated education or programming component that allows students living on campus to learn from a physical environment supported by active education.

Scale Design

The scales to assess self-reported ERB among each of these treatment groups was designed based on common behavior and previous knowledge of what infrastructure students may use while living on campus at UGA. Some statements were also adapted from existing scales (Parker, 2013). Two sections were developed—one asking students to report ERB "within their residence hall" and one section asking students to report ERB "away from campus." These sections each include 11 items on a 5-point scale prompting students to indicate how often they participate in each ERB. Possible responses included: *1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always*.

Pilot Test

The Self-Reported ERB Scale (SERB) was included in a pilot test of a survey also measuring student's environmental attitudes, ecocentrism, satisfaction with university sustainability initiatives, and constraints to participation in ERB. The pilot test was distributed to 30 students living in the residence halls during summer 2013. This pilot test provided information on the scale's reliability and validity, completion time of the entire survey, potential issues related to wording of statements, and general formatting issues. A revised survey was created based on verbal feedback from pilot participants and analysis of pilot test responses.

Administration

The revised survey was distributed in an electronic format using Qualtrics, which allowed each student to respond to the survey once. Students in each treatment group received a link to the survey via email and also had the opportunity to take the survey in person during three random, in-person survey administration occurrences in the lobby of each treatment group (i.e., residence hall). A pretest was administered over the course of one month during fall 2013 and fall 2014. A posttest was administered to the same students over the course of one month in spring 2014 and spring 2015, respectively. Across all treatment groups and semesters, 1,023 unique respondents took a pretest survey (n = 557), posttest survey (n = 356), or both (n = 110). Responses represent a 28.4% overall response rate. Thus, sub-sample sizes vary for the SERB scale on the pretest for "within your residence hall" (n = *655*), the pretest for "away from campus" (n = 619), the posttest for "within your residence hall" (n = 461), and the posttest for "away from campus" (n = 447).

Data Analysis

All statistical tests were conducted using Statistical Package for Social Science Version 24 ("Statistical package," 2016). The scale was tested for reliability and internal consistency using Cronbach's alpha and test-retest reliability. The coefficient alpha scores for the pretest and posttest SERB sections were .82 and .71, respectively, for "within your residence hall" and .86 and .80, respectively, for "away from campus." All numbers exceeded the commonly accepted Cronbach's alpha score of 0.70 (DeVellis, 2016). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were conducted on each section to support the factor analysis (Pallant, 2013). All KMO values were above 0.6 and each Bartlett's test was significant (p < .001),

meaning a factor analysis was appropriate. For the "within your residence hall" SERB, the KMO value was .830 for the pretest and .777 for the posttest. For the "away from campus" SERB, the KMO value was .850 for the pretest and .792 for the posttest.

Scores for each section of the scale (i.e., "in your residence hall" and "away from campus") were calculated as the mean of all items in the section. Those scores were used to compare pretest and posttest responses in analyses of variance (ANOVA) and *t*-tests. Students reported similar ERB within their residence halls when compared to their ERB away from campus (Table 3.1). An exploratory factor analysis (EFA) revealed the ERB statements represent four different types of behaviors: those that require foresight (Foresight), those that require additional resources (Additional Resources), those that students may consider cost-saving and conservation-minded choices (Cost Saving), and those that are accessible to students living on campus at UGA as well as in most American cities (i.e., recycling) (Accessible). Foresight factor accounted for 10% of the item variance, the Additional Resources factor accounted for 14.9% of the item variance, the Cost Saving factor accounted for 11.9% of the item variance, and the Accessible factor accounted for 34.5% of the item variance.

It is important to note that participation in one type of ERB does not automatically correlate to participation in other ERB. Certain ERB may share motivational roots or perhaps have the tendency to influence each other (Thøgersen, 2004). The relationship between each of the four categories of the SERB scale was investigated using Pearson product-moment correlation coefficient (Table 3.2). There was a significant, positive correlation between each pairing, with the exception of the correlation between Cost Saving and Additional Resources. Of all the pairings, it is easy to identify these two as

the pair that would not yield a significant correlation. Logically, there is not an obvious link between a simple action such as turning off the sink when someone brushes his or her teeth and donating money to an environmental cause. In fact, some may view those two actions as vastly different in regard to intensity of commitment to the environmental movement—with one representing a minimal commitment and one representing a very serious commitment.

Results and Discussion

A paired samples *t*-test revealed that there was a significant difference in some student responses to "within residence hall" and "away from campus" ERB statements (Table 3.3). There was a significant difference in scores for three out of the five statements in the Accessible category. This result may indicate a different level of accessibility to resources between students' residence halls and locations they may visit away from campus. For example, each residence hall on campus is equipped with at least one recycling location where students can recycle paper, plastic, and glass. Depending on where a student visits away from campus, there may not be a location to recycle one or more of those items. Students seem more likely to give their own money to help save wild plants or animals away from campus than they would within their residence halls. This finding may indicate a few possibilities that students considered when responding to this statement, including that they may interact with "wild plants and animals" or are more connected with natural environments when away from campus.

A one-way ANOVA was conducted to explore the impact of the treatment group on overall ERB both within the residence halls and away from campus. There was no statistically significant difference in ERB between the three groups for responses about

behavior within the residence halls (p = .597) or behavior away from campus (p = .155). However, further investigation revealed a significant difference in ERB when the SERB was broken down into the four categories—Foresight, Cost Savings, Additional Resources, and Accessible (Table 3.4). A one-way ANOVA was conducted to explore the impact of the treatment groups on each section of SERB using the difference in means between pretest and posttest scores within each section. There was a statistically significant difference at the $p < .05$ level in Accessible and Cost Saving ERB (i.e., recycling and turning off the lights when leaving a room). Post hoc comparisons using the Tukey HSD test indicated that the mean score for Program-based education group (M = 0.27, SD = 0.83) was significantly different from the control group (M = -0.30, SD = 0.77) within the Accessible category for "within residence halls." The comparison also indicated that the mean score for the Immersion-based treatment group (M = -0.36, SD = 0.92) was significantly different from that of the control group (M = 0.23, SD = 0.72) within the Cost Saving category "within residence halls."

Within the Accessible category, students in the Program-based treatment group may have had more exposure to opportunities to engage in ERB, specifically those types of ERB discussed in the Accessible category (i.e., recycling). This result would explain the significantly higher means in that category for students in the Program-based treatment group. The other statistically significant difference shows a higher mean for students in the control group compared to the Immersion-based treatment group for ERB in the Cost Saving category. While it may be expected that students immersed in a more environmentally efficient building would have more opportunities to engage in cost saving ERB, it is perhaps the opposite in the case of these particular buildings. For

example, students in the Immersion-based treatment group lived in Building 1516, which is equipped with automatic lights, motion censored sinks, and devices that cut off the HVAC when a window is opened. Students in the control group lived in Reed Hall, which is not equipped with any of those features. Thus, students in Reed Hall may have to put more effort into cost saving ERB and have to make a conscious choice to engage in such behavior.

According to residence hall billing information from 2013, 2014, and 2015 acquired from University Housing at UGA, students in the two treatment groups consumed significantly less water per person on a daily basis. Students in the Program-based treatment group consumed an average of 27.48 gallons per person per day (gppd) and students in the Immersion-based treatment group consumed an average of 36.52 gppd. Meanwhile, students in the control group consumed an average of 41.05 gppd. While all study participants consume significantly less water than the average American, the two treatment groups seem to display better water conservation habits (EPA, 2016). Unsurprisingly, these numbers also align with students' responses to the water conservation ERB statement, "I turn off the sink when I am brushing my teeth to save water." Students in the Program-based treatment group self-reported an average of 4.48 (on a scale of one to five, where *1 = Strongly Disagree* and *5 = Strongly Agree*) and students in the Immersion-based treatment group self-reported an average of 4.34, whereas students in the control group self-reported an average of 4.33. Likewise, as apparent ability to save energy increases, so do students' responses to the energy conservation ERB statement, "I turn off the lights when I leave a room to save energy." Students in in the Program-based treatment group self-reported an average of 4.69 (on a

scale of one to 5, where *1 = Strongly Disagree* to *5 = Strongly Agree*) and use approximately 2,326.51 kilowatt hours of electricity per student per year. Students in in the Immersion-based treatment group self-reported an average of 4.52 and use approximately 3,007.03 kilowatt hours of electricity per student per year. Students in in the control group self-reported an average of 4.60 and use approximately 2,600.14 kilowatt hours of electricity per student per year. While the numbers for electricity use may not reflect the expected results after exposing students to each treatment, they do reflect the students' self-reported responses.

Like many universities, UGA and the surrounding community has ample opportunities for students to get involved in activities and academic pursuits related to environmental science. Students self-reported their previous experience with programs or courses that might influence environmental literacy and ERB by responding to three questions (Table 3.5).

The University of Georgia offers a myriad of environmental science courses and hosts dozens of environmental-themed events per year (i.e., Earth Day celebrations, eco-film screenings, etc.), so it is expected that 33.6% of the entire sample had—to some extent—previous experience with an environmental science course or some form of environmental education. Significantly higher proportions of respondents were *previously* involved in an environmental organization, but did not report being in one currently. Table 3.6 shows the correlation between posttest SERB scores (calculated as a mean of each individual's responses to the entire section) and two variables: environmental education/environmental science course (EE) and past participation in an environmental organization (EOp). Across all groups, there was a correlation between the variables.

While the education occurring within the residence halls can have an enormous impact on students living on campus, it is important to consider outside influences as a factor during development of environmental education programming. Understanding the correlation between ERB and involvement in outside environmental courses or organizations will only enhance the concepts explored in on campus programs and initiatives.

A multiple regression analysis was conducted to determine whether treatment groups or previous experience with environmental education (EE) were predictors of SERB in posttest responses. The model, which controlled for both treatment group and EE, explains only about four percent of variance in SERB for responses regarding behavior within the residence halls and away from campus. Of the two independent variables, EE makes a stronger unique contribution to explaining SERB both within the residence halls and away from campus. Similar trends occur when the same model is applied to pretest results, however students had not yet been exposed to a treatment making this trend reasonable and easily explained. While students' environmental behaviors may not have been influenced by a residence hall environment at the time they took a pretest survey, it is possible that they might have been influenced by either an environmental science college course or involvement in an outside EE organization.

Conclusion and Implications

In future studies, it will be vital to more comprehensively investigate the previous environmental education experiences of participants. This study addressed students' previous experiences with environmental education, an environmental science course, and environmental organizations, however there are certainly more factors (i.e., knowledge of environmental science or engagement in environmental action or service).

While students' experiences outside of the residence halls may be the better predictor of their ERB in the case of this study, it is vital to consider what students are exposed to in their residence halls (i.e., the treatments used in this study) and what they may participate in within the university at large in the development of an environmental literacy program within college or university housing. It is also important to consider the environment all of these initiatives are taking place. For example, a building with a third party green building certification may be a wonderful accolade for a campus housing department, however if the staff and residents are unaware of the unique features of the building, an important message may get lost. In that case, the department may be missing a spectacular opportunity to educate students on important ERB that will have a positive impact on their lives outside of campus housing. Any efforts to display the a building's efficient fixtures or green features can help students understand how they can use built environments—including their future homes—to contribute to positive environmental stewardship and potential cost saving.

An ideal environmental education or literacy program combines immersion and programming, while also considering outside factors such as campus events and academic requirements or optional courses. Taking advantage of the unique environment of college and university campus housing, administrators and directors have the opportunity to create comprehensive environmental education programs that can improve environmental literacy among students and staff alike.

Today's students come from the most numerous, diverse, affluent, and educated generation (Howe & Strauss, 2000). Millennials are known to be sheltered, confident, respectful of structure and rules, and made to feel special by older generations and they

tend to focus on teamwork, achievement, modesty, and good conduct (DeBard, 2004; Howe & Strauss, 2000). These factors mean that the best way to disseminate information to residents is to provide opportunities for service learning, structured programs and activities for them to participate in, and opportunities to collaborate with others to achieve common goals. Millennials come from an era where adults had a more positive view of children, so it's important to mimic that in programming and give residents power and purpose (Howe & Strauss, 2000).

A comprehensive approach to an environmental literacy program for campus housing would include the following essential elements, which summarizes ideas from this study as well as previous research and existing program models:

1. Appropriate training for staff (including sharing knowledge of special green building features)
2. Creating and implementing environmental education (e.g., a sustainability programming requirement among staff, invited guest speakers annually or bi-annually, etc.)
3. Creating and sharing plans for infrastructure updates (e.g., water bottle refill stations, more efficient light bulbs, etc.)
4. Helping students create connections to campus and community natural environments to increase the chances of students taking ownership over the local natural resources and not just the natural environments they may interact with away from campus (i.e., create usable outdoor spaces)

5. Incorporating sustainability initiatives into all future plans for the department (e.g., new construction, policy updates, mission or value development or adjustments, etc.)
6. Providing structured and frequent sustainability-related leadership or service opportunities for students and staff (e.g., river clean-up's and eco-representative positions in student leadership)
7. Policy updates that match departmental values in sustainability (e.g., computer shut-off mandates, new construction guidelines, etc.)

While an intentional combination of the aforementioned approaches to environmental education is ideal, some colleges and universities lack funding for such comprehensive initiatives. Some administrators may choose to move forward with the initiatives slowly, incorporating programs or infrastructure changes as funds become available and prioritizing any program that promotes ERB that students will be likely to engage in. Others may seek external funding to guarantee a transition that will impact students quicker and possibly more effectively. For example, administrators may want to focus on ERB that students are already engaging in to be certain students have the resources necessary to be successful environmental stewards. With limited funding, student affairs professionals should certainly focus programming on ERB in the Accessible and Cost Saving categories, including recycling and opportunities for service activities like cleaning up litter at a local park. Facilities managers can also focus on the categories students are already performing in (i.e., Cost Saving ERB), by improving infrastructure students interact with daily by installing features such as low-flow aerators in bathroom sinks and occupancy-censored lighting in common spaces.

Adequate funding is essential to most sustainability initiatives, especially those related to construction or installation of new fixtures (Zhang et al., 2011). Sustainability programs or initiatives need funding for both initial support and maintenance (Pike et al., 2003). Campus housing administration can find funding for projects and initiatives that will enhance from both traditional and nontraditional sources. Funding for new construction projects traditionally comes from tax exempt revenue bonds, reserve funds, private developer funds, and state appropriations (Balogh et al., 2005). Other funding sources include green revolving funds, grants, or partnerships with local, regional, and national organizations ("Campus sustainability revolving loan funds database," 2012; "Green revolving fund," 2015). However, regardless of the funding source, funding sustainability initiatives can have long term, positive impacts on students' informal education and the overall cost of operations for a building, department, or entire campus.

Moving forward, it is essential to incorporate environmental education into as many aspects of housing departments as possible, including professional development, infrastructure, and incorporated into the language of a mission statement (McIntosh, 2001; Wolfe, 2001). Combining those strategies with the strategies addressed during this study—programming and infrastructure updates—may provide the advanced, comprehensive program that may empower a generation of students to become the most effective environmental stewards. Without altering the foundation of a department much, incorporating environmentally sound practices and initiatives can make students' on-campus living experiences significantly more substantial.

References

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel, 25*(4), 297-308.

Balogh, C. P., Grimm, J., & Hardy, K. (2005). ACUHO-I construction and renovation data: The latest trends in housing construction and renovation. *Journal of College & University Student Housing, 33*(2), 51-56.

Banning, J. H., & Strange, C. C. (2001). *Educating by design: Creating campus learning environments that work*: San Francisco, CA: Jossey-Bass.

Campus sustainability revolving loan funds database. (2012). Retrieved May 31, 2015, from http://www.aashe.org/resources/campus-sustainability-revolving-loan-funds/

DeBard, R. (2004). Millennials coming to college. *New Directions for Student Services, 2004*(106), 33-45.

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26) (pp. : Thousand Oaks, CA. Sage publications.

Devereaux, J., Fulton, J., Cunningham, M., van der Veen, R., & Schwer, P. (2011). Green living: Why invest in a deep green residence hall? *Sustainability: The Journal of Record, 4*(3), 121-127.

Eichholtz, P., Kok, N., & Quigley, J. M. (2010). Doing well by doing good? Green office buildings. *The American Economic Review, 100*(5), 2492-2509.

EPA. (2016). Indoor water use in the united states. *WaterSense.* Retrieved October 23, 2016, from https://www3.epa.gov/watersense/pubs/indoor.html

Erlene Parece, T., Younos, T., Grossman, L. S., & Geller, E. S. (2013). A study of environmentally relevant behavior in university residence halls. *International*

Journal of Sustainability in Higher Education, *14*(4), 466-481. doi: 10.1108/ijshe-01-2012-0008

Green revolving fund. (2015). *Harvard University.* Retrieved May 31, 2015, from http://green.harvard.edu/programs/green-revolving-fund

Howe, N., & Strauss, W. (2000). *Millennials rising : The next great generation*: New York, NY: Vintage Books.

Intergovernmental Panel on Climate Change. (2014). *Climate Change 2014 Synthesis Report, Summary for Policymakers.* Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

Konvalinka, A. H. (2015). The will to leed: Can a campus be committed to sustainability without leed certification? *Talking Stick: The Authoritative Source for Campus Housing*, *32*(5), 43 - 50, 70 - 71.

Leed projects and case studies directory. (2011). *U.S. Green Building Council.* Retrieved May 28, 2015, from http://www.usgbc.org/LEED/Project/RegisteredProjectList.aspx

McIntosh, M. (2001). *State of the campus environment: A national report card on environmental performance and sustainability in higher education.* Reston, VA: National Wildlife Federation.

Newsham, G. R., Mancini, S., & Birt, B. J. (2009). Do leed-certified buildings save energy? Yes, but…. *Energy and Buildings*, *41*(8), 897-905.

Pallant, J. (2013). *Spss survival manual*: *a step by step guide to data analysis using SPSS*. New York, NY: McGraw-Hill Education.

Parece, T. E., Grossman, L., & Geller, E. S. (2013). Reducing carbon footprint of water consumption: A case study of water conservation at a university campus *Climate change and water resources* (pp. 199-218): Springer.

Parker, S. E. (2013). *National forest use and outdoor recreation constraints across four ethnic and minority populations in georgia. [electronic resource]*: 2013.

Petersen, J. E., Shunturov, V., Janda, K., Platt, G., & Weinberger, K. (2007). Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives. *International Journal of Sustainability in Higher Education, 8*(1), 16-33.

Pike, L., Shannon, T., Lawrimore, K., McGee, A., Taylor, M., & Lamoreaux, G. (2003). Science education and sustainability initiatives: A campus recycling case study shows the importance of opportunity. *International Journal of Sustainability in Higher Education, 4*(3), 218-229.

Rowe, D. (2002). Environmental literacy and sustainability as core requirements: Success stories and models. *Available at:ncsonline.org/efs/debrarowe.pdf.(Accessed 20 October 2010)*, 3.

Schroeder, C. C., & Mable, P. (1994). *Realizing the educational potential of residence halls.* San Fransisco, CA: Jossey-Bass Inc.

Shreck, B., & Vedlitz, A. (2016). The public and its climate: Exploring the relationship between public discourse and opinion on global warming. *Society & Natural Resources, 29*(5), 509-524.

Shriberg, M. (2002). Toward sustainable management: The university of michigan housing division's approach. *Journal of Cleaner Production, 10*(1), 41-45.

Singh, A., Syal, M., Grady, S. C., & Korkmaz, S. (2010). Effects of green buildings on employee health and productivity. *American Journal of Public Health, 100*(9), 1665.

Statistical Package for Social Science (Version 24, 2016) [Computer Software]. Armonk, NY: IBM Corporation.

Stegall, N., & Dzombak, D. (2004). *Cost implications of LEED silver certification for new house residence hall at Carnegie Mellon University* (Senior thesis). Carnegie Mellon University, Pittsburgh, PA.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior, 25*(5), 322-348.

Thøgersen, J. (2004). A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *Journal of environmental Psychology, 24*(1), 93-103.

Trinklein, A. J. (2009). Sustainability and residence hall construction. *Journal of College & University Student Housing, 36*(1), 24.

USGBC. (2011). *Green building and leed core concepts: Green building and leed core concepts guide* (Vol. 2). Washington, DC: U.S. Green Building Council.

Wolfe, V. L. (2001). A survey of the environmental education of students in non-environmental majors at four-year institutions in the USA. *International Journal of Sustainability in Higher Education, 2*(4), 301-315.

Zhang, N., Williams, I. D., Kemp, S., & Smith, N. F. (2011). Greening academia: Developing sustainable waste management at higher education institutions. *Waste Manag, 31*(7), 1606-1616. doi: 10.1016/j.wasman.2011.03.006

Table 3.1

ERB "Within Residence Halls" Compared to "Away From Campus"

ERB	*N*	Mean Score "Within Residence Hall"[1]	*N*	Mean Score "Away from Campus"[1]
Foresight		3.95		3.89
Carpool to work/home/school	461	3.72	447	3.66
Use a reusable water bottle	461	4.18	447	4.11
Cost Saving		4.39		4.39
I turn off the lights when I leave a room to save energy	459	4.49	447	4.45
I turn off the sink when I am brushing my teeth to save water	458	4.29	446	4.32
Additional Resources Required		2.11		2.56
Compost my food waste	458	2.16	444	2.15
Give some of my own money to help save wild plants or animals	460	2.05	446	2.36
Accessible		3.31		3.4
Help to clean up parks and forests in my neighborhood	458	2.45	445	2.72
Recycle paper, plastic or glass	461	3.91	447	3.81
Recycle your paper products	461	3.69	445	3.71
Recycle your plastic products	461	3.79	446	3.85
Tell my friends or my family about things they can do to help protect nature	460	2.72	444	2.91

[1]Mean score calculated using all posttest scores across all treatment groups over the two rounds of sampling

Table 3.2

Intercorrelations (Pearson r) of the Four Categories Found in the SERB for "Within Residence Hall" [1]

SERB Category	Foresight	Cost Savings	Additional Resources	Accessible
Foresight	-			
Cost Savings	.180**	-		
Additional Resources	.092*	.069	-	
Accessible	.371**	.229**	.414**	-

N = 460

[1]*Pearson r* calculated using all posttest scores across all treatment groups over the two rounds of sampling
* $p < .05$. ** $p < .01$.

Table 3.3

Paired Samples t-test Between "Within Your Residence Hall" and "Away From Campus"

ERB	*N*	Mean Difference	*SD*	*df*	Sig.
Foresight					
Carpool to work/home/school	444	.054	1.107	443	.304
Use a reusable water bottle	444	.065	.797	443	.085
Cost-saving					
Turn off the lights when I leave a room to save energy	442	.052	2.553	441	.668
Turn off the sink when brushing my teeth to save water	440	.005	.678	439	.888
Additional Resources Required					
Compost my food waste	439	.027	1.055	438	.588
Give some of my own money	442	-.290	.879	441	.000*
Accessible					
Help clean up parks and forests in my neighborhood	440	-.245	.917	439	.000*
Recycle paper, plastic or glass	444	.124	.983	443	.008*
Recycle your paper products	442	-.002	1.108	441	.966
Recycle your plastic products	443	-.036	1.125	442	.500
Tell my friends or my family about things they can do to help protect nature	441	-.175	.820	440	.000*

*Significant at $p < .05$

[1]Calculated using all posttest scores across all treatment groups over the two rounds of sampling

Table 3.4

ANOVA For Four SERB Categories Across All Treatment Groups

SERB Category	SS	*df*	MS	*F*	Sig.
Additional Resources					
Within residence halls	1.692	2	0.846	0.822	.44
Away from campus	3.615	2	1.807	1.870	.16
Accessible					
Within residence halls	4.603	2	2.301	3.389	.04*
Away from campus	0.286	2	0.143	0.197	.82
Foresight					
Within residence halls	0.547	2	0.273	0.334	.72
Away from campus	0.363	2	0.182	0.166	.85
Cost Saving					
Within residence halls	6.223	2	3.112	5.391	.01*
Away from campus	2.107	2	1.054	1.528	.22

*Significant at $p < .05$

Table 3.5

Self-reported Participation in Environmental Education Outside of the Residence Halls[1]

	Yes (Valid %)	No (Valid %)
Within the last year did you attend any environmental education programming (i.e. a nature talk, UGA hosted sustainability event) and/or take an environmental science class (i.e. FANR 1100, ECOL 1000, etc.)?		
Overall	33.6	66.4
Control group	26.4	73.6
Immersion-based treatment group	29.1	70.9
Program-based treatment group	42.4	57.6
Have you ever been involved in an environmental organization (on campus or away from campus)?		
Overall	27.6	72.4
Control group	27.6	72.4
Immersion-based treatment group	25.7	74.3
Program-based treatment group	29.7	70.3
Are you currently a member of an environmental organization?		
Overall	3.1	96.9
Control group	1.2	98.8
Immersion-based treatment group	1.7	98.3
Program-based treatment group	5.4	94.6

[1]Percentages calculated using posttest surveys, however both pretest and posttest responses show very similar distributions across all questions

Table 3.6
Bivariate Correlation Between Posttest SERB Within Residence Halls and Previous Experience with Environmental Education

		N	**Pearson *r***	**Sig.**
Overall	EE	428	-.185**	< .01
	EOp	420	-.105*	.03
Immersion-based education	EE	174	-.174*	.022
	EOp	174	-.178*	.019
Program-based education	EE	170	-.220**	.004
	EOp	170	-.161*	.036
Control	EE	84	-.187	.089
	EOp	84	-.263*	.016

** Correlation is significant at the .01 level
* Correlation is significant at the .05 level

CHAPTER 4

PERCIEVED CONSTRAINTS TO STUDENT PARTICIPATION IN ENVRIONMENTALLY RELEVANT BEHAVIOR: CREATING ACCESSIBLE SUSTAINABILITY INITIATIVES AND PROGRAMS

Introduction

Experts on climate science have pointed to humans as major contributors to global climate change and threats to human health and productivity that change has caused. It is undeniable that the planet is warming—the Greenland and Antarctic ice sheets are losing mass, the last three decades have been the warmest in recorded history since at least 1850, and the sea level is rising (Intergovernmental, 2014). Humans are increasingly producing greenhouse gases through seemingly simple daily practices like driving and eating. In fact, greenhouse gas emissions from cars, power plants, and agricultural practices are thought to be the leading cause of a warming planet (Carlsson-Kanyama & González, 2009; Pew, 2011). Though different organizations and agencies have varying opinions on the scale of intensity, understanding of how humans can act, and reasons for action, it is widely recognized that human action can negatively impact the biophysical environment (Gray & Weigel, 1985; Stern et al., 1999). There is an increased awareness of these issues among policymakers and citizens alike, however debate over the cause of global climate change persists in media and public or private conversation worldwide (Fisher, Waggle, & Leifeld, 2013; Schmidt, Ivanova, & Schäfer, 2013). However, without immediate action, humans may be creating a problem too great to solve in the

future. As Gray and Weigel (1985) stated, “The ravages of any single [ecological] abuse ripple throughout the total ecosystem or land community. Norms for nonabusive behavior are sorely needed and must relate to the total biosphere” (p. 13).

Environmental educators worldwide are advocating for changes in human behavior that may reduce a heavy impact on the planet, possibly slowing, or even reversing, some of the damage and preventing more. With the enormous amounts of money and time needed to lessen some of the global impacts of climate change, a better global understanding of climate change is necessary for people to appropriately handle the reality of a future riddled with environmental issues (Lutz et al., 2014). Environmental educators have the responsibility to educate people on a range of topics, all related to how people interact with natural resources. Those interactions are not strictly one-sided. In fact, natural resources and the proper use of them can lead to many benefits to human health and well-being (Bouvard et al., 2015; Carlsson-Kanyama & González, 2009; Louv, 2008; Schmidt et al., 2013; Singh et al., 2010; Springmann et al., 2016). Thus, to reduce the heavy burden on the planet and any risk to human health or longevity, environmental educators must convey the concept of environmentally relevant behavior (ERB).

Devising solutions to issues resulting from climate change has become an interdisciplinary challenge. Professionals, researchers, and volunteers from a number of fields have contributed to problem solving and some of the greatest contributions have come in the form of social and behavioral theories that can be applied to a better understanding of ERB (Newsome & Alavosius, 2011). Several theories suggest that a person’s behavior can be predicted by a number of factors, including values, beliefs,

social norms, and attitudes (Newsome & Alavosius, 2011). For instance, Ajzen's (1991) theory of planned behavior places an individual's intention at the center of a behavioral model where a person's intentions can reflect how much effort people are planning to exert to perform a particular behavior.

Stern (2000) theorized that environmentally significant behavior can be influenced by both attitudinal and non-attitudinal factors, such as personal capabilities, context, and habits. Though Stern's study also revealed that causal factors vary significantly across specific environmental behaviors, and thus a general theory of ERB may not be achievable (Stern, 2000). Some theories suggest that behavior changes as a result of certain consequences (i.e., benefits) such as improved health, cost savings, and improved environmental conditions (Newsome & Alavosius, 2011; Schwartz, 1977). In fact, most social movements, like the environmental movement, develop positions based on basic human values that help people form particular beliefs and lead to understanding of consequences and personal norms that obligate people to support some or all of the movement's goals (Stern et al., 1999).

Figure 4.1 displays a model representing variables in Stern's (1999) Value-Belief-Norm (VBN) theory as it applies to the environmental movement. The VBN theory links the norm-activation theory (Schwartz, 1977), the theory of personal values (Stern et al., 1993), and the New Ecological Paradigm hypothesis (Dunlap et al., 2000) to draw a connection between a person's values and their engagement in environmentalism. Findings from this study suggest that environmental citizenship behavior (i.e., ERB) can be affected by many factors, including spiritual or religious beliefs, beliefs about how society should be organized, and an individual's capabilities and constraints.

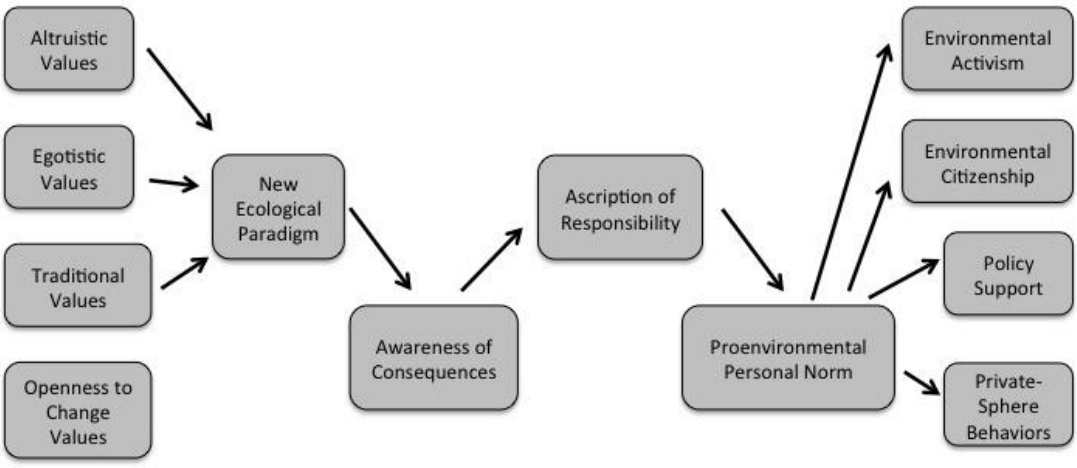


Figure 4.1. Schematic model representing Stern's (1999) Value-Belief-Norm theory, which links the norm-activation theory, the theory of personal values, and the New Ecological Paradigm hypothesis.

People also fall along a spectrum in regard to how engaged in ERB they might be. For example, someone might serve more as a leader, or activist, who incorporates ERB into a significant portion of his or her lives or jobs, or choose to be supportive through more simple, low-commitment activism like joining organizations and reading up on current events in topics relevant to environmentalism (Stern et al., 1999). Regardless of how or why a particular individual is motivated to engage in the environmental movement, there seems to be a plethora of opportunities to engage in environmentalism within every type of organization, agency, institution, or government sector. Widespread environmental education and global understanding of natural resource conservation practices are essential to the future of our planet and, as Gray and Wiegel (1985) stated, "to behave in an ecologically unsound way is to behave in a humanly unjust, economically expensive, and humanly threatening manner" (p. 16). This statement still rings very true today and, while the environmental community has a significant amount

of work ahead, there are some widespread efforts to create more engaged and educated global citizens.

The efforts to reduce the human impact on global climate change have led some companies and organizations to more formally influence and advocate for ERB. International companies like Boeing, Clorox, and Hewlett-Packard are making public commitments to reducing their environmental footprints through investments in renewable energy, large scale recycling initiatives, and innovation in material development and use (Boeing, 2016; Nidumolu et al., 2009). These companies save money and gain public support, as well as earn the trust of policymakers who may influence industry regulations down the line (Nidumolu et al., 2009).

Non-profit organizations across the globe put time and resources into advocacy and education, some focusing on broad or specific environmental causes. While a lot of environmental education can be geared toward wide audiences, some organizations and agencies choose to provide education to targeted audiences. For example, the Ocean Conservancy (OC) provides service, education, and contribution to scientific research through their International Coastal Clean-up (Mallos, 2016). With a similar goal of protecting the world's oceans, a non-profit organization called Sailors for the Sea sends a team of environmental educators to sailing regattas to help participants and spectators understand their role in keeping oceans clear of human impact ("Clean regattas," 2017).

Faculty, staff, and students at colleges and universities are also among the leading contributors to wise environmental stewardship practices and research on climate science. For example, institutions of higher education have increasingly become leaders in advances in green transportation (Balsas, 2003). By providing such infrastructure,

universities not only allow students to understand the many benefits of ERB but also create allies in long-term, university-wide goals to conserve resources and thus money.

While infrastructure and initiatives can reach a campus-wide audience, many such programs exist strictly within the confines of campus housing departments. Students living in residence halls on university campuses are exposed to many opportunities to engage in ERB, such as with recycling initiatives or water conservation. Campus housing provides a unique environment for a more comprehensive execution of ERB. Students are not just occasionally interacting with campus housing buildings, like they would with an academic building, but they are experiencing their entire lives in residence halls. Housing administrators from institutions around the world have meticulously introduced environmental sustainability to students living on campus in subtle ways (i.e., the general availability of recycling), but also with large initiatives or movements. For example, some institutions have created entire living-learning communities around concepts in environmentalism or sustainability (Whiteman, 2009); some have incorporated green building design into renovations and new construction (Stegall & Dzombak, 2004); and some have included language on sustainability or environmental stewardship in departmental strategic plans or mission statements ("Sustainability," 2017).

Problem

Despite the great effort some institutions have put forth to improve environmental literacy and behavior among students, staff, and faculty, there are still a number of barriers to widespread participation in ERB. Colleges and universities invest a significant amount of time and resources into programs and initiatives from which students can learn about environmental stewardship. They may also choose invest in green infrastructure in

the form of small modifications (i.e., replacing lighting with more energy-efficient fixtures and bulbs) or large renovations. While construction of a green building can cost just two percent more than construction of a conventional building (Kats, 2003) that may require up to an additional $1.3 million to invest in green technology (Abramson, 2014). Despite an overwhelming amount of programs and initiatives that students can engage in, theory suggests that people still engage in ERB, even if it means they need to make some form of a short-term sacrifice, like spending time on a particular behavior (Harland, Staats, & Wilke, 1999). Students may be participating in ERB during their experience living on campus, however few studies have determined common constraints that may prevent students from being able to actively engage in those behaviors.

Additionally, while many studies have discussed the impact of particular consequences (e.g., financial repercussions) to not participating in certain ERB (e.g., recycling), it is challenging to apply the same concept to residence hall living. For instance, students living on campus do not experience the same consequences of those living outside of a college campus. In fact, since most costs associated with ERB (i.e., waste management, water bill, electricity bill, etc.) are never seen by a student who pays to live on campus, it would be difficult to even guarantee that students living on campus understand to what extent they might need to improve or maintain their ERB. A key component of many theories, including the theory of planned behavior, is perceived behavioral control, or in the case of ERB, access to means with which to participate in ERB (Ajzen, 1991). Thus, if a student feels as though he or she does not have the right resources or information to participate in any type of conservation habits, it is unlikely he or she will engage in those habits at all.

Purpose

This study aimed to identify common constraints to student participation in ERB while they lived on campus at a college or university. Results could provide researchers and campus housing administrators with the perspective they need to develop the most effective environmental education for students, including potential infrastructure updates and planned educational programming. Hence, this study examined what may prevent students from participating in ERB. Additionally, this study aimed to understand how exposure to increased environmental education or living in a particular building affects those constraints. Students in Building 1516, a Leadership in Energy and Environmental Design (LEED)-certified residence hall at the University of Georgia (UGA) and in Brumby Hall, a traditional non-LEED-certified residence hall at UGA where increased sustainability and environmental education programming was taking place, were included in this study. By comparing constraints of students in Building 1516 and Brumby Hall to those of students in Reed Hall, a traditional residence hall with fewer environmental education programs, this study will examine potential differences that may be dependent on a student's environment.

Methods

Treatment Groups

Three groups of students were evaluated over two academic school years at UGA from fall 2013 to spring 2015. Three residence halls were selected for this study and all students living in the three halls were evaluated using a pretest and posttest survey. The Immersion-based treatment group was represented by students in a suite-style, co-ed residence hall called Building 1516, which houses approximately 555 students. Building

1516 achieved LEED-Gold certification when it opened in fall 2010 and contained green building design features that set it apart from other residence halls at UGA. Some of those features include low-flow faucets and showerheads, an advanced, energy-conserving heating and air system in each suite, an indoor bicycle storage room, and recycling rooms on each floor.

The Program-based treatment group consisted of students living in Brumby Hall, a traditional, co-ed residence hall, which houses approximately 950 students. Students in the Program-based treatment group had more opportunities to attend environmental education programs in their residence hall. Staff in Brumby Hall were trained to provide one environmental education and one sustainable program throughout the academic year. Appendices A and B provide a look at the information packet and presentation used to train staff in the Program-based treatment group during the fall semester of each year of the study. For the purpose of this study, an environmental education program was defined as *a program with the intention of educating residents about some environmental concept (recycling, water conservation, upcycling, etc.)* (Diener, 2013, p. 4). A sustainable program was defined as *a program with minimal environmental impact*. Brumby Hall staff provided the Program-based treatment group with significantly more environmental education and sustainable programs when compared to the other high-occupancy, co-ed, traditional residence halls on UGA's campus for the first year of the study (Figure 4.1). The control group consisted of students in Reed Hall, a traditional, co-ed, suite-style residence hall, which houses approximately 295 students. Reed Hall lacks sustainable amenities like Building 1516 and does not have a formal environmental education program like that in Brumby Hall during this study.

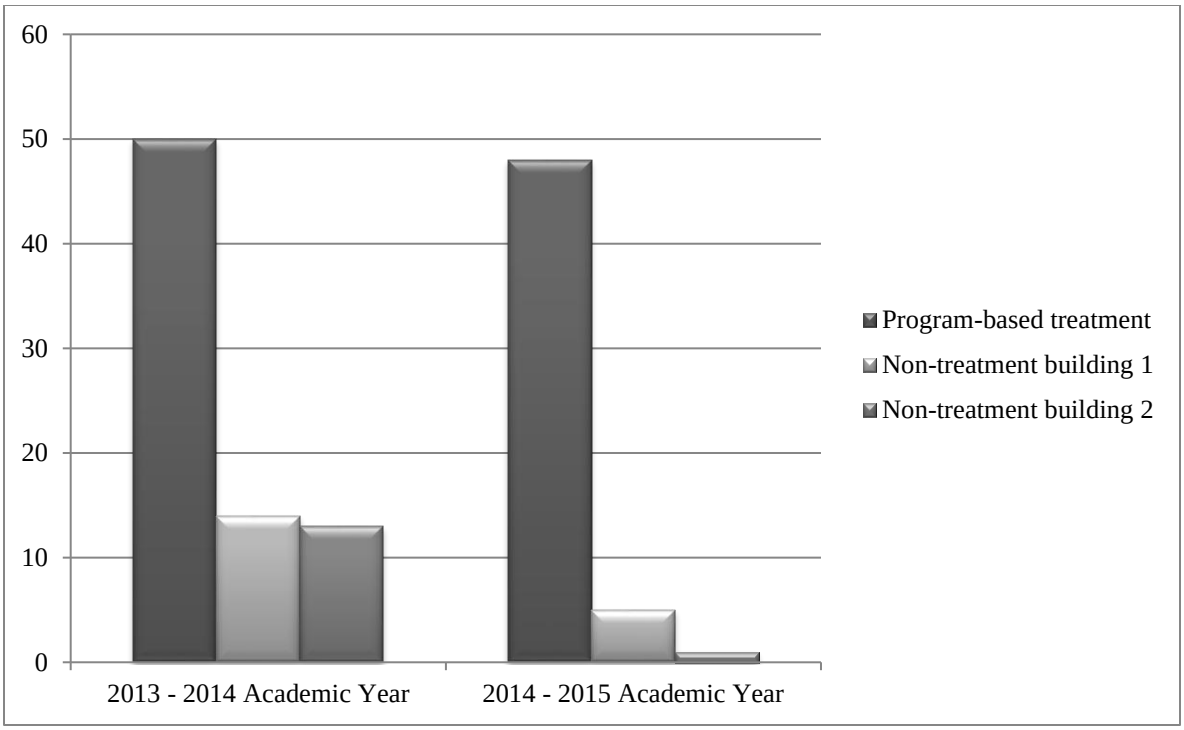


Figure 4.2. Occurrence of Environmental Education Programming in Program-based Education Treatment Compared to Similar Residence Halls at UGA.

Scale Design

To assess the degree to which students are affected by common constraints to participation in ERB, the Perceived Constraints Scale (PCS) was created. Constraints were measured by 12 items representing reasons that may reduce a student's ability to participate in sustainable actions (i.e., ERB). Students responded to each statement using a four point semantic scale where 1 = *Not a Reason,* 2 = *Minor Reason,* 3 = *Moderate Reason, and* 4 = *Major Reason.* The scale format and phrasing of some items were adapted from a study on outdoor recreation constraints across ethnic and minority populations in Georgia (Parker, 2013). The rest of the statements were based on constraints specific to college or university students (i.e., common activities such as extracurricular programs or jobs). The survey was tested for reliability using coefficient

alpha for both the pretest (α = .773) and posttest (α = .856). These numbers exceeded the commonly accepted Cronbach's alpha score of .70 (DeVellis, 2016).

Pilot Study

The PCS was included in a pilot test of a survey also measuring student's environmental attitudes, behavior, ecocentrism, and satisfaction with university sustainability initiatives. The pilot test was distributed to 30 students living in the residence halls during summer 2013. This pilot test provided information on the scale's reliability and validity, completion time of the entire survey, issues related to phrasing of statements, and general formatting issues. A revised survey was created based on verbal feedback from pilot participants and analysis of pilot test responses. The only changes affecting the PCS were in regard to formatting. Most items were altered slightly to add an underlined or bolded word for emphasis. For example, the phrase "I don't understand the benefits of participating in sustainable actions" was changed to "I **don't** understand the benefits of participating in sustainable actions."

Administration

The revised survey was distributed in an electronic format using Qualtrics, which allows each student to respond to the survey once. Students in each treatment group received a link to the survey via email and had the opportunity to take the survey in person during three random, in-person survey administration occurrences in the lobby of each treatment group (i.e., residence hall). A pretest was administered over the course of one month during fall 2013 and fall 2014. A posttest was administered to the same students during spring 2014 and spring 2015, respectively. Across all treatment groups

and semesters, 1,023 unique respondents took a pretest survey (n = 557), posttest survey (n = 356), or both (n = 110). Responses represent a 28.4% overall response rate.

Data Analysis

All statistical tests were conducted using Statistical Package for Social Science Version 24 ("Statistical package," 2016). Of the 584 students who took the pretest PCS, 214 were in the Program-based treatment group (36.6%), 235 were in the Immersion-based treatment group (40.2%), and 109 were in the control group (18.7%). Of the 433 students to respond to the posttest PCS, 171 were in the Program-based treatment group (39.4%), 175 were in the Immersion-based treatment group (40.4%), and 85 were in the control group (19.6%). Table 4.1 displays other sociodemographic of the students sampled for this study.

The 12 items of the PCS were subjected to a principal components exploratory factor analysis (PCA). Prior to performing the PCA, a suitability of data for factor analysis was assessed. Inspection of the correlation revealed presence of many coefficients of .3 and above (Costello, 2009). The Kaiser-Meyer-Olkin value was .843, exceeding the recommended value of .6 (Kaiser, 1974) and Bartlett's Test of Sphericity reached statistical significance, supporting the application of a factor analysis.

Principal components analysis revealed the presence of four components with eigenvalues exceeding 1, explaining 39.1%, 11.9%, 11.0% and 9.1% of the variance, respectively. An inspection of the screeplot revealed a clear break after the first component and another break between the third and fourth components. It was decided to retain three components for further investigation. Table 4.2 shows the breakdown of the PCS statements within the three components. Appendix D shows results of the three-

component solution. The three-component solution explained a total of 62.0% of the variance, with Component 1 (i.e., Access to Resources) contributing 39.1%, Component 2 (i.e., Social Norms) contributing 11.9%, and Component 3 (i.e., Time Available) contributing 11.0%.

Results and Discussion

A score for Constraints was calculated as the mean of an individual's responses to both the pretest and posttest PCS (Table 4.3). Mean scores were also calculated for each factor across all students' pretest and posttest results and then broken down by treatment group within each factor. A paired samples *t*-test was conducted to evaluate the impact of the treatment on mean scores for each of the three factors. There was a statistically significant difference across all treatment groups for Social Norms between the pretest ($M = 1.52$, $SD = 0.60$) and posttest ($M = 1.71$, $SD = 0.78$) scores, $t\ (5) = 2.65$, $p < .05$ (two-tailed). There was a very slight difference in mean scores for Access to Resources between the pretest ($M = 1.89$) and posttest ($M = 1.99$) results, however this difference was not significant ($p = .148$). Not surprisingly, there was no difference whatsoever ($p = 1.00$) between the pretest and posttest mean scores ($M = 2.11$) for Time Available.

The lack of statistical significance in the two factors Access to Resources and Time Available may be explained by the lack of change in those two aspects of students' lives. For example, if a student starts the academic year with limited time due to particular activities, it is unlikely that would change by the end of the academic year. Likewise, if a student starts out the year with limited access to resources like recycling bins or water saving fixtures in their residence hall, it is very likely those factors would not change much by the end of the academic year. It is unlikely for a residence hall to get

new fixtures or infrastructure throughout the year unless something is broken or stolen. The very slight, though statistically insignificant, increase between pretest and posttest results for Access to Resources may represent the small population of students that did in fact get access to new resources (e.g., a new recycling bin on their hallway) or the students who sought out additional resources to fill some sort of need (e.g., placing a work request for a different sink faucet or light bulb). The statistically significant difference in Social Norms between the pretest and posttest results across all treatment groups may be explained by the increase in exposure to new people and activities during their time at UGA. Students enter colleges and universities seeking a wide range of outcomes and the institutions they attend become the environments where they can establish new relationships, test aspects of identity, explore values, and interact with people from other cultures and backgrounds (Banning & Strange, 2001). Considering 50% of the students involved in this study were first year students, the increase in Social Norms may represent students' exploration of new values, particularly related to their ERB.

A regression analysis was conducted to determine whether particular sociodemographic characteristics could be predictors of students' perceived constraints to participation in ERB. One model, which controlled for both class standing and whether a student had attended an environmental education program or class within the last year, explained about 1.6% percent of variance in perceived constraints for participating in ERB ($p < .05$). Of the two independent variables, attending an environmental education program or class makes a more significant unique contribution to explaining perceived constraints than class standing ($p = .04$).

Multiple regression analyses for the overall sample, which controlled for demographics such as sex, race, and status as a resident or staff member, did not explain a significant percentage of the variance in students' self-reported perceived constraints. However, when a multiple regression analysis was conducted to determine if any of those demographics might be predictors of perceived constraints strictly in the Program-based education treatment group, the model explained about 5.4% of the variance in students' perceived constraints ($p < .05$). Of the three independent variables, a student's race makes a more significant unique contribution to explaining perceived constraints than class standing ($p < .01$). Though there is no clear reason why race explains the most variance in perceived constraints, it is worth noting that the breakdown of self-reported race (by percentage) for the students in the Program-based education treatment group differs from that of the entire group of students who responded to the PCS. For example, no students in the Program-based education treatment group identified as Asian or Pacific Islander on their posttest responses and a larger number of students identified as White (non-Hispanic) (71.4%).

Overall responses to the PCS indicated that students do not consider "lack of knowledge" to be a major constraint (25% reported as moderate/major reason). However, students did seem to consider "lack of time due to schoolwork" and "limited resources in residence hall" to be constraints to their participation in ERB (50% and 43%, respectively, reported as moderate/major reason). Finally, students also reported that it was "not convenient" to participate in ERB (43% reported as moderate/major reason). These results (Figure 4.2) indicate that students believe they have the knowledge to participate in ERB, but do not have all the resources to be successful in that area. Hence,

students may participate in more ERB if they were provided with more resources or if they had more time to engage.

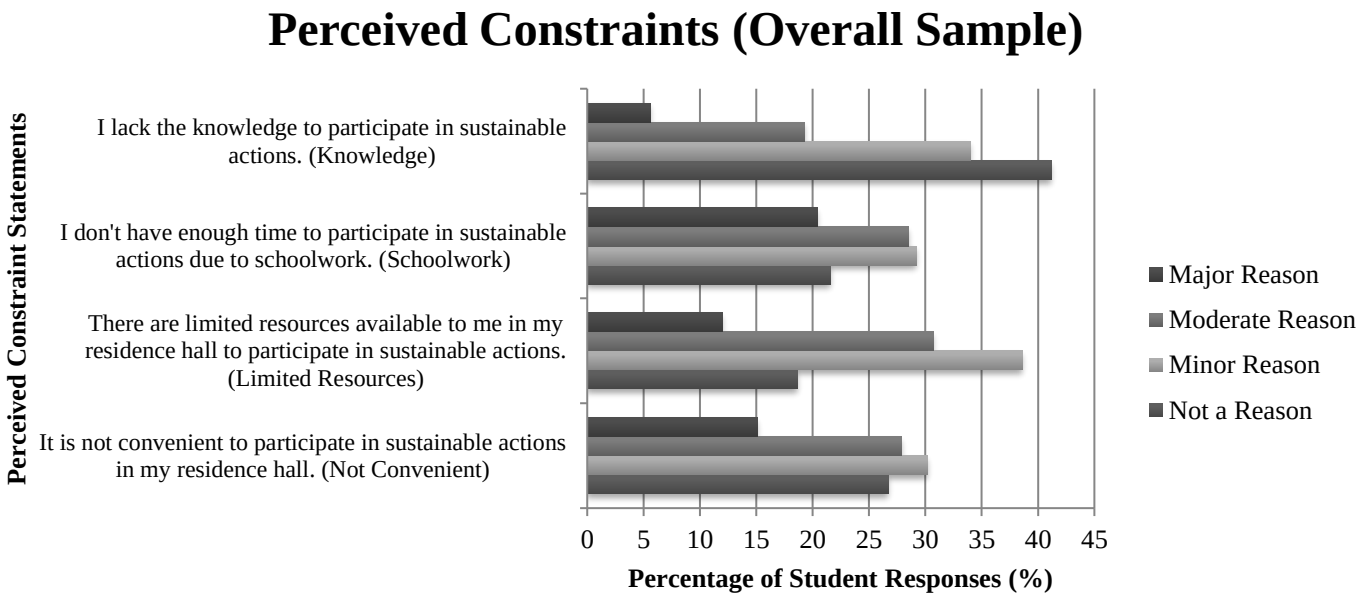


Figure 4.3. Select findings from overall student responses to "What reasons may reduce your ability to participate in sustainable actions within your residence hall?"

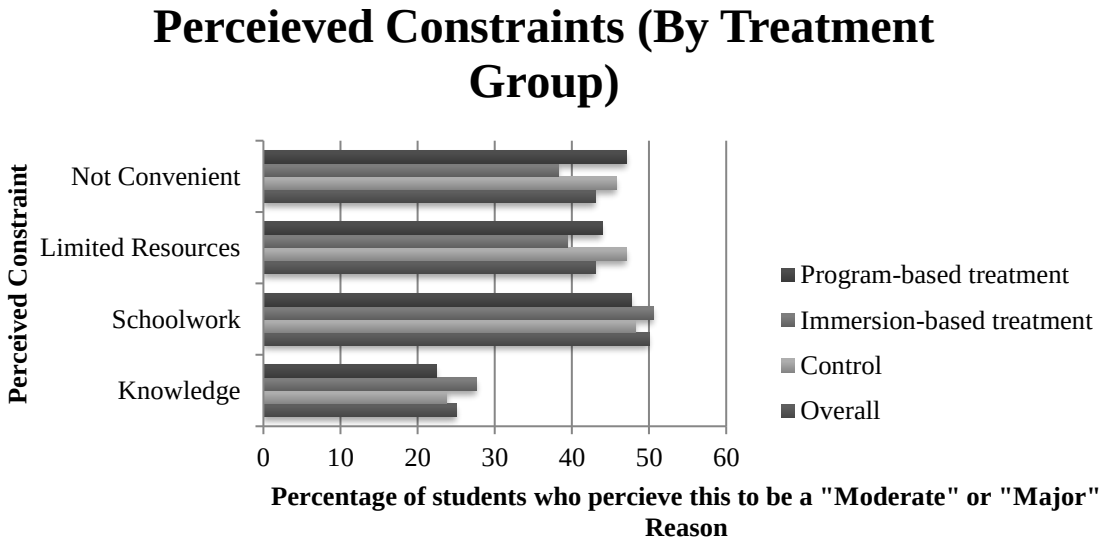


Figure 4.4. Select findings from student responses to "What reasons may reduce your ability to participate in sustainable actions within your residence hall?" broken down by treatment group.

When student responses were broken down by treatment group (Figure 4.3) and class standing (Figure 4.4.), there seemed to be a very similar trend in students' perceived constraints. This comparison revealed that the Immersion-based treatment group and the Program-based treatment group may not have been exposed to enough additional environmental education to see much of a change in their concept of perceived constraints. Likewise, it seemed as though students in the Immersion-based treatment group still did not feel as though they had any more access to resources than students in the other groups.

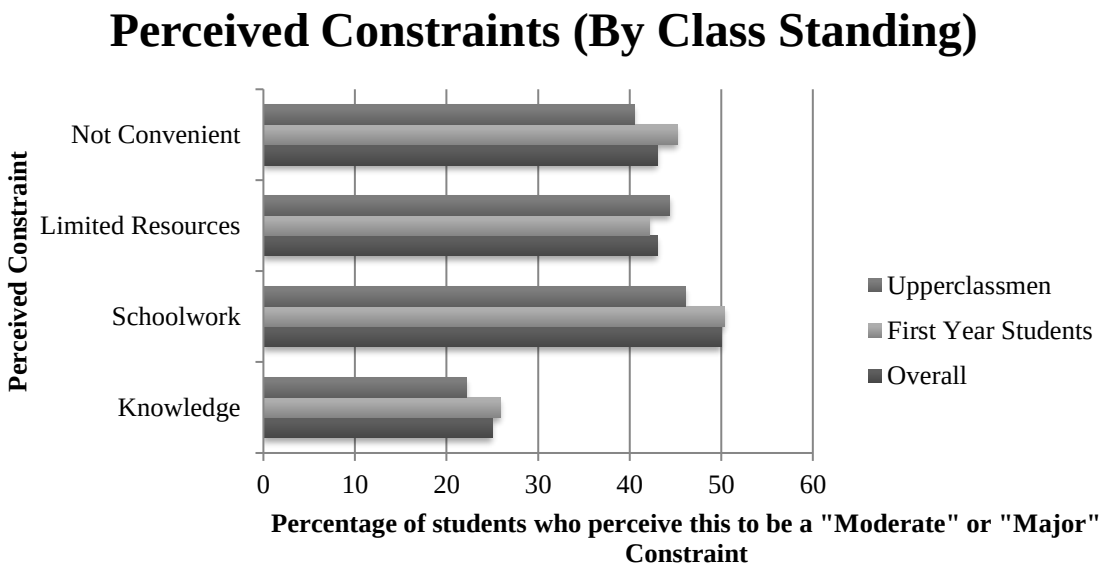


Figure 4.5. Select findings from student responses to "What reasons may reduce your ability to participate in sustainable actions within your residence hall?" broken down by class standing (i.e., Freshmen and all other students, or Upperclassmen).

Conclusion and Implications

Institutions of higher education that require students to attend at least one environmental science class may ultimately have a more environmentally-conscious student body. However, even without such a requirement, managers within departments that have a concern for students' ERB (i.e., campus housing) can provide increased

environmental education programming and inform students about key environmental features in building design. Even if only a small percentage of students attend programming or notice the infrastructure, those efforts to engage students in more education and ERB can have a profound impact on resource consumption on a college or university campus.

While this study utilized programming and infrastructure to convey environmental literacy to students living on campus, there are certainly more methods by which to educate students about ERB during their on-campus housing experience. For example, providing feedback may be one of the best ways to alter students' ERB. With additional feedback on how their conservation behavior may impact either the environment or their cost of living on campus, perhaps students would be able to contextualize their role as environmental stewards and use the feedback to maintain or improve their ERB.

While a large portion of the responsibility lies on the students to engage and participate in ERB, the residence life administration and managers can provide students with the programming and infrastructure they need to be successful environmental stewards (e.g., effective recycling bins and efficient water and energy fixtures). Campus housing administrators and managers have a unique opportunity to create living-learning environments for students through the development and implementation of everything from one short-term initiative to entire department-wide plans. Departmental goal setting related to ERB can contribute to long-term cost saving for university, long-term education for students, and better overall environmental stewardship from the campus housing community (Newsome & Alavosius, 2011).

Campus housing departments have the unique opportunity to provide students with programs and services they can enjoy from the comforts of their own homes. Beyond green building design, residence life can be the perfect setting for programs that combine the concepts in this study, such as residential learning initiatives. Learning communities offer one of the most unique experiences for students on college and university campuses and often provide students with a sense of place (Shapiro & Levine, 1999). This type of environment would allow residents to be fully immersed in green living to get holistic exposure to sustainable design concepts that will enhance their experience while they are part of the community and provide them with valuable lessons to carry with them afterward (Devereaux et al., 2011).

Many institutions of higher education have developed learning communities to support the global move toward conservation and effective natural resource stewardship. The Portland State University First Year Experience Sustainability Freshman Inquiry program provides students with a unique combination of field experience and course work that builds on their experience in their living environment, which features one of the largest green roofs in the city ("The sustainability fye-frinq," 2015). Pomona College residence halls Sontag and Pomona host the Outdoor Education Center and a rooftop classroom used for educating residents and visitors about the building's specific energy conservation features (Konvalinka, 2015). Western Oregon's Ackerman Hall is home to ten learning communities and hosts a kiosk that encourages sustainable behavior and provides information on energy, water, and material use (Konvalinka, 2015). Though these programs represent completely different student experiences, they share in their

missions to provide quality environments for students where they can develop as leaders in regards to environmental sustainability.

Assessment and international information-sharing are also essential to further the impact of environmental education in campus housing. Information collected through evaluation and assessment can inform decisions on all aspects of the community such as the curriculum, physical space, marketing, student support services, faculty development, and community activities (Shapiro & Levine, 1999). It is also essential to get the right staff and support. Social movements rely heavily on driven, intelligent proponents, but a social movement such as sustainability could not be successful without support from others, such as students, staff, and faculty (Stern, et. al., 1999). While it is the proponents (i.e., campus sustainability professionals) who lead the way, general support is essential to the environmental movement (Dietz et. al., 1989).

A student's available time may never change, so housing administers and managers need to make practical decisions and adjustments that meet students' needs. Programs and initiatives need to be simple, easily accessible, and take very little time from a student's packed schedule. For example, students may not have time to attend a 30 minute program on the benefits of recycling, however they may have time to stop at a table in the lobby of their residence hall to play a two minute game where they get a prize for correctly sorting trash between a landfill and recycling bin. If campus housing professionals seek to make programs convenient and accessible, students may view them as worthwhile, even with their busy academic and extracurricular schedules.

The environmental issues society is faced with cannot be solved completely by education, even in combination with many other factors like legislation and media

coverage (Nidumolu, 2009). College and universities around the world need large shifts in campus culture and incorporate ERB into every field, industry, government sector, and agency. Sustainability has to be at the forefront of decision-making, for any decision from small to large. We need to consider environmental impact in planning everything from the smallest supply purchase to the largest construction renovation projects that occur at an institution of higher education, and across all levels of engagement with campus housing departments. Environmentally relevant behavior such as reducing electricity use or buying environmentally friendly products can make a significant impact if those actions are widespread across an entire group of people, like a college campus (Stern et. al., 1999). With a combination of education, policies, and the infrastructure to support ERB and environmental literacy, campus housing is in a unique position to help foster the next generations of environmental stewards who could lead the global community in reversing the negative effects of climate change.

References

Abramson, P. (2014, May). College housing report. C*ollege Planning and Management Magazine*, 20-31. Retreived from https://webcpm.com/~/media/E69C528079 3C45FC8042F49DA553B77C.pdf

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Balsas, C. J. (2003). Sustainable transportation planning on college campuses. *Transport Policy, 10*(1), 35-49.

Banning, J. H., & Strange, C. C. (2001). *Educating by design: Creating campus learning environments that work*: San Francisco, CA: Jossey-Bass.

Boeing. (2016). The boeing company 2016 environment report. 5 - 60. Chicago, IL.

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., El Ghissassi, F., Benbrahim-Tallaa, L., . . . Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *Lancet Oncology, 16*(16), 1599.

Carlsson-Kanyama, A., & González, A. D. (2009). Potential contributions of food consumption patterns to climate change. *The American Journal of Clinical Nutrition, 89*(5), 1704S-1709S.

Clean regattas. (2017). Retrieved February 5, 2017, from http://www.sailorsforthesea.org/programs/clean-regattas

Costello, A. B. (2009). Getting the most from your analysis. *Pan, 12*(2), 131-146.

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26) (pp. : Thousand Oaks, CA. Sage publications.

Devereaux, J., Fulton, J., Cunningham, M., van der Veen, R., & Schwer, P. (2011). Green living: Why invest in a deep green residence hall? *Sustainability: The Journal of Record, 4*(3), 121-127.

Diener, J. (2013). *Environmental education and sustainability programming.* Paper presented at the CLASS Advocate and Resident Assistant Training, University of Georgia.

Dietz, T., Stern, P. C., & Rycroft, R. W. (1989, March). Definitions of conflict and the legitimation of resources: The case of environmental risk. *Sociological Forum 4*(1), 47-70.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: Measuring endorsement of the new ecological paradigm: A revised nep scale. *Journal of Social Issues, 56*(3), 425-442.

Fisher, D. R., Waggle, J., & Leifeld, P. (2013). Where does political polarization come from? Locating polarization within the us climate change debate. *American Behavioral Scientist, 57*(1), 70-92.

Gray, D. B., & Weigel, R. H. (1985). *Ecological beliefs and behaviors: Assessment and change* (Vol. 4). Santa Barbara, CA: Praeger Pub Text.

Harland, P., Staats, H., & Wilke, H. A. (1999). Explaining proenvironmental intention and behavior by personal norms and the theory of planned behavior1. *Journal of Applied Social Psychology, 29*(12), 2505-2528.

Intergovernmental Panel on Climate Change. (2014). *Climate Change 2014 Synthesis Report, Summary for Policymakers.* Retrieved from https://www.ipcc.ch/pdf/ assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika*, *39*, 31-36.

Kats, G., Alevantis, L., Berman, A., Mills, E., & Perlman, J. (2003). The costs and financial benefits of green buildings. A Report to California's Sustainable Building Task Force. Retrieved from: http://www.usgbc.org/Docs/Archive/MediaArchive/607_Kats_PA184.pdf

Konvalinka, A. H. (2015). The will to leed: Can a campus be committed to sustainability without leed certification? *Talking Stick: The Authoritative Source for Campus Housing*, *32*(5), 43 - 50, 70 - 71.

Louv, R. (2008). *Last child in the woods : Saving our children from nature-deficit disorder*. Chapel Hill, NC Algonquin Books of Chapel Hill.

Lutz, W., Muttarak, R., & Striessnig, E. (2014). Universal education is key to enhanced climate adaptation. *Science*, *346*(6213), 1061-1062.

Mallos, N. (2016). 2016 international coastal cleanup report. Washington, DC: Ocean Conservancy.

Newsome, W. D., & Alavosius, M. P. (2011). Toward the prediction and influence of environmentally relevant behavior: Seeking practical utility in research. *Behavior and Social Issues*, *20*, 44.

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review*, *87*(9), 56-64.

Parker, S. E. (2013). *National forest use and outdoor recreation constraints across four ethnic and minority populations in georgia. [electronic resource]*: 2013.

Pew Center on Global Climate Change. (2011). *Climate change 101: understanding and responding to global climate change*. Retrieved from https://www.c2es.org/docUploads/climate101-overview.pdf

Schmidt, A., Ivanova, A., & Schäfer, M. S. (2013). Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries. *Global Environmental Change, 23*(5), 1233-1248.

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology, 10*, 221-279.

Shapiro, N. S., & Levine, J. H. (1999). *Creating learning communities: A practical guide to winning support, organizing for change, and implementing programs.* San Fransisco, CA: Jossey-Bass Inc.

Singh, A., Syal, M., Grady, S. C., & Korkmaz, S. (2010). Effects of green buildings on employee health and productivity. *American Journal of Public Health, 100*(9), 1665.

Springmann, M., Godfray, H. C. J., Rayner, M., & Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences, 113*(15), 4146-4151.

Statistical Package for Social Science (Version 24, 2016) [Computer Software]. Armonk, NY: IBM Corporation.

Stegall, N., & Dzombak, D. (2004). *Cost implications of LEED silver certification for new house residence hall at Carnegie Mellon University* (Senior thesis). Carnegie Mellon University, Pittsburgh, PA.

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407-424.

Stern, P. C., Dietz, T., Abel, T. D., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*(2), 2.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior, 25*(5), 322-348.

Sustainability. (2017). *Division Initiatives.* Retrieved February 5, 2017, from https://www.studentaffairs.umd.edu/about-us/division-initiatives

The sustainability fye-frinq. (2015). *Enrollment Management and Student Affairs: Housing and Residence Life.* Retrieved May 28, 2015, from https://www.pdx.edu/housing/fye-sustainability

Whiteman, D. (2009). Creating a "green bubble" on campus: A model for programming in a green living-learning community. *Journal of College & University Student Housing, 36*(1), 38-47.

Table 4.1
Sociodemographic Information of Students Who Responded to PCS Pretest or Posttest

		Pretest (%)	Posttest (%)
Involvement in environmental education programming or environmental science class (within the last year)	Yes	24.1	22.9
	No	75.9	77.1
Class Standing	First year	64.9	53.7
	Second year	24.3	30.5
	Third year	7.2	9.5
	Fourth year	3.2	5.3
	Fifth year	0.4	0.0
	Graduate student	0.2	0.1
Resident or Staff	Resident	93.7	87.2
	Staff	6.3	12.7
Sex	Male	46.7	41.1
	Female	53.1	58.9
	Other	0.2	0.0
Race	Asian/Pacific Islander	12.5	9.7
	Black (non-Hispanic)	15.4	14
	Hispanic	5.2	6.5
	Native American (non-Hispanic)	0.0	0.0
	White (non-Hispanic)	62.5	64.5
	Other	4.5	5.4

Table 4.2

Factor Loadings of each Variable on the Perceived Constraints Scale[1]

	Factor Loadings		
Variable	Factor 1 Access to Resources	Factor 2 Social Norms	Factor 3 Time Available
I **don't** understand the benefits of participating in sustainable actions.	.412		
There are limited resources available to me in my residence hall to participate in sustainable actions.	.939		
It is **not** convenient to participate in sustainable actions in my residence hall.	.526		
I **lack** the knowledge to participate in sustainable actions.			
I **don't** have enough time to participate in sustainable actions due to schoolwork.			-.883
I **don't** have enough time to participate in sustainable actions due to a job.			-.768
No one I know on my hallway participates in sustainable actions.		-.826	
No one in my family participates in sustainable actions.		-.772	
Sustainable actions are **not** easy to participate in within my residence hall.	.746		
No one I know in my residence hall participates in sustainable actions.		-.837	
None of my close friends participate in sustainable actions.		-.853	
I **don't** have enough time to participate in sustainable actions due to extracurricular activities.			-.857

[1]EFA represents data from posttest results only

Table 4.3
Descriptive Statistics for Pretest and Posttest PCS

	Pretest		Posttest	
	N	Mean	*N*	Mean
Overall sample	584	1.93	433	2.01
Control group	109	1.89	87	2.01
Immersion-based treatment group	238	1.86	176	1.98
Program-based treatment group	216	2.00	172	2.02

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

Summary and Recommendations

The goal of this study was to assess self-reported ERB of students living on campus at an institution of higher education. This study was conducted from June 2013 to May 2015. Researchers conducted a comprehensive assessment of students' self-reported ERB, attitudes toward the environment, and satisfaction with campus housing sustainability initiatives and infrastructure. This study included a pilot test of the survey during the summer of 2013 using a sample of undergraduate students living on campus. The sample was selected from the population of students living on campus in University Housing at UGA.

Administrators for University Housing along with the research team selected three residence halls for this study, one for each of the two treatment groups and one for the control group. The Immersion-based treatment group (1) consisted of students in Building 1516, a LEED Gold-certified which houses approximately 555 students per academic year and features sustainable amenities—such as an efficient heating, air conditioning, and ventilation system. At the time of this study, Building 1516 surpassed all other UGA residence halls in green building design, efficiency, and modern updates (i.e., efficient lighting and infrastructure for a building-wide grey-water system). The Program-based treatment group (2) consisted of students in Brumby Hall, a traditional, co-ed residence hall, which houses approximately 950 first year students. Students in the

Program-based treatment group had more opportunities to attend environmental education programs in their residence halls. Staff in Brumby Hall were trained (Appendix B) to provide significantly more environmental education or sustainable programs each semester when compared to all other residence halls at UGA. The control group consisted of students in Reed Hall, a traditional, co-ed residence hall, which houses approximately 295 undergraduate students. Reed Hall lacks sustainable amenities like Building 1516 and does not have a formal environmental-education program.

Data was collected using an 11-page survey created for this study and partially developed from existing scales (Appendix C). The survey contained nine distinct sections (in order of presentation in survey): satisfaction with campus housing sustainability programming and infrastructure, ERB "within your residence hall," attitudes toward the environment, ERB "away from camps," environmental knowledge, constraints to participation in ERB, ecocentrism, recommendations for improvement to sustainability in campus housing (open-ended), and sociodemographic information. After a pilot test, a revised survey was administered in an electronic format using Qualtrics, an intuitive, web-based survey platform available to graduate students at UGA. Students were also able to take the survey in person during three random, in-person survey administration occurrences in the lobby of each treatment group (i.e., residence hall). A pretest was administered over the course of one month during fall 2013 and fall 2014. A posttest was administered to the same students during spring 2014 and spring 2015, respectively. Across all treatment groups and semesters, 1,023 unique students took a pretest survey (n = 557), posttest survey (n = 356), or both (n = 110). Partially completed surveys were

omitted from data analysis. Responses represent a 28.4% overall response rate. Key findings from the chapters outlined in Chapter 1 are highlighted below:

Comprehensive Quantitative Research Environmental Attitudes, Behaviors, Ecocentrism, and Satisfaction

- Holistic analysis of current infrastructure and initiatives may lead administrators and managers to make more informed decisions about future modifications and updates to sustainability education and may also lead to improved communication of special features related to sustainability (both infrastructure and education).
- Construction of efficient buildings may increase an overall budget by only two percent, but that could be millions of dollars on a large project (Kats, 2003). Project managers can utilize data from a comprehensive analysis to influence their decision on such construction projects.
- Studies that combine quantitative data collection, qualitative data analysis, and building usage data may allow campus housing managers and administrators to make more informed decisions on behalf of students living on campus.
- For future studies, researchers and campus housing managers may consider a similar format to this study for collecting accurate data on students' ERB. However, future methodology can include a posttest survey that will follow-up with students after they have moved off campus so that campus housing managers can assess any long-term impact of their initiatives.

Environmentally Relevant Behavior Among Students Living On Campus

- Programs and initiatives that students engage in outside of the confines of their campus housing environments may be more influential than residence halls or campus housing programs in regard to ERB.
- Students may have access to infrastructure that allows for easier participation in ERB (e.g., efficient water or electricity fixtures, recycling bins, etc.), however if they do not receive any information on said infrastructure they may not take away any long-term lessons that they could potentially apply to their lives after college.
- Funding is essential to new programs—and even modification to existing programs. Funding for environmental education and literacy programs or initiatives can come from dedicated departmental funds for sustainability initiatives. Funding for addition of or modification to infrastructure can come from tax exempt revenue bonds, reserve funds, private developer funds, state appropriations, green revolving funds, grants, or partnerships with local, regional, and national organizations (Balogh et al., 2005; "Campus sustainability revolving loan funds database," 2012; "Green revolving fund," 2015).
- An ideal environmental education or literacy program for students living on campus is one that combines the following concepts:
    - Immersion in an environmentally efficient building
    - Exposure to frequent environmental education programs or initiatives
    - Consideration of additional activities occurring outside of the campus housing department
- A comprehensive environmental education and literacy program within a campus housing department may include:

- Implementation of environmental education
- Incorporation of sustainability into all official future department plans
- Opportunity for structured and frequent sustainability-related leadership or service
- Plans for widespread infrastructure updates
- Policy updates to supplement departmental values in sustainability
- Staff training

Perceived Constraints to Student Participation in Environmentally Relevant Behavior

- Colleges and universities that have a campus-wide requirement of all students to take an environmental science course may be at an advantage in regard to student engagement in ERB.
- Campus housing departments can take on the responsibility of providing environmental education or literacy programming to improve student engagement in ERB, despite common constraints.
- Sustainability-themed living-learning communities can provide students with a sense of place and simultaneously allow residents to get holistic exposure to concepts in sustainability that they may apply to life after college (Devereaux et al., 2011; Shapiro & Levine, 1999).
- A prevalent constraint to student participation in ERB is time. Students appear constrained by time, however they are more likely to participate in ERB if it does not take a lot of their time away from school, extracurricular activities, or a job. Campus housing departments should strive to provide students with convenient and accessible environmental education programs and initiatives.

With the aforementioned findings and recommendations, campus housing managers can make more informed decisions that could lead to wise environmental and financial stewardship. While students go to college or university to get a degree and hopefully begin a career, it is essential to provide them with lessons they can apply to life beyond their academic experience. If institutions of higher education want to contribute to solving the issues caused by global climate change, environmental education should be a priority across all academic and student affairs departments. Teaching students about environmental stewardship—through campus housing initiatives or otherwise—will give them the tools they need to face the difficult realities of a planet in turmoil and the confidence they need to work with others in their generation to reverse negative effects of climate change.

References

Balogh, C. P., Grimm, J., & Hardy, K. (2005). ACUHO-I construction and renovation data: The latest trends in housing construction and renovation. *Journal of College & University Student Housing, 33*(2), 51-56.

Campus sustainability revolving loan funds database. (2012). Retrieved May 31, 2015, from http://www.aashe.org/resources/campus-sustainability-revolving-loan-funds/

Devereaux, J., Fulton, J., Cunningham, M., van der Veen, R., & Schwer, P. (2011). Green living: Why invest in a deep green residence hall? *Sustainability: The Journal of Record, 4*(3), 121-127.

Green rating press release. (2014). [Press release]

Green revolving fund. (2015). *Harvard University.* Retrieved May 31, 2015, from http://green.harvard.edu/programs/green-revolving-fund

Shapiro, N. S., & Levine, J. H. (1999). *Creating learning communities: A practical guide to winning support, organizing for change, and implementing programs.* San Fransisco, CA: Jossey-Bass Inc.

APPENDIX A

BRUMBY PROGRAMMING RESOURCES

Brumby Programming Resources

Please use the following resources to create more sustainable programs and incorporate more sustainability topics into programming. Remember to use proper formatting and grammar in any email you send to any organization or individual you may communicate with.

Speakers

- Bulldog Bikes: Sahana Srivatsan (ssriv@uga.edu)
- Recycling: Suki Janssen (suki.janssen@athensclarkecounty.com)
- The Office of Sustainability Staff is a great place to start for speakers. Here are some people to contact about different topics:
    - Kevin Krische (kkirsche@uga.edu) – overview of UGA sustainability initiatives in education, research, service & operations; bulldog bikes; campus sustainability grants; etc.
    - Jennifer Dunlop (jdunlop@uga.edu) – sustainable events and office programs
    - Andrew Lentini (alentini@uga.edu) – Communications, social media; waste reduction / recycling / composting
    - Tyra Byers (tyrab@uga.edu) – sustainability in curriculum & research opportunities; watersheds; internship program

Field Trips

- ACC Water Conservation Office and Water Treatment Plant: Laurie Loftin (laurel.loftin@athensclarkecounty.com)
- ACC Recycling: Suki Janssen (suki.janssen@athensclarkecounty.com)
- UGArden: Lindsay Davies (lndavies@uga.edu)

Documentaries

For a full list of available documentaries, please contact Jane Diener. Feel free to attend our Sustainability Film Series.

Games and Books

Contact Jane Diener to check out books on topics like Tshirt crafts and natural remedies or games like Earthopoly and Sort That Waste.

Restaurants

Note: All restaurants listed below accept credit cards. If you would like a restaurant to be added to the approved vendor list, please notify Jane Diener. The restaurants listed below are my general recommendations. **There are plenty of other restaurants in Athens that either provide local food or are locally owned and have wonderful customer service.** These are just the restaurants that I have recommended in the past. I would be happy to make more recommendations upon request.

- Sandwiches: Subway on Lumpkin (approved vendor)
- Pizza: Transmetropolitan on Clayton
- Biscuits: Mama's Boy on Oconee
- Burritos: Barberitos (any location)
- Jamaican: Kelly's Jamaican Jerk on Lumpkin
- Indian: Taste of India on Broad
- Produce: UGA Food Service, Athens Farmer's Market
- Soul Food: Weaver D's on Broad

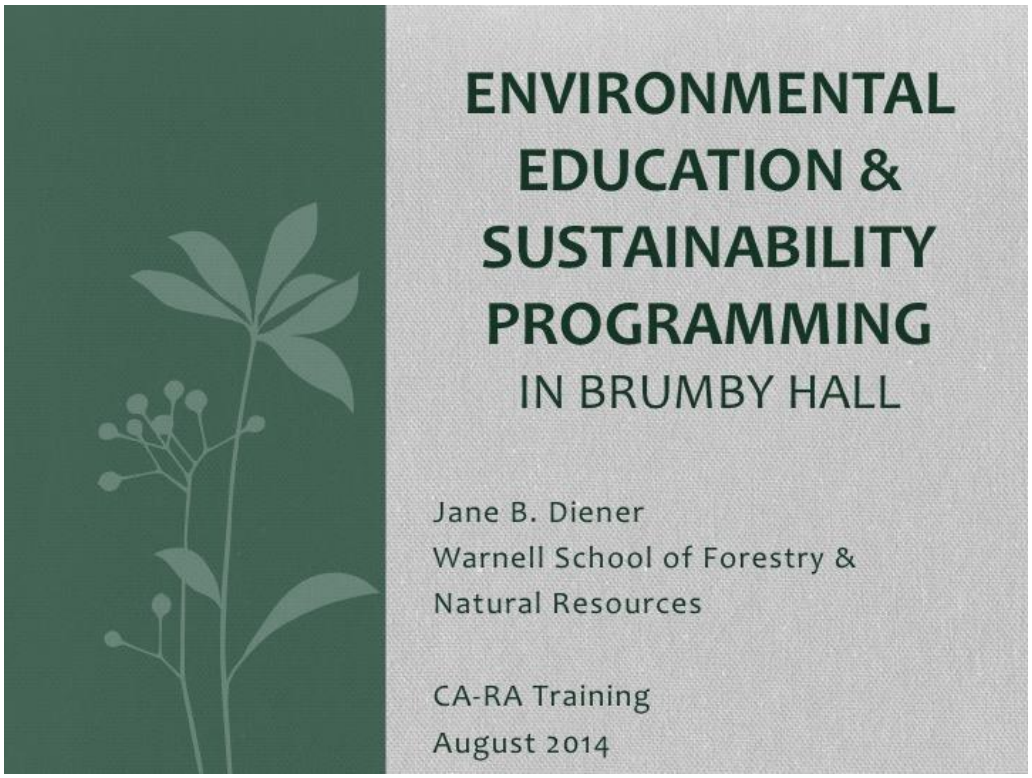
- Desserts/Pastries: Ike and Jane on Prince
- Coffee: Jittery Joe's (any location)
- Burgers: Clocked on Washington

General Tips on Sustainable Programming

- Advertise sustainably
    - Re-use flyers
    - Use newspaper instead of office paper
    - Electronic advertising
    - Invite residents personally
- Check to see if any supplies you are purchasing already exist in Brumby
    - Another CA-RA could've had a similar program and had leftover materials
- Order food from a locally owned restaurant
    - You can find out if a restaurant is locally owned by calling in advance
- Invite a speaker to present on a sustainable topic
    - You can also ask your speakers to mention how sustainability is a part of their jobs/departments
- Provide more sustainable food
    - Local
    - Vegetarian/vegan
    - Fresh (pick it yourself at UGArden or buy at the Farmer's Market)
- Ask residents to bring their own _____.
    - This can eventually become an expectation if enough people do it
    - Bring some extra cups or plates in case someone forgets
    - The Office of Sustainability has reusable kitchen supplies you can rent for FREE as part of their Resource Library (http://sustainability.uga.edu/get-involved/resource-library/)
- Provide recycling at the program
- Don't provide anything "extra" at the program
    - Only provide utensils your residents will **need** (i.e. spoons only for an ice cream party, forks only for a spaghetti night, and no utensils for pizza)
    - Serve beverages in large coolers or punch bowls instead of plastic bottles
    - Don't provide small bottles of anything (i.e. water)
- Explain the choices you made at the program and let your residents know that some choices were made to support sustainability initiatives
- Any leftover supplies should be offered to your co-workers for their programming (so they don't have to buy more resources that already exist)
- Recycle all your advertisements and supplies used
- Questions? Contact Jane Diener at jbdiener@uga.edu.
- Be creative! There are so many ways to incorporate sustainability into your programming.

APPENDIX B

BRUMBY TRAINING PRESENTATION



Summary of Study

- **Title**
  - Impacts of a LEED-certified Building and Environmental Education Programming in Residence Halls
- **Objectives**
- To measure resident environmental knowledge, environmental perceptions, and willingness to participate in environmental action
- To measure resident satisfaction with departmental focus on sustainability initiatives, education, and amenities
- **Treatments**
  - *Treatment 1:* Immersion-based education
  - *Treatment 2:* Program-based education
  - *Control:* Reed Hall

Brumby's Part

- Residents in Brumby Hall will be exposed to a "Programming Treatment" during the study
- Resident Assistants & C.L.A.S.S. Advocates will be trained to run **environmental education or sustainability education** programs and implement them throughout the 2013 – 2014 Academic Year

Definitions

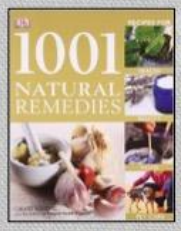
- **Sustainable program**: a program with minimal environmental impact
- **Environmental education program:** a program with the intention of educating residents about some environmental concept (recycling, water conservation, upcycling, etc.)
- **Local**: transported from within 100 miles of 500 miles; most people would consider something local if it was transported from their state or region of the country (e.g. a Vidalia onion or a peach from South Carolina)
- **Locally grown**: grown within 100 miles or 500 miles; most people could consider an item locally grown if it was grown within their city or state
- **Organic:** food composed of ingredients mostly grown and processed using no synthetic fertilizers or pesticides

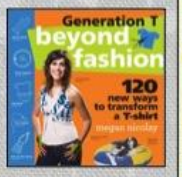
Programming Expectations

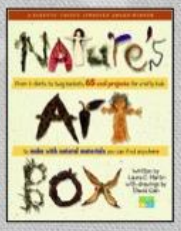
- RAs and CAs will each facilitate one environmental education program each semester.
  - This program will **NOT be an additional requirement beyond the required five programs**.
- Brumby RAs and CAs should adjust one of the five programs (social, personal development/recreational, diversity, or educational) to be a sustainable program or an environmental education program.
- Co-programming and piggybacking rules still apply
  - No more than 2 CA-RAs co-programming
  - No colony programs

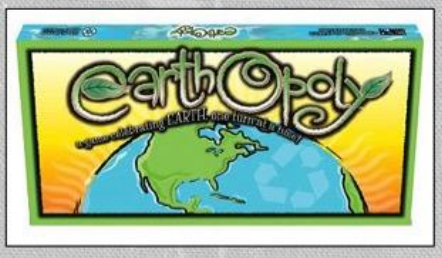
Resources Available

- Programming Guide with **some** recommended vendors
- Environmentally-friendly program checklist
- Sustainability Film Series
- Books and games
  - Earthopoloy
  - Tshirt crafts
  - Natural remedies
- Office of Sustainability Calendar
- Doctoral Intern for Sustainability









How is this going to work?

- Fall
  - Sustainability: Darien and Wentworth
  - Environmental Education: Sunbury and Newport
- Spring
  - Sustainability: Sunbury and Newport
  - Environmental Education: Darien and Wentworth
- I can provide detailed recommendations for anyone
  - Email: jbdiener@uga.edu
- Your GR will hear about programs in one-on-ones
- Follow up
- Ideas and challenges from last year?

Examples

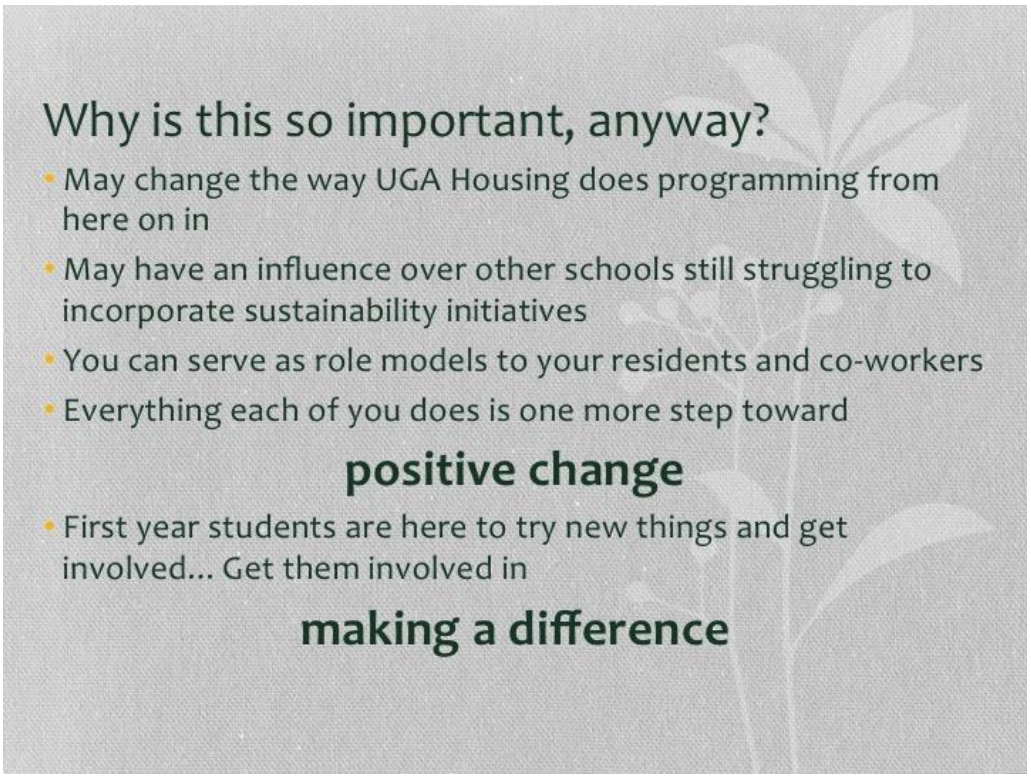
- Documentary viewing and discussion
- Environmental policy/topic debate
- UGA environmental sciences fair
- Crafts made from recycled materials
- Natural beauty tricks
- How to "green" your residence hall room
- Choosing environmentally-friendly products
- Eating sustainably
- Why you should: recycle, compost, etc.
- "Green" apartments in Athens
- Bike tune-up education
- Trip to the Farmer's Market

Activity

1. Find a group of three to five people you don't know very well yet
2. Pick out a strip of paper
    1. Green paper: Read about the "traditional" program and find a way to make it entirely sustainable
    2. Blue paper: Read about the "traditional" program and find a way to make it an environmental education program
3. Be creative!
4. You do not need to write down anything… This is just a discussion-based activity.
5. Get ready to give a one-minute summary of your ideas to the whole group

In the works…

- "Sustainable" vendors list
- Department-wide definitions
- Pre-made environmental sustainability bulletin board instead


Why is this so important, anyway?
• May change the way UGA Housing does programming from here on in
• May have an influence over other schools still struggling to incorporate sustainability initiatives
• You can serve as role models to your residents and co-workers
• Everything each of you does is one more step toward
positive change
• First year students are here to try new things and get involved... Get them involved in
making a difference

APPENDIX C

SURVEY

This survey will examine your opinion about the level of Environmental Education programming and features in your residence hall. Your answers will help to improve environmental education within the Department of University Housing at the University of Georgia. Please answer all questions. There are no right or wrong answers. Thank you for participating in this survey.

Name: _____

UGA Email Address: _____

Residence Hall: _____

Have you previously responded to this survey on-line? Yes/No

If **yes**, we do not need another response. Thank you for your time.

If **no**, please continue.

Section 1: Assessment of Sustainability in On-campus Housing

*After you read each item, you will see five choices: Strongly Disagree, Disagree, Neither Disagree nor Agree, Agree, and Strongly Agree. Check the one that best describes how you **feel** about each statement.*

	Strongly Disagree	*Disagree*	*Neither Disagree nor Agree*	*Agree*	*Strongly Agree*
Sustainability is a priority within UGA Housing.	☐	☐	☐	☐	☐
Waste reduction is practiced and encouraged in my residence hall.	☐	☐	☐	☐	☐
An environmental sustainability mission statement is in place within UGA Housing.	☐	☐	☐	☐	☐
Local and/or organic food is often provided at programs in my residence hall.	☐	☐	☐	☐	☐
Recycling is practiced and encouraged in my residence hall.	☐	☐	☐	☐	☐
Programs about sustainability or the environment are offered in my residence hall each semester.	☐	☐	☐	☐	☐
Water conservation is practiced and encouraged in my residence hall.	☐	☐	☐	☐	☐
Sustainability issues (i.e., waste reduction and water conservation) are integrated into programming in my residence hall.	☐	☐	☐	☐	☐

Section 1 (continued): Assessment of Sustainability in On-campus Housing

*After you read each item, you will see five choices: Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, and Strongly Agree. Check the one that best describes how you **feel** about each statement.*

	Strongly Disagree	*Disagree*	*Neither Disagree nor Agree*	*Agree*	*Strongly Agree*
UGA Housing has incorporated sustainable design in recent construction/renovations.	☐	☐	☐	☐	☐
A coordinating person/office for sustainability exists within UGA Housing.	☐	☐	☐	☐	☐
A committee that deals directly with sustainability exists within UGA Housing.	☐	☐	☐	☐	☐
Energy conservation (i.e., automatic on-off light switches) is practiced and encouraged in my residence hall.	☐	☐	☐	☐	☐
My resident assistant provides quality programs (i.e., social programs, educational programs, etc.).	☐	☐	☐	☐	☐
My resident assistant provides quality environmental education programs (i.e., sustainability education programs, recycling programs, etc.).	☐	☐	☐	☐	☐

Section 2: How likely are you to participate in the following within your **RESIDENCE HALL**?

*After you read each item, you will see five choices: Never, Rarely, Sometimes, Often, and Always. Check the one that best describes how **often** you do each of the following* within your **RESIDENCE HALL**?

	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Give some of my own money to help save wild plants or animals	☐	☐	☐	☐	☐
Compost my food waste	☐	☐	☐	☐	☐
I turn off the sink when I am brushing my teeth to save water	☐	☐	☐	☐	☐
I turn off the lights when I leave a room to save energy	☐	☐	☐	☐	☐
Help to clean up parks and forests in my neighborhood	☐	☐	☐	☐	☐
Tell my friends or my family about things they can do to help protect nature	☐	☐	☐	☐	☐
Recycle paper, plastic or glass	☐	☐	☐	☐	☐

*After you read each item, you will see five choices: Never, Rarely, Sometimes, Often, and Always. Check the one that best describes how **often** you do each of the following* within your **RESIDENCE HALL**?

	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Use a reusable water bottle	☐	☐	☐	☐	☐
Carpool to work/home/school	☐	☐	☐	☐	☐
Recycle your paper products	☐	☐	☐	☐	☐
Recycle your plastic products	☐	☐	☐	☐	☐
Compost your food waste	☐	☐	☐	☐	☐

Section 3: Your Ideas about Nature

*After you read each item, you will see five choices: Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, and Strongly Agree. Check the one that best describes how you **feel** about each statement.*

	Strongly Disagree	*Disagree*	*Neither Disagree nor Agree*	*Agree*	*Strongly Agree*
Plants are important to me.	☐	☐	☐	☐	☐
Animals are important to me.	☐	☐	☐	☐	☐
I like to learn about plants and animals.	☐	☐	☐	☐	☐
To me, all plants and animals play an important role in nature.	☐	☐	☐	☐	☐
I care about protecting plants and animals.	☐	☐	☐	☐	☐
I like to learn about nature.	☐	☐	☐	☐	☐
Taking care of nature is important to me.	☐	☐	☐	☐	☐
I want to help fix problems in nature.	☐	☐	☐	☐	☐
Protecting the natural environment is important to me.	☐	☐	☐	☐	☐
Plants and animals have as much of a right to exist as humans do.	☐	☐	☐	☐	☐
When humans interfere with nature it often produces negative consequences.	☐	☐	☐	☐	☐
The balance of nature is strong enough to cope with the impacts of modern industry.	☐	☐	☐	☐	☐
Humans were meant to rule over the rest of nature.	☐	☐	☐	☐	☐
The balance of nature is very delicate and easily upset.	☐	☐	☐	☐	☐
Humans have the right to change the natural environment to suit their needs.	☐	☐	☐	☐	☐

Section 4: How likely are you to participate in the following ***AWAY FROM CAMPUS*** (e.g. when visiting your hometown)?

*After you read each item, you will see five choices: Never, Rarely, Sometimes, Often, and Always. Check the one that best describes how **often** you do each of the following **AWAY FROM CAMPUS** (e.g., when visiting your hometown).*

	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Give some of my own money to help save wild plants or animals	☐	☐	☐	☐	☐
Compost my food waste	☐	☐	☐	☐	☐
I turn off the sink when I am brushing my teeth to save water	☐	☐	☐	☐	☐
I turn off the lights when I leave a room to save energy	☐	☐	☐	☐	☐
Help to clean up parks and forests in my neighborhood	☐	☐	☐	☐	☐
Tell my friends or my family about things they can do to help protect nature	☐	☐	☐	☐	☐
Recycle paper, plastic or glass	☐	☐	☐	☐	☐

*After you read each item, you will see five choices: Never, Rarely, Sometimes, Often, and Always. Check the one that best describes how **often** you do each of the following **AWAY FROM CAMPUS** (e.g., when visiting your hometown).*

	Never	*Rarely*	*Sometimes*	*Often*	*Always*
Use a reusable water bottle	☐	☐	☐	☐	☐
Carpool to work/home/school	☐	☐	☐	☐	☐
Recycle your paper products	☐	☐	☐	☐	☐
Recycle your plastic products	☐	☐	☐	☐	☐
Compost your food waste	☐	☐	☐	☐	☐

Section 5: Your Awareness of Sustainability *(Please circle the best answer.)*

1. To conserve water, I can
    a. leave the water running on low while I brush my teeth.
    b. take shorter showers.
    c. only wear an outfit once before washing it.
    d. throw away facial tissues by flushing them down the toilet.

2. Low-flow faucets on sinks can save up to
    a. approximately 400 gallons of water per year.
    b. approximately 4,000 gallons of water per year.
    c. approximately 13,000 gallons of water per year.
    d. approximately 50,000 gallons of water per year.

3. Leaving a computer on overnight (without using it) for one year uses the same amount of energy as
    a. making 9,280 bags of popcorn.
    b. using a blow dryer for 5,568 hours.
    c. washing 464 loads of laundry.
    d. All of the above

4. The proper temperature to leave a thermostat on in the winter is
    a. between 72 and 76 degrees Fahrenheit.
    b. between 80 and 84 degrees Fahrenheit.
    c. between 68 and 71 degrees Fahrenheit.
    d. between 60 and 64 degrees Fahrenheit.

5. "CFL" stands for
    a. certified fluorescent lamp.
    b. compact fluorescent light.
    c. compact fluoride light.
    d. certified fluorescent light.

6. To avoid using extra energy when washing my clothes in a washing machine I can
    a. only put half a load of washing in the machine.
    b. use warm or cold water ("Brights" or "Permanent Press" settings).
    c. use hot water ("Whites" setting).
    d. There is no way to save energy while using a washing machine.

7. Scraps of food left from my meal can be used for
    a. recycling.
    b. compost.
    c. chap stick.
    d. trash.

8. Three things I can do with trash or waste are
    a. reduce, reheat, recycle.
    b. reduce, relive, reheat.
    c. reduce, reuse, recycle.
    d. recycle, remake, reuse.

9. When I throw away a plastic bottle it can go to
    a. the ocean.
    b. a landfill.
    c. the street.
    d. All of the above

10. Of the following items, which takes the longest to biodegrade in a landfill?
    a. Paper plate
    b. Flowers
    c. Plastic bag
    d. Candy bar wrapper

11. Earth is approximately 70% water. What percentage of that water is available for human use?
    a. 1%
    b. 5%
    c. 30%
    d. 45%

12. Approximately how many gallons of water does the average American use each day?
    a. 25
    b. 40
    c. 75
    d. 150

Section 6: What reasons may **reduce your ability** to participate in sustainable actions (i.e. recycling, conserving water, joining a campus environmental organization) within your **RESIDENCE HALL**?

After you read each item, you will see four choices: Not a Reason, Minor Reason, Neither a Major or Minor Reason, and Major Reason. Check the box that best describes how these reasons may affect your ability to participate in sustainable actions.

	Not a Reason	*Minor Reason*	*Moderate Reason*	*Major Reason*
I **don't** understand the benefits of participating in sustainable actions.	☐	☐	☐	☐
There are limited resources available to me in my residence hall to participate in sustainable actions.	☐	☐	☐	☐
It is **not** convenient to participate in sustainable actions in my residence hall.	☐	☐	☐	☐
I **lack** the knowledge to participate in sustainable actions.	☐	☐	☐	☐
I **don't** have enough time to participate in sustainable actions due to schoolwork.	☐	☐	☐	☐
I **don't** have enough time to participate in sustainable actions due to a job.	☐	☐	☐	☐
No one I know on my hallway participates in sustainable actions.	☐	☐	☐	☐
No one in my family participates in sustainable actions.	☐	☐	☐	☐
Sustainable actions are **not** easy to participate in within my residence hall.	☐	☐	☐	☐
No one I know in my residence hall participates in sustainable actions.	☐	☐	☐	☐
None of my close friends participate in sustainable actions.	☐	☐	☐	☐
I **don't** have enough time to participate in sustainable actions due to extracurricular activities.	☐	☐	☐	☐

Section 7: Self-assessment

For each scale, read the options and check the option that best represents your opinion.

☐ **1** Natural resources are more important than humans.	☐ **2**	☐ **3** Natural resources and humans are equally important.	☐ **4**	☐ **5** Humans are more important than natural resources.

☐ **1** It is important to totally preserve our natural resources.	☐ **2**	☐ **3** It is important to conserve most of our natural resources, but use what society needs.	☐ **4**	☐ **5** It is important to use all of the natural resources available to us.

☐ **1** Sustainable practices (i.e., recycling, water conservation, etc.) are more important than meeting the needs of humans.	☐ **2**	☐ **3** The needs of humans should be balanced with sustainable practices.	☐ **4**	☐ **5** Meeting the needs of humans is more important than sustainable practices.

Section 8: Open-ended Question

What do you think could be done to make your residence hall more sustainable? List up to three things:

1. _____
   _____
   _____
2. _____
   _____
   _____
3. _____
   _____
   _____

Section 9: Demographics

1. Within the last year did you attend any environmental education programming (i.e. a nature talk, UGA hosted sustainability event) and/or take an environmental science class (i.e. FANR 1100, ECOL 1000, etc.)?

Yes	☐
No	☐

2. Have you ever been involved in an environmental organization (on campus or away from campus)?

Yes	☐
No	☐

If yes, within the last year? ☐, One to two years? ☐, 2+ years? ☐

3. Are you currently a member of an environmental organization?
   If so, which one(s)? _____
   _____
4. Hometown: _____
5. Zip code: _____
6. Are you a resident or staff member?

Resident	☐
Staff member	☐

7. Current GPA: _____
8. Class standing:

First year ☐	Second year ☐	Third year ☐	Fourth year ☐
Fifth year ☐	Sixth year ☐	Seventh year ☐	Graduate student ☐

9. Sex:

Female ☐	Male ☐	Other: _____

10. Academic Major: _____
11. Race:

Asian or Pacific Islander ☐	Black (non-hispanic) ☐	Hispanic ☐
Native American (non-hispanic) ☐	White (non-hispanic) ☐	Other: _____ ☐

Thank you for your time and feedback. If you have any further questions or if you are interested in the results of this study, please contact Jane B. Diener (jbdiener@uga.edu) or Dr. Gary T. Green (gtgreen@uga.edu).

APPENDIX D

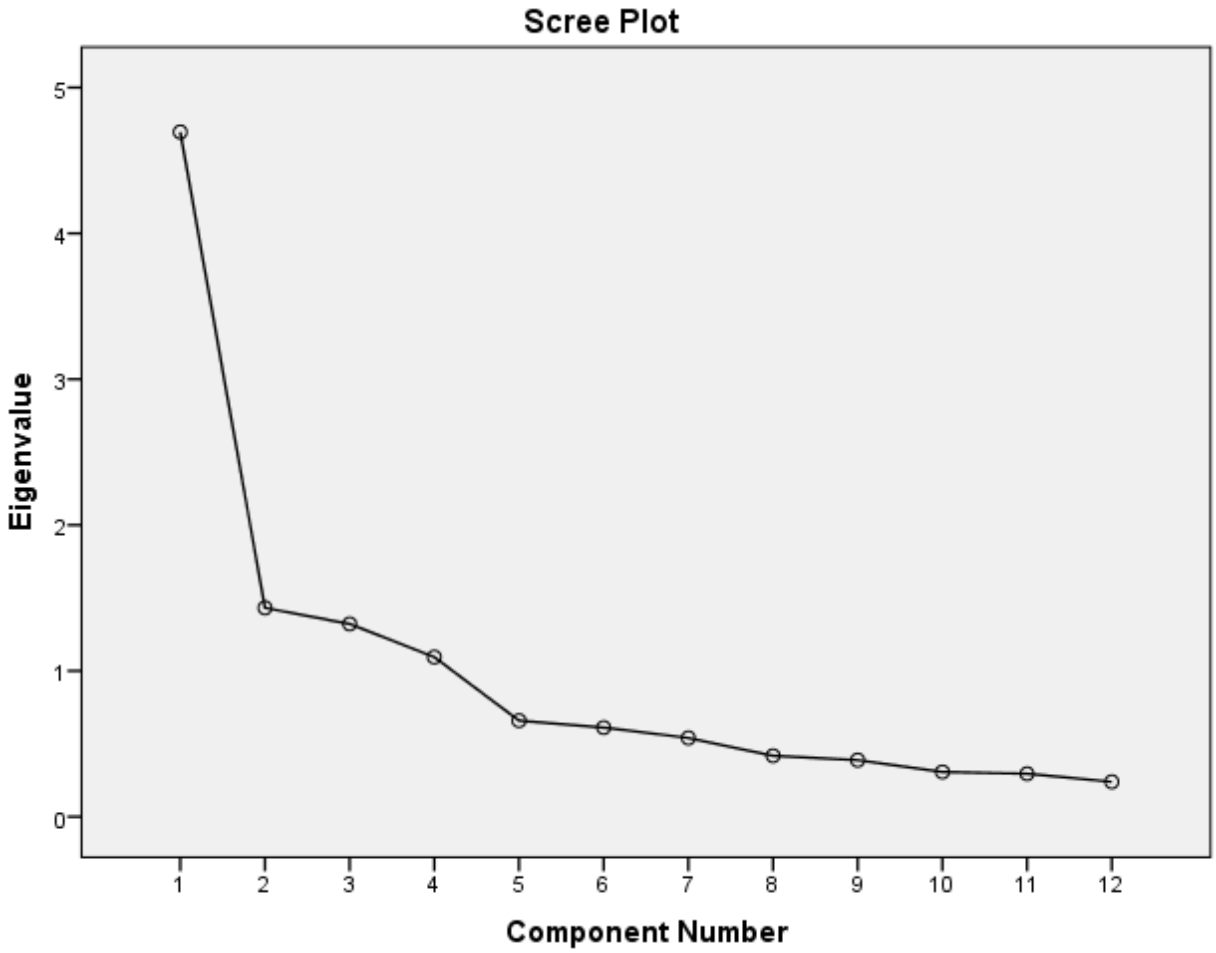
CHAPTER 4 PRINCIPLE COMPONENTS ANALYSIS OUTPUT

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.843
Bartlett's Test of Sphericity	Approx. Chi-Square	2045.991
	df	66
	Sig.	.000

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.695	39.124	39.124	4.695	39.124	39.124
2	1.432	11.934	51.058	1.432	11.934	51.058
3	1.322	11.019	62.077	1.322	11.019	62.077
4	1.095	9.121	71.198			
5	.658	5.487	76.685			
6	.611	5.094	81.779			
7	.540	4.501	86.280			
8	.418	3.484	89.763			
9	.388	3.231	92.994			
10	.307	2.557	95.552			
11	.295	2.456	98.008			
12	.239	1.992	100.000			


Scree Plot
Eigenvalue
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
10
11
12
Component Number

Component Matrix[a]

	Component		
	1	2	3
No one I know on my hallway participates in sustainable actions.	.775	-.398	
No one I know in my residence hall participates in sustainable actions.	.755	-.425	
None of my close friends participate in sustainable actions.	.747	-.440	
I don't have enough time to participate in sustainable action due to schoolwork.	.660	.354	-.474
I don't have enough time to participate in sustainable action due to extracurricular activities.	.642	.341	-.461
Sustainable actions are not easy to participate in within my residence hall	.602		.499
No one in my family participates in sustainable actions.	.597	-.443	
It is not convenient to participate in sustainable actions in my residence hall.	.581	.331	
I lack the knowledge to participate in sustainable actions.	.578		
I don't have enough time to participate in sustainable action due to a job.	.565	.359	-.376
I don't understand the benefits of participating in sustainable actions.	.459		
There are limited resources available to me in my residence hall to participate in sustainable actions.	.443	.431	.609

Extraction Method: Principal Component Analysis.[a]

a. 3 components extracted.

Pattern Matrix[a]

	Component		
	1	2	3
No one I know on my hallway participates in sustainable actions.	.939		
No one I know in my residence hall participates in sustainable actions.	.746		
None of my close friends participate in sustainable actions.	.526		-.304
I don't have enough time to participate in sustainable action due to schoolwork.	.423		
I don't have enough time to participate in sustainable action due to extracurricular activities.	.412		
Sustainable actions are not easy to participate in within my residence hall		-.853	
No one in my family participates in sustainable actions.		-.837	
It is not convenient to participate in sustainable actions in my residence hall.		-.826	
I lack the knowledge to participate in sustainable actions.		-.772	
I don't have enough time to participate in sustainable action due to a job.			-.883
I don't understand the benefits of participating in sustainable actions.			-.857
There are limited resources available to me in my residence hall to participate in sustainable actions.			-.768

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.[a]

a. Rotation converged in 11 iterations.

Structure Matrix

	Component		
	1	2	3
No one I know on my hallway participates in sustainable actions.	.842		
No one I know in my residence hall participates in sustainable actions.	.779	-.418	
None of my close friends participate in sustainable actions.	.630	-.309	-.488
I don't have enough time to participate in sustainable action due to schoolwork.	.546	-.430	-.383
I don't have enough time to participate in sustainable action due to extracurricular activities.	.497	-.335	
Sustainable actions are not easy to participate in within my residence hall	.376	-.869	-.420
No one in my family participates in sustainable actions.	.320	-.868	-.400
It is not convenient to participate in sustainable actions in my residence hall.	.413	-.863	-.342
I lack the knowledge to participate in sustainable actions.		-.742	
I don't have enough time to participate in sustainable action due to a job.	.302	-.380	-.886
I don't understand the benefits of participating in sustainable actions.		-.372	-.860
There are limited resources available to me in my residence hall to participate in sustainable actions.			-.767

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

Component Correlation Matrix

Component	1	2	3
1	1.000	-.378	-.360
2	-.378	1.000	.408
3	-.360	.408	1.000

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.