The "Greening" of Campuses in Higher Education and K-12 Schools: The Value of Experiential Learning for Sustainability

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Abstract

Institutions of higher education have been involved in campus sustainability programs and activities since the 1970s; however, increasingly, schools in K-12 education have become involved in aspects of the green movement, such as energy efficiency and high performance building design, to facilitate sustainability on their campuses, as well. This interest at the elementary and secondary levels of education is mainly promoted by two relatively recent comprehensive programs: the United States Department of Education's *Green Schools Initiative (GSI)*, and the nationwide, online *Green Ribbon Schools (GRS)* program (USDOE, 2012).

The goals of this research were twofold: 1) to assess how students and administrators at campuses in higher education engaged in sustainable programs and practices; and, 2) to observe the creative activities of teachers and students in K-12 education toward campus sustainability. To achieve our first goal, we created a list of 10 criteria that defined a sustainable campus and applied them to a sample of 23 universities having approximately equal enrollment. Two-thirds engaged in half or more of our ten criteria. The two most frequent were: *evidence of student organizations dedicated toward environmental causes;* and, whether the universities included *sustainable*

policies in their Master Plans. Alternative energy programs and a *commitment to reduce emissions on campus* were also important. The second goal of observing campus sustainability for K-12 schools called for examining the website of the *GRS* program, the original award and recognition program for K-12 schools. Of 730 registered schools, 68, or about 10% were green ribbon award winners in 2011, the majority emanating from Texas, with California schools, second. Though the *GRS* program is comprised of four cornerstones, we only observed the "EcoCampus" cornerstone to remain consistent with the aims of the research. The majority of projects focused on "recycling/waste," and "energy." A case study of an elementary school that developed curriculum using the "building as a teaching tool" is presented and illustrates how this school incorporated STEM concepts and lifelong learning. Overall, this research concluded that no matter the scale, size, enrollment of an institution of education, nor level of education, that a growing number of educators, students, and administrators are participating in sustainability activities on campus to achieve short-term efficiencies and savings, as well as, long-term benefits toward educating the next generation of environmentally-aware, and conservation-minded citizens.

Keywords: Campus sustainability-higher education; campus sustainability-K-12 schools, green campuses, *Green Ribbon Schools* program, *Green School Initiative*, green school resources, school conservation programs

The Concept of a Sustainable Campus

A sustainable campus may be defined as an educational institution that addresses, involves, and promotes, on a local, regional, or a global level, the minimization of negative environmental, economic, societal, and health effects through teaching, research, outreach, partnership, and stewardship. These activities save resources, promote healthier lifestyles, and improve areas in and around campuses, and, through this experiential education, eventually assist society in transitioning to more sustainable lifestyles (Velazquez et al., 2006, p. 810). Velazquez aimed this definition at universities and colleges, however, increasingly, schools in K-12 education have become involved in the "green movement" to facilitate sustainability on their campuses as well (Kensler, 2012). This interest at the elementary and secondary levels of education is mainly promoted by two relatively recent comprehensive programs: the United States Department of Education's (USDOE) *Green Schools Initiative (GSI)*, and the nationwide, online *Green Ribbon Schools (GRS)* program.

Whether to assume the mantle of leadership in environmental practices, use resources more efficiently, and/or to better their images, institutions of higher education and K-12 schools are changing policies, building "smarter," implementing conservation programs and activities, adapting courses, and creating organizations centered on environmental stewardship (Kensler, 2012). Therefore, to examine campus sustainability, the goals of this research were twofold: 1) to assess how students and administrators at campuses in higher education engage in sustainable programs and practices; and, 2) to observe the creative activities of teachers and students in K-12 education toward campus sustainability. Each goal is presented separately.

Goal 1: Campus Sustainability in Higher Education

Background

Created at the United Nations Conference on the Human Environment, the Stockholm Declaration of 1972 laid the foundations for sustainability on college campuses. Being the first of its kind, this declaration recognized the importance of university campuses worldwide for promoting the importance of the interdependence of humanity and the environment. The Stockholm Declaration also suggested several ways that campuses might achieve environmental sustainability (Alshuwaikhat & Abubakar, 2008, p. 1777; Wright, 2002). In 1980, the International Union for the Conservation of Nature (IUCN) published, *World Conservation Strategy: Living Resource Conservation for Sustainable Development*, which reflected the IUCN's goals for helping the world find pragmatic solutions to our most pressing environmental and developmental challenges (IUCN, 2011). In 1987 with the report from the World Commission on Environment and Development titled, "Our Common Future," sustainable development became a common global phenomenon (Leiserowitz, 2006; Wright, 2002).

Student Involvement

While the first Earth Day in 1970 and subsequent events afterwards, promoted increased environmental awareness, few environmental organizations were "specifically geared to a student constituency" towards campus stewardship (Keniry, 1993, p. 42). In addition, "little or no information was shared across campuses concerning environmental issues or how to organize

projects" (Keniry, 1993, p. 42). In 1989, the first national student environmental conference called "Threshold" took place at the University of North Carolina at Chapel Hill, headed by the Student Environmental Action Coalition (SEAC). Attendance for the event reached over 1,700 students from 43 states and 225 separate colleges and universities. As of 1993, SEAC was represented on 700 college campuses (Keniry, 1993, p. 44).

Over the past 22 years, the SEAC has successfully networked student environmentalists and assisted in launching campaigns from a local to national level. The organization has also trained activists and helped broaden perspectives to help thwart the main proponents of environmental injustice (SEAC, 2011).

Administrative Involvement

In 1990, the Dean of Environmental Studies at Tufts University in Talloires, France, Anthony Cortese (2011), met with administrators from 31 other universities worldwide to collectively discuss the need to address the challenges of environmental stewardship (Koester, Eflin, & Vann, 2006). The *Talloires Declaration* was formulated, and encompasses a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations, and outreach at colleges and universities (Alshuwaikhat & Abubakar, 2008; Wright, 2002). To date, over 300 administrators at institutes of higher learning spanning 40 countries, have signed this monumental declaration.

Methods

To meet our first goal, three objectives were set forth: 1) identify 10 criteria that represented the most important sustainable activities and programs on a campus; 2) apply the criteria to our sample of universities; and, 3) observe our sample's total rankings and scores in each of the 10 categories. The campus sustainability criteria were adapted from the Sustainable Endowment Institute's (SEI) survey which examines both present environmental policies, programs, and activities of a university, as well as, the nature of long-term investments of a university - that is, whether the university engages in environmentally friendly investments, or not. This research differed, however, in that each university in our sample was examined to assess the degree of involvement of *present* environmental policies, programs and activities — not

long-term investments — rationalizing that students, faculty, and staff have more choice over current actions than investment decisions. Our ten criteria, expressed in question format, appear in Table 1.

Sample of Universities

After some deliberation, we deemed that *enrollment* would be the most suitable constant for compiling our sample, rationalizing that enrollment

Table 1.
Ten criteria developed to observe campus sustainability in higher education.

1. Has the University created a Master Plan that includes sustainable policy, or some other formal policy currently in place? [ADMINISTRATION]

2. Does the school operate an office of sustainability or does it have an office or series of positions that are utilized likewise? [ADMINISTRATION]

3. Does the school have alternative or renewable energy on campus? [CLIMATE CHANGE AND ENERGY]

4. Does the school compost food waste from the dining halls? [RECYCLING]

5. Does the school purchase more than 10% of its food from local means? [LOCAL FOOD]

6. Has the schools administration made a written or verbal commitment to reduce its emissions substantially in the near future? [CLIMATE CHANGE AND ENERGY]

7. Does the school currently maintain LEED certified buildings on campus? [GREEN BUILDING]

8. Does the school offer sustainability internships? [STUDENT INVOLVEMENT]

9. Does the University have student organizations dedicated toward environmental causes? [STUDENT INVOLVEMENT]

10. Has the school made changes to their vehicle fleet and or shuttle bus system to include alternate energy vehicles? [TRANSPORTATION]

would logically serve as a proxy for an adequate level of resources available to administrators for campus conservation, as well as, the campus being large enough to provide opportunities for student involvement. Twenty-three universities of approximately equal enrollment, having readily accessible sustainability data breakdowns for each of our 10 respective criteria comprised the sample. The study group's enrollment ranged from a low of 27,014 for the University of Alabama, to a high of 31,574 for Boston University.

Data was collected from several sources: the SEI's website, campus websites, and printed and other materials provided by every university in the study group regarding their sustainable endeavors on campuses following our 10 criteria. Providing a matrix that summarizes our data, the sample of 23 universities appears in the first column, while the 10 criteria are represented across the top (Table 2). We placed an "X" in the table for each criteria that was observed from our data collection for each university. The column totals give the number and percent of each of the 10 criteria employed on campuses, thereby, indicating the frequency of each criteria. The row totals give the number and percentage of criteria that each university engaged in, thus, determining the percent of effort and/or involvement in sustainability for each institution.

Observations of Campus Involvement/Rankings

The percentage of campus involvement in sustainable practices ranged from 20 to 100 percent. The sample as a whole received an overall sustainable percentage of 63%, thus indicating that the majority in our sample were employing some, or all of the 10 criteria. In particular, 18 of the 23 universities demonstrated the use of half or more of the 10 criteria. The University of North Carolina at Chapel Hill showed 100% involvement followed by SUNY-Buffalo and the University of California-Davis, both receiving a score of 90%. Several universities showed an 80% involvement: Boston University; University of California-San Diego; University of South Carolina; and, University of Utah. Louisiana State University, Texas Tech University, and Kansas State University ranked the lowest with less than 30% participation overall in campus sustainability programs and activities.

Frequency of the 10 Criteria

Aggregating scores of each of the 10 columns in Table 2 revealed that one criteria received a perfect 100 score—the *existence of student organizations dedicated toward environmental causes* (Q. 9). Next in order of frequency was whether the *university included evidence of sustainable policy, or some other formal policy currently in place in their Master Plan* (Q. 1). We found that over 90% of the universities incorporated this measure of sustainability campus-wide. The majority, almost 70%, also reported *having alternative or renewable energy on campus* (Q. 3), as well as, nearly two-thirds (65.2%) indicating that *their school's administration made a written or verbal commitment to reduce its emissions substantially in the near future* (Q. 6). Another favorable criteria, overall, was whether the school currently maintained certifications for Leadership in Energy and Environmental Design (LEED) buildings on campus (Q. 7; 60.9%). The two lowest criteria incorporated by our sample included whether *the school made changes to their vehicle fleet and or shuttle bus system to include alternate energy vehicles* (Q. 10; 47.8%) and whether *the school purchased more than 10% of its food from local means* (Q. 5; 39.1%).

Table 2.

Ranking of sample of colleges and universities toward campus sustainability practices and programs.

CRITERIA*	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	TOTAL %
UNC-Ch. Hill	X	X	X	X	X	X	X	X	X	X	100
SUNY-Buffalo	X	X	X	X	X	X	X		X	X	90
UC-Davis	X		X	X	X	X	X	X	X	X	90
Boston U.	X	X	X	X	X		X	X	X		80
UC-San Diego	X	X	X			X	X	X	X	X	80
S. Carolina	X	X	X			X	X	X	X	X	80
Utah	X		X	X	X		X	X	X	X	80
Colorado St.	X	X	X	X		X	X		X		70
Cincinnati	X	X	X		X	X	X		X		70
Missouri	X	X	X		X	X		X	X		70
Tennessee	X	X	X	X		X		X	X		70
Virginia Tech	X	X		X		X	X		X	X	70
Wayne State	X		X	X		X	X	X	X		70
Geo. Mason	X	X				X		X	X	X	60
UNLV	X		X			X	X		X	X	60
Purdue	X	X						X	X	X	50
TX State-SM	X		X	X		X			X		50
Pittsburgh	X				X		X	X	X		50
Alabama	X			X	X				X		40
Iowa	X		X				X		X		40
LSU	X								X	X	30
Texas Tech			X			X			X		30
Kansas St.		X							X		20
TOTAL	21	13	16	11	9	15	14	12	23	11	AVG.
PERCENTAGE of EACH CRITERIA	91.3%	56.5%	69.6	47.8	39.1	65.2	60.9	52.2	100	47.8	% Involvement 63.0

*Note: The 10 criteria appear in Table 1.

Goal 2: Campus Sustainability for K-12 Education

We next turn to examining campus sustainability at the level of K-12 education. While there are obvious differences in scale, focus, and participation, classroom teachers, students, and administrators, are, nonetheless, interested and engaged in sustainable teaching and learning, and committed to "doing their part" toward improving their campuses through eco-friendly activities. At the K-12 level of education, campus sustainability is typically found at the scale of the classroom teacher and student where activities/projects are undertaken to benefit their school campus; however, unlike the behemoth college campus, where programs and activities are anchored in volunteerism and formal organizations/departments, the lone classroom has, for its edification and convenience, a growing number of federal, regional, state and local resources, and grants specifically geared toward K-12 "green" education that the university/college campus does not. These resources and grants are becoming more and more available to a growing number of teachers and students who want to *directly* impact their immediate environment, enhance STEM teaching through practical knowledge and hands-on experiential learning, and become the next generation of environmentally-literate citizens.

Background

More than 50 organizations offer environmental resources for K-12 education (Table 3); however, as mentioned earlier, two flagship programs guide the majority of teachers and administrators across the U.S. in "greening" their campuses, and educating the next generation towards a more efficient use of the Earth's resources – the *Green Ribbon Schools (GRS)* program and the U.S. Department of Education's *Green Schools Initiative (GSI)*. Launched online in 2010, the *GRS* program currently reports that more than 730 elementary and secondary schools across the U.S. are participating. Teachers guide students in creating sustainable activities in four cornerstone areas that will count toward earning a "Green Ribbon School Award" which is given for participating in all cornerstones. This original *GRS* program was inspired by the national "Children in Nature" movement. The program is designed to facilitate, inspire, and champion the great work that schools are doing to: 1) promote healthy living for students, parents, and staff; 2) encourage students' connection to nature; 3) create an environmentally-friendly campus; and, 4) stimulate physical activity and cooperative outdoor play (GRS, 2010).

Table 3.

Selected environmental groups and resources for K-12 education.

Algalita Marine Research Foundation	Green Teacher
Alliance for Climate Education (ACE)	Green Youth Alliance
Center for Ecoliteracy	Growing Greener Schools
Center for Green Schools	Healthy Schools Campaign
Classroom Earth	Healthy Schools Network
Climate Change Education	Kids F.A.C.E.
Cloud Institute	Inconvenient Youth
The Collaborative for High Performance	International Climate Champs
Schools	LEED for Schools
Cool the Earth (CETI)	Lexus Eco Challenge
EarthTeam	National Association of Independent
Eco-Schools	Schools (NAIS) Sustainable Schools
Energy Action Coalition	Listserve
Energy Efficient Schools Initiative (EESI)	National Center for Science Education
EnergySmart Schools Program	(NCSE)
Energy Star for K-12 School Districts	National Clearinghouse for Educational
Facing the Future	Facilities
Focus the Nation	Natural Resource Defense Council (NRDC)
Free the Planet!	Green Squad
Global Green USA	No Impact Man
Go-Green Initiative	North American Association for
Green School Buildings	Environmental Education
Green Schools	Project BudBurst
Green Schools Alliance (GSA)	Second Nature
Green Schools Caucus	Sierra Student Coalition
Green Schools Fellowship	Sierra Youth Coalition
Green Schools Initiative	
A Smart Energy Future	
Student Environmental Action Coalition	
Sustainable Schools Project	
Teens Turning Green	
Teens Turning Green Schools	
US Partnership for Education for Sustainable Development	
Zero Footprint Foundation	

The second program, the Department of Education's *GSI*, partners with the Environmental Protection Agency (EPA) and the White House Council on Environmental Quality, and is larger in scope. The *GSI* is a federally directed recognition initiative that encompasses the three institutional roles of schools, including: 1) environmental impact and energy efficiency; 2) school environmental health; and, 3) environmental and sustainability literacy. To participate in the USDOE's program, schools must become eligible by: 1) demonstrating high achievement in the program's pillars and elements; 2) complying with all applicable federal civil rights and federal, state and local health, environment and safety statutory and regulatory requirements; and, 3) meeting high college- and career-readiness standards. Once eligibility has been established, a school's nomination may be considered by their state, or

comparable authority, including each Chief State School Officer (CSSO), the Department of Defense Education Activity (DoDEA), and the Bureau of Indian Education (BIE). Each authority is permitted only a few nominations each year based on eligibility requirements and criteria (GRS, 2010).

Both programs seek to recognize and award schools (with "green" ribbons) that make exemplary efforts in greening schools in the following three areas: environmental impact and energy efficiency; healthy school environment; and, environmental and sustainability education; both believe that recognizing schools for their environmental and sustainability efforts is a tremendous step forward in making our schools healthy green living laboratories that will provide students with the skills necessary to innovate and excel in the 21st century global economy (GRS, 2010). Furthermore, teachers are discovering ways to enhance science, technology, engineering, and math (STEM) teaching into their curricula and lesson plans.

While both the *GRS* and *GSI* programs are relatively new and innovative, this research only examines the nationwide, online program to observe how K-12 educators and students are "greening" their campuses. This is because of the *GRS's* easy availability to all K-12 schools through online participation, as well as, its grassroots, non-bureaucratic approach. The *GRS* program allows all schools to participate immediately by simply registering on the website and starting their activities right away - schools compete only against themselves if they wish (GRS, 2010). A description of the *GRS* program follows; additional information and resources for schools, teachers, and students may be found on its website, *www.greenribbonschools.org*.

The Green Ribbon School Program

Founded in 2007, and implemented online in 2010, the *GRS* program has worked alongside teachers, administrators, students, and designers to create a comprehensive program and user-friendly website that aids teachers and students in the creation, implementation, and publishing of their efforts to green their own schools and communities. Through the *GRS* website, students and teachers share their projects with the global community and inspire others to also take action for a greener, healthier world (GRS, 2010).

The *GRS* program provides the following benefits: 1) the opportunity for teachers/students to keep all activities, and project communication, in one place; 2) tools to publish their activities, which allows them to share the results of their work with the wider school community and beyond, creating a sense of pride and accomplishment for the school and helping accelerate adoption

and change; 3) increased visibility for a school in the green movement, which will undoubtedly aid schools in receiving attention from federal and state organizations; and, 4) opportunities to incorporate *GRS* activities into science, technology, engineering, and math (STEM) teaching and learning by using the campus as a laboratory. Finally, the *GRS* program tools can also help schools with their USDOE submissions, grant opportunities and funding programs, and any other recognition programs schools apply to (GRS, 2010).

The *GRS* program recognizes schools' achievements each year with: bestowing the annual "*GRS* Award" for schools that have activities in all four cornerstone areas; providing digital badges for individual accomplishments on the website; displaying featured schools and classrooms on the *GRS* website home page; and disseminating local and national press releases (GRS, 2010).

The *GRS* program is an *inclusive* program and provides the opportunity for all schools, regardless of size, budget, or location to earn an annual "*GRS* Award" by completing and publishing activities in the four cornerstone areas: 1) Eco-Campus; 2) Health and Fitness; 3) Nature Adventure; and, 4) Natural Classrooms (GRS, 2010).

Methods

Because this study addresses only active *campus* sustainability, data was only collected from the first cornerstone listed above - "Eco-Campus" activities. These include projects related to the categories of: energy, water, transportation, pollution, recycling/waste, and greenspaces. *GRS* provides a definition of each category, as well as, suggested activities that teachers and students might consider for ensuring an "eco-friendly" campus (Table 4).

The *GRS* website also provides data for 730 schools in primary and secondary education that have registered for the program; the list indicates those that have achieved a "*GRS* Award" in 2010-11 (first year of operation) and 2011-12. This research looked at the most recent, 2011-12, award winning schools and examined the activities undertaken in the "EcoCampus" cornerstone.

Observations

Of the 730 schools that were registered with the *GRS* program, 68, or about 10%, earned a "*GRS* Award" in 2011-12, meaning that at least one activity was performed in all four cornerstone areas. The website did not include

Table 4.

The components and popular activities of the EcoCampus Cornerstone of the GRS Program.

1. ENERGY - *To reduce energy consumption one must first know how much is currently being used, and then create ways to reduce that consumption.*
Activity Ideas
- School Energy Audits
- Energy Vampire Audits
- Lights-Off Campaign
- Use of Fluorescent or LED light bulbs/lights
- Energy Conservation Awareness Program
- Alternative Energy Source
- Student Proposals for Green Energy Design at School
- Explore Wind Energy

2. WATER - *To reduce our water consumption we must first know how much we are currently using, and then discover and create ways to reduce that consumption.*
Activity Ideas
- School Water Audits
- Rain Water Harvesting
- Infrastructure Drip Audit
- Water Conservation Awareness Program
- Calculate Water Footprint
- Student Proposals for Water Recycling Programs

3. TRANSPORTATION - *Transportation to and from school and school activities can add up to a lot of pollution and get very expensive. Activities like carpooling, walking or riding a bike to school can reduce the pollution and costs involved with other means of transportation.*
Activity Ideas
- Carpooling Program
- Implement Safe Routes for Biking and Walking
- Transportation Carbon Footprint Audit
- Bike To School Program
- Student Proposals on Green Transportation Alternatives

4. POLLUTION - *The harmful pollutants that we introduce into the atmosphere impact the air we*
breathe. *By reducing that amount of pollution and increasing the amount of air cleansing plant life, we increase the overall health of our world and our bodies.*
Activity Ideas
- Air Quality Test
- Toxic Chemical Cleaners Audit
- Toxic Chemical Cleaners Reduction Program
- Establish NO-IDLE Zone
- Operation Styrofoam Free
- Student Proposals for Pollution Reduction Strategies

5. RECYCLE/WASTE - *Recycling conserves our natural resources, saves landfill space, conserves energy, and reduces the pollution that causes global warming. By reducing, reusing, recycling and buying recycled products we are taking steps to preserve our world and personal health.*
Activity Ideas
- School Recycling Program
- Non-Recyclable Materials Audit
- Composting Program
- Waste-Free Lunch Days
- Charity Reuse Collection Program
- Great Locker Cleanout Program
- Purchase of Recycled Materials
- Operation No Bottled Water
- Electronics Recycling Program
- Paper Use Reduction Program

6. GREEN SPACES - *Creating green spaces on campus where we can be active and observe nature is key to both our health and understanding our world.*
Activity Ideas
- Outdoor Classroom
- Nature Playscape
- Community Garden
- Outdoor Exploration Area
- Vegetable and Herb Garden
- Water-Wise Landscaping
Wildlife Habitat Project
Classroom Plant Life Program
Butterfly Garden

Source: Cornerstone 1: The Environmentally-Friendly Campus
http://www.greenribbonschools.org/programs/grs/activity.php?view=category&cat=2&sub=105

the extent to which the remaining schools were involved in any cornerstone projects (eco-campus, health and fitness, nature adventure, natural class-rooms), but the site does indicate schools that earned badges for individual activities. Forty percent of 2011-12 award winners were teachers from ele-mentary schools, while 12% were middle school teachers, and 21% were high

school teachers. The remaining 19 schools had a wider range of grades, such as PK-8, or PK-12, and teachers from those campuses comprised 28% of the total award winners. The majority of 2011-12 "*GRS* Award" winning schools, 42, or 62% were from Texas; California followed second with 10 schools or 15% of the total, and the remaining numbers emanated from Alaska, Arizona, Florida, Georgia, Hawaii, Indiana, Kansas, Maryland, New Jersey, New York, and Guam.

Table 5 summarizes the school, their activities/projects and percentages of the total in the "Eco-Campus" cornerstone. All 68, 2011-12 "*GRS* Award" winning schools together produced a total of 146 projects just in the cornerstone of EcoCampus. The most frequently occurring activity/project was for "recycling/waste" on campus; there were 79, or 54% recycling/waste projects/activities. The second most frequent was "energy" with 25, or 17% of total activities/projects, and in third place was "greenspaces" with 21, or 14% of all activities/projects.

Case Study: The Building as a Teaching Tool

Baker (2012) writes that one of the major developments in the area of school facilities in the 1990s and beyond was the emergence of green building, or high performance, building movement, largely influenced by the launch of a new green building rating system in 1998 known as Leadership in Energy and Environmental Design, or LEED. The movement grew significantly in the early 2000s, and today is acknowledged to be the most significant influence on school design and construction (Baker, 2012, p. 20). Baker cautions, however, that LEED certification is not enough to produce energy and resources savings, and that the human component needs to be considered as well. Thus, increasingly, attention has been paid to air quality, thermal comfort, lighting, acoustics, as well as, occupant education and communication (2012, p. 21).

Built in 1932, Stoddert Elementary School in northwest Washington, D.C., lacked the spaces typically found in today's elementary schools - cafeteria, library, media center, and gym. Modernization in 2010 of the building and grounds resulted in a LEED, "Gold for Schools," certification because of the following improvements: an innovative ground source heat pump system, daylight views to the surrounding landscape, enhanced classroom acoustics, recycled content in building materials, and low flow water fixtures. Involvement by the students with the architects, designers, and builders, however, generated the greatest impact from the renovation. Students developed projects such as, "How Loud is Too Loud," "Air Pollution Math,"

Table 5.

Green Ribbon School Award winners, 2011-12 – EcoCampus Cornerstone.

SCHOOL	City, State	EcoCampus Activity(ies)
St. Mary's, PK-12	St. Mary's, AK	ENERGY, RECYCLE/WASTE
Cdr. WM C. McCool, EL/Mid	Fpo, AP(Guam)	RECYCLE/WASTE
Skyline High	Mesa, AZ	ENERGY
Billy Mitchell EL	Lawndale, CA	WATER, GREENSPACES (3)
Matilija Jr. High	Ojai, CA	RECYCLE/WASTE
Meiners Oaks EL	Ojai, CA	RECYCLE/WASTE
Mira Monte EL	Ojai, CA	TRANSPORTATION
Nordhoff High	Ojai, CA	RECYCLE/WASTE, GREENSPACES (2)
San Antonio EL	Ojai, CA	RECYCLE/WASTE
Summit EL	Ojai, CA	RECYCLE/WASTE
Topa Topa EL	Ojai, CA	RECYCLE/WASTE
New Horizon, PK-8	Pasadena, CA	ENERGY, RECYCLE/WASTE
Pescadero EL/Mid	Pescadero, CA	RECYCLE/WASTE (2)
Learning Gate Comm., K-8	Lutz, FL	GREENSPACES
Ascension Catholic, PK-8	Melbourne, FL	ENERGY, POLLUTION, RECYCLE/WASTE (2), GREENSPACES
Fernbank EL	Atlanta, GA	TRANSPORTATION
Gen. Ray Davis Mid*	Stockbridge, GA	GREENSPACES
Feagin Mill Mid	Warner Robins, GA	RECYCLE/WASTE
Academy of Pacific, 5-12	Honolulu, HI	ENERGY (2), RECYCLE/WASTE
Cardinal Ritter High	Indianapolis, IN	RECYCLE/WASTE
Eisenhower High	Goddard, KS	TRANSPORTATION, POLLUTION
Bethesda EL	Bethesda, MD	RECYCLE/WASTE
No. 76 Reilly Mid	Elizabeth, NJ	RECYCLE/WASTE
St. Paul Inter Paroch., PK-8	Ramsey, NJ	ENERGY, WATER, TRANSP., RECYCLE/WASTE (3), GREENSPACES (2)
Green Magnet Career, Mid	Briarwood, NY	ENERGY, RECYCLE/WASTE, GREENSPACES
Schuylerville EL	Schulerville, NY	RECYCLE/WASTE
Northstar, Mid/High*	Arlington, TX	RECYCLE/WASTE, GREENSPACES
Navo Mid*	Aubrey, TX	POLLUTION
Bryker Woods EL	Austin, TX	ENERGY, TRANSPORTATION, RECYCLE/WASTE (2)
Doss EL*	Austin, TX	TRANSPORTATION, RECYCLE/WASTE (2), GREENSPACES
Magellan Intl., PK-Mid*	Austin, TX	ENERGY, RECYCLE/WASTE
Redeemer Lutheran, PK-8*	Austin, TX	RECYCLE/WASTE
Travis High*	Austin, TX	RECYCLE/WASTE (2)
Coppell High*	Coppell, TX	WATER, TRANSPORTATION, RECYCLE/WASTE
Arthur Kramer EL	Dallas, TX	RECYCLE/WASTE (3)
Lakehill Prep., K-12*	Dallas, TX	RECYCLE/WASTE
St. Johns Episcopal, PK-8*	Dallas, TX	ENERGY, RECYCLE/WASTE, GREENSPACES
Temple Emanuel, Pre-K	Dallas, TX	RECYCLE/WASTE
Winfree Acad. Charter, 9-12	Denton, TX	RECYCLE/WASTE
Horizon High	El Paso, TX	RECYCLE/WASTE
Dorie Miller Interm.	Ennis, TX	RECYCLE/WASTE
Ennis Jr. High	Ennis, TX	ENERGY
Comanche Springs EL	Ft. Worth, TX	RECYCLE/WASTE
Ft. Worth Country Day, Mid*	Ft. Worth, TX	WATER
Greenbriar EL	Ft. Worth, TX	RECYCLE/WASTE
Westwood EL	Friendswood, TX	ENERGY, RECYCLE/WASTE, GREENSPACES
Wakeland High	Frisco, TX	ENERGY, WATER, RECYCLE/WASTE (2), GREENSPACES

and "Garden Scavenger Hunt" which were coordinated with the construction. Students also studied: geothermal resources with the installation of the ground source heat pump; ideas for green roofing; and, types of recycled materials that might be incorporated into the building of their community garden (e.g., a greenhouse made from 1,400 recycled plastic soda bottles). In addition, students monitor the GreenTouch Screen to track the building's energy use and water consumption from their classrooms, thereby, integrating "real time" data into their lessons (O'Donnell et al., 2011).

Table 5. (continued)

Green Ribbon School Award winners, 2011-12 – EcoCampus Cornerstone.

SCHOOL	City, State	EcoCampus Activity(ies)
Oppe EL	Galveston, TX	ENERGY, WATER, RECYCLE/WASTE
Berry EL	Houston, TX	WATER, POLLUTION, GREENSPACE
James E. Williams EL	Katy, TX	RECYCLE/WASTE
Zelma Hutsell EL*	Katy, TX	ENERGY, RECYCLE/WASTE (2)
Timberview Mid*	Keller, TX	ENERGY
Willis Lane EL	Keller, TX	ENERGY, RECYCLE/WASTE
Armando Chapa Mid	Kyle, TX	RECYCLE/WASTE
Lehman High	Kyle, TX	GREENSPACES
Negley EL	Kyle, TX	RECYCLE/WASTE (2)
Simon Mid	Kyle, TX	RECYCLE/WASTE
Susie Fuentes EL*	Kyle, TX	ENERGY, TRANSPORTATION (2), RECYCLE/WASTE (4)
Brooks Wester Mid	Mansfield, TX	ENERGY
Green Valley EL	No. Rich. Hills, TX	RECYCLE/WASTE
Ore City High*	Ore City, TX	RECYCLE/WASTE
St. Helen Catholic, K-8*	Pearland, TX	ENERGY (2), WATER, RECYCLE/WASTE (9), GREENSPACES
Timmerman EL	Pflugerville, TX	ENERGY
Wyatt EL	Plano, TX	RECYCLE/WASTE (6), GREENSPACES (2)
Red Oak High	Red Oak, TX	ENERGY, RECYCLE/WASTE
Chandler Oaks EL*	Round Rock, TX	RECYCLE/WASTE
East Central High*	San Antonio, TX	RECYCLE/WASTE
Travis EL	San Marcos, TX	RECYCLE/WASTE

ENERGY	25	(17%)
WATER	8	(6%)
TRANSPORTATION	9	(6%)
POLLUTION	4	(3%)
RECYCLE/WASTE	79	(54%)
GREENSPACES	21	(14%)
TOTAL	146	(100%)

EcoCampus Projects from 2011-12 Green Ribbon Award Winners

*Also, Green Ribbon Award Winner in 2010-11

These lessons/units reflect a permanent modified school curriculum that calls for integrating 10 hours per week of green-building instruction per student per year, including presentations by architects, designers, and building engineers. The new lessons/units establish goals, incorporate relevant standards, and define what students should be able to do and learn after each lesson/unit. Further, the principal and teachers have developed measures, such as pre- and post- testing of lessons/units to evaluate learning and outcomes. Finally, the school, along with the Green Education Foundation (GEF), is creating an "elementary school prototype" with lessons/units to show teachers how to use their buildings and campus grounds as a teaching tool. The GEF website, in partnership with the U.S. Green Building Council's, Center for Green Schools, also provides a clearinghouse of lesson plans contributed by teachers on myriad green/conservation topics at all grade levels and in all subject areas. For example, opening the middle school category, and clicking on "social studies," opens sustainability lesson plans and ideas

for designing a neighborhood, imagining cars of tomorrow, building green roofs, and calculating food-o-meters. Opening the high school level, and clicking on "math," yields ideas for monitoring school energy usage, doing a transportation survey, and performing a healthy schools audit. Opening the 3-5 grade level, and clicking on "science" shows lessons entitled "A Day in the Life of a Drop," "Be 'Sun'-sable about Heating Water," "Before We Drove Cars," and "Build a Butterfly Garden" (GEF, 2012).

Discussion

Higher Education and Sustainability on Campus

Our observations suggest that the sustainable movement throughout campuses of higher education in the United States reflects a large number of commonalities within our study group which covered 20 different states. The most common sustainability practices engaged in by universities included: *environmentally-driven student organizations*, as well as, the *creation of a campus master plan* or *formal sustainability policy*. For the latter, over 90% of our study group met the master plan criteria, and for the former, all 23 schools had more than one student-led environmental organization. The next two criteria of effort included: on-campus *alternative power generation*; and, a verbal or written commitment to *reduce its emissions substantially* in the future. Overall, about two-thirds of our sample were/are employing half or more of the ten criteria that defined our concept of campus sustainability.

Incorporating Campus Sustainability at K-12 Schools

Supportive efforts from the federal government, non-governmental organizations, state agencies, and private organizations for primary and secondary education are more recent, as compared to those of higher education which began in the 1970s, stemming from national and international movements (USGBC 2009, 2012); however, the exponential growth of resources for K-12 education, especially online resources, more than closes the time gap (e.g., USDOE's website for Green Ribbon School Resources). Organizations such as the Green Ribbon Schools Program, the Green Schools Initiative, the Green Education Foundation, and The Center for Green Schools, as well as, innovative campus education programs, such as those developed by Stoddert Elementary, have taken learning outside the classroom to a new level. These

organizations and institutions are playing a major role in providing ideas for lessons and projects, as well as, networking opportunities for teachers and their students. Their recognitions and awards provide encouragement for educators and students to apply and practice conservation on their campuses that will both facilitate today's STEM goals and challenges, and inspire others to become lifelong stewards of the planet (GRS, 2010; O'Donnell et al., 2011; USDOE, 2012).

Conclusion

There are two observations evident from this research - the first is that, no matter the scale, size, enrollment of an institution of education, nor level of education, that a growing number of educators, students, and administrators are becoming more aware of the depth and breadth of the environmental movement, and are interested in participating in this movement to establish programs on campus that result in energy efficiencies and savings, as well as, increasing conservation awareness at all scales. Second, educators are becoming more aware of the growing number of "green" resources and programs amenable to application in teaching and learning opportunities for students, as well as, benefits of introducing, and/or bringing those resources to their campuses. To do so provides a dual benefit of educating the next generation of citizens who are aware of issues pertaining to sustainability through incorporating "green" awareness and activities into curricula related to STEM teaching and learning - as highlighted in the exemplar of Stoddert Elementary (O'Donnell et al., 2011; USDOE, 2012)

The transition from gray to green is no longer an environmental option for campuses around the United States at any scale, from elementary schools to university campuses. The green movement has become strong, and students nationwide are actively encouraging their schools to become "green." Students are the largest part of this movement, and without their interest in environmentalism and campus sustainability, these steps would not currently be underway. Different paths are being utilized to determine the best ways to effectively change a campus for the better, and, ostensibly, some schools are more active than others. Our study suggests that campus leaders at all levels are leading the nation with inventive new ways to reduce emissions, recycle, save electricity, utilize alternative energy, and create greenspace. The green movement has definitely taken off, and campuses all over the United States, at all levels of education, are doing their part to change for the better.

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