Aligning End User Identified Issues with a Campus Sustainability Plan

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Abstract

In an attempt to mitigate the negative environmental impacts of college campuses, sustainability programs are becoming more popular on campuses across the United States. The goal of this research is to create a feasible sustainability plan that can be efficiently implemented in phases for the King's College campus located in Wilkes-Barre, Pennsylvania. Prior to identifying solutions and performing cost-benefit analysis, steps were taken to identify the most common sustainability issues noticed by the students, faculty, and staff of the college. Based off data collected through a campus-wide survey, and interviews with key decision-makers on campus, the issues were categorized based on their level of importance and the feasibility of their solutions. The decision support tool allowed for the proper weighing and sorting of the identified issues. After organizing the issues based on these parameters, they were sorted into four categories: energy consumption, waste disposal, education about sustainability, and water usage. With an organized list of present sustainability issues experienced on campus, steps were taken to assemble a sustainability plan that will be implemented through a series of phases, with elements of the initial phase being implemented as early as the spring of 2018. Some aspects of the sustainability program that will be implemented during the initial phase include providing an environmental awareness lecture during the mandatory first year experience course for freshman, and by distributing reusable water bottles and/or shopping bags to incoming freshmen during orientation. By slowly integrating the plan into the operation of the campus, campus support and success in implementing solutions to the larger, more involved sustainability issues during later phases can be achieved. The project is intended to not only decrease the environmental impact on campus, but to show the King's college community how to live their lives in a more sustainable manner.

Keywords: sustainability, sustainable education, multicriteria decision support matrix

1. Introduction

At King's College, many attempts have been made to create a more sustainable environment on campus, but not many have made a lasting impact. Therefore, our goal for providing this research is to create a feasible plan in which the college and community can work together to create a more comfortable and sustainable atmosphere on campus. Reducing the negative impact that the college creates on the world is important as well because the habits that are built while in college are ones that will be carried over into the graduates' everyday lives. Thus, if we could slowly implement and teach a more sustainable and comfortable lifestyle here at King's, we could successfully reduce the environmental impact our community generates here on campus and throughout the world.

1.1 Why Campuses Should Pursue Sustainability Initiatives

Throughout the recent years, there has been an increase of students attending college, and therefore these colleges and universities are producing significantly higher amounts of waste, energy usage, and many other negative effects that contribute to the ever growing killing of our planet. With these problems in mind, we have set out in aligning end user identified issues with a campus sustainability plan, to lessen the amount that our college, or "small city,"[1] harms the environment. This research is also for the benefit of other colleges, in hopes of other institutions looking to our school and our research as an example in which a sustainability initiative can be implemented at any school especially since we started from a low level of sustainability awareness on campus. The categories that will be highlighted in this section will be sustainability education, sustainable food, campus wide implementation, and sustainability assessment. With the understanding that colleges and universities have similar economic goals, comparable to businesses, we have taken on the obstacle of putting these sustainability practices into an economic perspective, but a majority of the answers to the problem, we believe, will lie in spreading this sustainability initiative across the shoulders of these college communities.

Sustainable education can be implemented across all departments from physics and engineering, to philosophy or business. A recent study lead by Aragon-Correa, showed how important it is to implement sustainable practices into education.[2] Initially, four main points are shown to highlight the goals of teaching sustainability. First, teaching sustainability and its learning resources must have a broad scope. Following, discussions about sustainability must demand asking questions related to issues of successful implementation and outcome analysis. Next, effective models have been seen to be observing illustrations and experientially solving real world situations. Finally, sustainability resources must contain a general focus and concern, from an economic perspective. With these four important scopes in mind when discussing sustainability education, it is important to understand the students' perspective. Aragon-Correa and Alberto conducted a survey in which students ranked their satisfaction with existing sustainability teaching resources. The students' responses revealed that the most satisfying teaching resources were academic journal articles, 73% very satisfied to satisfied, and videos and real-life cases were 50% very satisfied to satisfied. It was shown that, "cases are important because, although it may be true in general that sustainability can lead to a positive business outcome, this positive outcome does not hold in every instance. Achieving it requires long-term thinking, dedication, and patience."[2]. In "Sustainability-Across-The-Curriculum Audit at George Brown College." written by Sandra C. Neill, a professor in the department for Academic Excellence in Ontario, Canada at George Brown College, went through this process. The concern of this audit was rather simple, using Sustainability Tracking Assessment and Ratings System (STARS), an audit was conducted to view which courses contained the most to the least learning outcomes related to sustainability, this was done across every course offered at the school and then each center/department was compared to each other. For an educational institution to teach students how to do a certain job, sustainability may not be a priority to teach in the classroom, but if an institution aims to demonstrate to students how to work in their field and how to live, then sustainability is the key to linking many aspects together to show a sustainable way to live.

Information about the food people eat should be important to the consumers but in "Public views of the benefits and barriers to the consumption of a plant-based diet", by EJ Lea, it was shown that "the strongest barrier for both university-educated and non-university-educated groups was a lack of information about plant-based diets". Therefore, in most cases, many had not even attempted a more sustainable and healthy diet, due to lack of information not motivation. It was also shown that, "people often face barriers when they attempt to alter their food intake,"[3] which shows that changes to people's diets towards a more sustainable plant-based diet may be difficult. The understanding of sustainable eating, such as a plant-based diet or vegetarianism and veganism, are often misunderstood, but eating less or no meat/animal products is not the only way to eat sustainably. At Bates College, it was shown, that their actions have been contributing to not only saving money, but also in recognition for the school as they have been given the *3 star Certified Green restaurant title*. Some steps that Bates College took were eliminating garbage disposals, daylighting in dining halls, sensor control lights, shade trees, and a take/leave-a-mug programs. Not only did Bates college benefit from these actions, but through purchasing more locally sourced food, the local community and economy benefited as well.[4]

True campus-wide implementation of different sustainable practices spreads the work across the shoulders of many, making it an easier overall job. In "Campus Sustainability Best Practices" by Deval L. Patrick and Timothy Murray, a compilation of different sections with material pertaining to nearly every aspect of what colleges can do to lead a sustainable and educated example for their students was put together. In regard to energy efficiency, ideas such as; having Resident Assistants double check everything is unplugged before long breaks, "power down with X- college"[5]

a period where all electricity is turned off for 30 min on campus and with alumni, computer management systems to shut off/ sleep, and as simple as stickers on light switches/motion sensors.

1.2 Specific Campuses Sustainability Plans and Successes

Emory University's sustainability initiative history begins at first, in the early 1990's. The campus initially only considered recycling initiatives to make the campus more sustainable. Residence Life paid for each individual dorm room to have a recycling bin and had larger receptacles at the ends of the hall for students to empty their bins. Brochures about recycling were then provided to incoming students about how to use their bins. Education is a huge part of this change as it was with Emory University. Still, input variables are easier to control than output variables. If the college were to also provided students with reusable water bottles with their brochures, there would be less recyclables to dispose of in the first place.[6]

Another study was conducted at the University of Vermont through 2012 and 2013 in which a water bottle ban was put into place for the spring semester of 2013. In other words, water bottles were not sold on campus. Interestingly enough, the results of this ban led to a higher shipment of bottled beverages on campus per capita and a higher consumption of unhealthy beverages. Thus, the reverse effect of the ban occurred. One reason why this input control could have failed could be due to the fact that the change was just too extreme. Thus, a more gradual shift to a water bottle ban on campus might have been be more successful. Plus, whenever a change is made on a college campus, it is hard to predict its effects. Hence, it is crucial that student and faculty feedback after the change is recorded and implemented to monitor the success of the change.[7]

With this in mind, a study was conducted at Texas A&M University that determined that there was not a significant correlation between LEED certification (Leadership in Energy and Environmental Design certification distributed by the U.S. Green Building Council) and the thermal comfort of a building. This is because the LEED criteria, focus more on saving energy than on occupant comfort levels. The LEED buildings on campus tried to integrate natural light with artificial light, but this had the potential to produce a high amount of glare. One of the largest complaints amongst students was the controllability of the system. In other words, there was an inaccessibility to thermostats within the classrooms of the LEED buildings. If thermostats were accessible in every classroom, this waste of energy could be reduced manually. Yet, if instructors or students abuse the ability to use the thermostats, this may result in an additional loss of energy as well. Considering that each student living on campus has control of thermostat for their individual dorm rooms, this may be a major source of energy loss on campus. Therefore, the general campus should be educated about the proper use of thermostats and the degree variability for the thermostats should be limited.[8]

Composting is a method used by Kean University to reduce the amount of organic food waste being shipped from the campus to landfills. Their in-vessel composting system can handle up to 1000 lbs. of food scraps a day in addition to 250 lbs. of wood chips that must be added to the composter in order to reduce the odor. The composter aerates the compost every 15 minutes and rotates it every hour with the compost remaining in the composter for only 5 days. The resulting compost must then sit for another 20 days to decompose because its ammonium content is much too high before it can be applied to the soil. However, there is a 6-acre plot of land near campus where all of the composting goes to and in return this farm provides fresh vegetables and herbs to the dining halls and to a farm-to-table restaurant on campus. The composter serves as an educational and work study opportunity as students are paid to operate it. Additionally, the composter brings the campus an annual revenue of about $23,550 based on its cost-benefit analysis, which helps pay for its initial $188,000 cost. Kean's study showed that plants grown in their composted soil yielded more vegetables than plants grown in fertilized soil. However, this system will require cooperation with dining services in order to attain organic food wastes. It is important to show the decision makers on campus how sustainability changes like these will save the school money in the long-run despite their initial costs.[9]

1.3 General Difficulties

Along with collecting research surrounding successful sustainability initiatives and campus sustainability plans, the research also needed to be conscious of difficulties experienced by colleges and universities as they attempted to incorporate initiatives on their campuses. Two of the most common factors identified were time and funding, both of which have been incorporated into the decision-making process. The list of challenges was compiled by performing a literature review of sustainability plans and proposals for other college campuses, much like the one we are trying to create. It has been acknowledged in several articles that sustainability is often not a priority when it comes to university spending. Time is another challenge noted in the article, faculty and staff are busy and hiring more staff is usually not an option. Furthermore, many college students are too occupied with their schoolwork, extra-curricular activities, and

jobs to help mobilize changes on campus. The third challenge worth mentioning was lack of access to data. Different departments across campus hold the information such as budgets and utility bills that might be necessary for conducting research. All of these issues are likely to be faced by us as we compile our data to make a sustainability plan. Fortunately, we have the support of the administration to help us gather the data we need to be successful. However, we should keep these issues, and others mentioned in the article, in mind.[10]

2. Methodology

A recent study explored the importance of a Whole-Of-University approach to improving sustainability efforts on campus. This approach is one that "explicitly links research, educational, operational and outreach activities and engages students in each."[11] The main idea is that it makes students feel more involved in a way that is comparable to faculty and staff. One factor of this approach is bringing sustainability discussions into the classroom. This serves to help students become more aware of what issues they are experiencing in their school. Another factor is a divide and conquer form of research in which students choose aspects of sustainability to research such as recycling, education, or energy usage and they bring their findings together to create sustainability plans.[11] While time constraints have placed some limitations on the ability to incorporate all stakeholders throughout the entire process of developing a sustainable campus plan, our methodology incorporated feedback from various stakeholders and also includes initiatives that will allow for student and campus community members to have direct involvement. The "bottom up" approach was used in this process, this entails the students starting the initiative and bringing it up through the faculty and administration. This approach can be seen as "bottom-up is used to refer to students only,"[12] taking it upon themselves to be the catalyst of the change in the college.

Sustainability assessments should identify important issues, be calculable and comparable, move beyond eco-efficiency, measure processes and motivations, and stress comprehensibility. To move beyond eco-efficiency means to measure the overall contribution compared with a goal versus measuring one aspect. For example, measuring energy conservation is an eco-efficiency indicator while measuring total greenhouse gas emissions and comparing it to a goal of zero is a sustainability indicator. As previous literature has demonstrated, it is important for sustainability plans to provide incentives and considering why and how we plan to make a change towards sustainability, not focus solely on what should be changed.[13]

According to an article in the journal *Integrated Environmental Assessment and Management*, multicriteria decision support tools are often used in environmental management projects because there are factors outside of just the financial requirements that may influence the change. For instance, environmental sustainability changes often impact a wide variety of stakeholders, each with their own individual moral and ethical values. As a result, it was crucial for us to use a decision support matrix to aid in quantifying these values, so that we could decide what changes on campus would be most successful with our users (students and faculty). There is no hard science to making environmental sustainability changes because there are so many different variables to account for that cannot be easily quantified. Still, we believe that our multicriteria decision support matrix combined with the information that we gained from our survey and interviews provides us with the best method of evaluating what changes are the most pressing and practical on campus.[14]

Since King's College is a small school with limited resources as compared to some larger state schools, it was important to use a decision support tool that would give a cost-benefit analysis. A lot of changes that can be made on campus would save the school money in the long run and if this can be shown to the crucial decision makers on campus, it will make implementing the changes that much easier. Moreover, if there is a general concern around campus for these changes that can also be demonstrated to these decision makers, it will create an additional incentive for the changes to take place.

Using a mass email approach, a survey was distributed to the King's College community in an attempt to better understand the campus community and how it views sustainability initiatives. From the survey, we defined what the campus was interested in fixing or changing and what aspects of sustainability the campus community thought could use increased emphasis. Additionally, interviews were conducted in person to identify and rank attributes that are used when deciding on changes to implement. Each interviewee had a key role on campus and unique perspective on sustainability of the campus. During the interviews, those key members on campus ranked different decision criteria, and these rankings were later averaged. With both of these sets of data collected, the data was combined to create a "middle-ground" and to produce a multi-criteria decision support tool.

3. Data Collection

In order to create a decision support matrix, data was collected through two different methods in order to identify practical short-term and practical long-term solutions. First, a survey was distributed electronically via email to every current student, staff, and faculty member at King's College. In total, the survey was left open for three weeks and received 355 responses, which was deemed to be an acceptable sample size. In order for the survey to achieve an acceptable sample size, responses were needed from at least 10% of the people to whom the survey was distributed. Considering that King's College community has total population of about 2,850 people, the survey gave an accurate representation of the users on campus for the environmental changes to be made. Additionally, the survey had a total of 28 questions that varied across the four main identified areas of sustainability plans from other college campuses: recycling, water usage, energy usage, and education about sustainability. The responses of the users were implemented into the scaling of the decision support matrix for each of the environmental changes that were proposed based upon sustainability plans from other college campuses.

Furthermore, key community members were interviewed in order to create a better understanding for what changes the campus could practically achieve in the short-term and long-term. The interviewees included the president of the school, the dean of students, the head of the environmental department, and the sustainability department coordinator. Each interview was conducted in person and lasted about 30 minutes. In addition to questions specified towards each of the proposed changes, each interviewee was asked to rank from most important to least important the seven implementation criteria to be used in the decision support matrix (7 being the most important and 1 being the least important), shown in Table 1. The implementation criteria included the financial restrictions of the college, how much time it would take to implement a change, the impact that a change would have on the campus, the impact that a change would have on the community, how much a change would have to be marketed in order to achieve its maximum benefit, how visible the change would be on campus, and the labor or maintenance that would be required to create and sustain the change. The rankings from each interviewee were averaged to create a final ranking of the implementation criteria that was used in the decision support matrix. For each of the implementation criteria for each proposed change, a number value was assigned, shown in Table 2. Table 2 outlines how a 0, 1, 2, and 3 was defined for the financial criteria. Similar definitions were developed and utilized for each of the other 6 decision criteria. This value was multiplied by the ranking of the implementation criteria and for each change, the values were added to create a total value.

Table 1. Ranking of different attributes.

Financial	6
Time	1
Campus Impact	7
Community Impact	5
Marketing	2
Visibility	3
Labor / Maintenance	4

Table 2. Example implementation scores for financial criteria.

Financial	
> $5,000	0
$2,000 - $5,000	1
$500 - $2,000	2
< $500	3

4. Analysis

Based upon the results of the survey, it was found that recycling was the most important area of sustainability on campus that the users wanted to see changed according to 34.9% of participants in the survey, followed by energy usage (24.5%), education (18.9%), and water usage (10.7%). The compiled results from this survey question can be viewed in Table 3. Therefore, proposed changes that fell under the area of recycling received higher scores for the campus impact implementation criteria along with the visibility of the change on campus. The lack of recycling receptacles around the campus and poor advertisement for what can and cannot be recycled was a major issue that the survey participants identified.

Moreover, it was found that the campus impact of a change was the most important implementation criteria according to our interviewees, receiving a score of 7. This was followed by financial restrictions, community impact, labor/maintenance, visibility, marketing, and time respectively. Since King's College is a relatively small tuition-based private school, it was obvious that the monetary requirements of a change were going to be the one criterion that would restrict the proposed changes from coming into fruition the most. However, since campus impact was identified as the most important implementation criteria, the funding for the certain changes will be there as long as enough students show a strong interest in making the change. The completed multicriteria decision support matrix can be seen in Table 4.

Table 3. End user sustainability areas of concern based upon survey data.

Recycling	34.9 %
Energy Usage	24.5%
Education	18.9%
Water Usage	10.7%
Other	11.0%

Table 4. Multicriteria decision support matrix filled out with values found in data.

		Education				Recycling				Energy Usage				Water Usage			
		Importance of Sustainability	Community Outreach	Sustainable Eating Initiatives	Campus Garden	Improved Signage	Increase # of Receptacles	Replace Paper Towels		Replace Lights with LED Lights	Automatic Lighting	Indoor Climate Regulation	Solar Panel Installation	Use of Reusable Water Bottles	Bottle Refill Water Fountains	Less General Water Usage	
Financial	6	3	2	3	1	2	1	2	-	2	1	1	0	1	0	3	-
Time	1	3	1	2	2	3	3	2	-	2	2	1	0	3	2	3	-
Campus Impact	7	3	2	3	3	3	3	3	-	3	2	2	3	3	3	3	-
Community Impact	5	1	3	1	3	3	3	2	-	1	1	1	3	1	3	1	-
Marketing	2	3	2	2	2	1	1	3	-	3	3	3	3	1	3	2	-
Visibility	3	2	0	2	0	3	3	3	-	2	3	3	2	2	3	1	-
Labor / Maintenance	4	3	3	0	1	3	3	2	-	1	2	2	0	3	2	3	-
Total	-	71	58	56	52	74	68	68	-	56	57	49	48	55	61	66	-

5. Conclusion

If a proposed change scored a 60 or above on the decision support matrix, it was placed into the short-term plan (changes that can be made within a single academic year). Proposed changes that scored higher on the decision support matrix were considered to be more practical and to bring about a greater benefit for the King's College community. Environmental changes that scored lower than 60 on the decision support matrix were placed within the long-term plan (changes that will take multiple academic years to complete). It is important to note that the decision support matrix was developed specifically for King's College. Therefore, it should be modified before applying it to other campuses and institutions.

With that in mind, the proposed changes that scored the highest on the decision support matrix at 74 was improved signage around campus on recycling bins. A general conception around campus was that King's does not recycle or hardly recycles at all. Students and professors often have a hard time finding recycling bins and when they do, they have no idea as to what can and cannot be recycled. To alleviate this issue, improved signage over or on recycling receptacles would not only show where to recycle, but what to recycle. These signs are to promote that King's College uses single-stream recycling, meaning that aluminum cans, glass, plastic, cardboard and paper can all be recycled into the same receptacle. This change goes hand-in-hand with the proposed change to add more recycling receptacles on campus which was tied for having the third highest score on the decision support matrix at 68. One area on campus that was most in need of increased signage and additional receptacles was the dorm rooms on campus. Each on-campus living building typically had just two recycling bins per floor at the ends of the hallways. Ideally, every dorm room on campus would have its own recycling bin, but this change will have to be implemented over time for financial reasons. Yet, the addition of more receptacles around campus is a change that can at least be started within a single academic year and can be continued to be carried out in years to come.

Additionally, the general education of students on the importance of sustainability scored the second highest on the decision support matrix with a score of 71. This change aligns very closely with the college's mission statement that is to "teach students how to make a living and how to live." Creating this change will not be too much of a financial or time burden as it can be as simple as posting signs around campus or on the multimedia video boards around campus with facts about the importance of environmental sustainability. Furthermore, this change could be implemented through Earth Day activities or a lecture. On top of this, we plan on talking to freshmen in their First Year Experience class about the importance living a sustainable life. In the future, when the funding is available, freshman could also be provided with reusable shopping bags and reusable water bottles during their orientation weekend. Creating a general awareness among students about the consequences of their actions on the environment is crucial no matter what their major is because it is a universal and real issue in every single occupation.

Lastly, the education about sustainability through the campus garden scored low on the decision-support matrix with just a score of 52. One reason for this is that many students on campus are unaware that King's even has a campus garden because it is located in a space that isn't very visible to the public. There are also financial burdens associated with the maintenance and growth of the garden and adding more beds. However, just because a change is a long-term goal, does not mean that it cannot start to be implemented. To help alleviate the burden of maintaining the garden, a water collection system was designed and placed in the garden by an engineering class at King's. The ultimate goal of the garden is to expand to the point at which it can provide the campus cafeteria with a source of fresh produce to use. This will teach students the importance of eating locally sourced foods and less meat to reduce their carbon footprint.

6. Future Research

There may not be a perfect decision support tool, but following a structured procedure will allow the best and most informed decisions to be made. It is essential that feedback from students and faculty is consistently taken into account when implementing new environmental changes on campus. As a result, a short survey will be distributed electronically through email as done in the original survey at the end of each of the next two semesters or after each new sustainability change was implemented on campus. This research will provide us with additional information to guide the direction of our changes and may help in gaining additional support to further some of our changes as well. In addition to the survey, continued communication between key faculty members on campus, such as the sustainability department coordinator and the students, will be crucial in implementing the changes on campus. Together, as a community, we can make the necessary changes to address the issues of environmental sustainability on our campus.

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