

Sustainable Behavior and Social Responsibility among College Students

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Many construction related training and education programs in the U.S. have now embraced the concept of sustainability, offering sustainable construction courses that highlight sustainable design and construction practices. These courses generally focus on green building strategies for design and construction of built environments, such as site selection, water efficiency, energy, and materials and resources. This study examined the levels of sustainable behavior and social responsibility among U.S. college students enrolled in construction related courses. A structured questionnaire was developed to determine whether sustainable construction education supports sustainable behavior and helps developing knowledge on sustainability issues. Sustainable construction education is not limited to delivering information about green building strategies used in the design and construction of sustainable buildings, but it also incorporates general sustainability knowledge and ethical concepts. This study hypothesized that students who have engaged in sustainable education are more open to adopting sustainable consumer behavior than students who have not as well as understanding sustainability in relation to the associated benefits to society. The findings of this study will provide support for the growing importance of sustainable education in higher education and offer insights for assessing curricular quality on how to balance technical and social perspectives in sustainability education.

Keywords: Sustainability Education, Sustainable Consumer Behavior, Sustainable Construction Education

Introduction

Since the World Commission on Environment and Development (Brundtland Commission, 1987) presented the new concept of sustainable development in 1987, sustainability has been used as a successful approach to shaping the international agenda and the international community's attitude towards economic, social and environmental development. According to the fifth Assessment Report of Intergovernmental Panel on Climate Change (IPCC) in 2014, global warming will displace millions of people, trigger falling crop yields, stoke conflict, and cost trillions of dollars in lost economic output, while poverty and economic shocks emanating from climate change will have a significant impact on migration, increasing the risks of violence from protests and civil or international conflicts (Hannum, 2014). Reflecting the trend of sustainable development, K-12 education currently focuses on core subject mastery and testing in order to instill and expand sustainability education (Church and Skelton, 2010). Many higher educations have also integrated sustainability into college curricula (Kevern, 2011) because higher education's responsibility is to continuously challenge and critique value and knowledge claims that have prescriptive tendencies.

Since U.S. Green Building Council (USGBC) launched Leadership in Energy and Environmental Design (LEED) version 1.0 in 1998 and version 2.0 in 2000, the certification system has grown to include a portfolio of nine rating system products that serve specific market sectors in the construction industry (Richards, 2012). LEED has grown to become the world's most widely used green building rating system, with nearly 80,000 projects participating in LEED across 162 countries, including more than 32,500 certified commercial projects (Green Building Council, n.d.). In accordance with the trend in the construction industry, an increasing number of construction related programs in the U.S. are embracing the concept of sustainability, offering sustainable construction courses that highlight sustainable design and construction practices. These courses have mainly focused on green building strategies for design and construction of built environments, such as site selection, water efficiency, energy, and materials and resources, and indoor environmental quality for students' career development and technical knowledge, rather than politics, regulations, green movement, and social responsibility. Similar to most engineering intensive program for the career development in higher education, sustainable construction education is generally centered on developing the ability to apply current knowledge of sustainable building and adapt to emerging applications of mathematics, science, engineering, and technology. Additionally, it also requires improving the ability to understand professional, ethical, and social responsibilities in preparing individuals for productive contribution through character development. With this background information, this paper examined levels of sustainable behavior and social responsibility among U.S. university students enrolled in construction related courses. In general, sustainable consumer behavior involves taking into account public consequences of consumption or attempting to use individual's purchasing power to create a social change (Webster, 1975). In other words, this behavior can improve social and environmental performance in the public as a global citizen. Based on this concept, this study hypothesized that "students who have engaged in sustainable education are more open to adopting sustainable consumer behavior than students who have not" as well as understanding sustainability in relation to the associated benefits to society. To test this hypothesis, the study surveyed college students using a structured questionnaire in construction related major including construction management, civil engineering, and airport management and development in two different universities.

Survey Design Sample Collection

Sample data were collected using a questionnaire survey administered during randomly selected regular classes at two regional universities located in the southern U.S. This survey was approved as a human subject exempt research by the IRB. A total of 95 students participated in the survey. According to Cohen's study (Cohen, 1992), the collected dataset of 92 samples is considered the effect size falling between medium and large. The sample size of 95 would be reasonable when assuming a significance level of 5% and a power of 80%. All data collected from the sample were used to measure the constructs in our study. Forty two students from the sample have taken sustainability courses during their university education and most students were familiar with the concept of sustainability although they have not taken any sustainability courses before.

Questionnaire Design and Sample Measure

The questionnaire consisted of three major parts. The first part of the questionnaire contained several questions about the respondent's general information such as their current academic standing, gender, major, age group, and green project involvement (i.e., whether they have experience in any sustainability projects). This part was designed to explore the difference in the level of sustainable consumer behavior across groups based on gender, academic standing, age group, etc. The second part of the questionnaire was created to determine the level of sustainability education and environmental concern and was divided into three sections; 1) general question, 2) objective knowledge, and 3) subjective knowledge. The general question section involves students' perception on the

environment including recognition of sustainability concept and experience of taking the sustainability course. The second section consisted of objective knowledge questions in order to examine knowledge acquisition from taking the sustainable construction course. The third section is designed to examine respondent's subjective knowledge, individual's perception of his/her own knowledge. Objective knowledge can simply refer to knowledge of an objective reality that refers to anything that exists as it is independent of any conscious awareness. Subjective knowledge would then be knowledge of any subjective reality that includes anything depending upon some (broadly construed) conscious awareness of it to exist (Wrenn, n.d.). These objective and subjective knowledge questionnaires are employed to explore respondents' perceptions on adopting sustainable consumer behavior precisely. The last part of questionnaire explored the main objective related to consumer behavior and was used to test the hypothesis, "Students who have engaged in sustainable education are more open to adopting sustainable consumer behavior than students who have not".

All questions in part two and three were based on seven-point Likert scales (e.g. 1 = strongly disagree to 7 = strongly agree or 1 = very unconcerned to 7 = very concerned, depending on the type of question) except objective knowledge questions in the part two. These questions consists of true/false and multiple choice questions.

Results and Interpretation

Respondent Information

According to the Construction Chart Book (2007), ten percent of construction workers are women, with 74 percent of them being in the managerial or support staff position. In line with this finding, our sample consisted of mainly male respondents which was approximately 84 percent. The sample gender distribution also reflects the gender imbalance in universities because construction or engineering major students are predominantly male. Among our sample, 77 students were majoring in construction management, 9 students in civil engineering, 5 students in airport management and development, and 2 students in undecided major. Regarding GPA, 8 students did not want to indicate their GPA, and none had less than 2.0. Predominant age group was 20 to 22. Most students did not have any construction work experience. For this reason, only a limited number of students had been involved in a green building project previously.

Level of Sustainability Education and Environmental Concern

The second part of the questionnaire was developed to understand individual's level of sustainability education and environmental concern and consisted of three sections: 1) general, 2) objective knowledge and 3) subjective knowledge. In the general section, the results showed that most respondents recognized the concept of sustainability. Three students who did not recognize the concept had not taken any courses related to sustainable construction before. 56% of the students responded that they had taken a course related to green building practice. Almost half of the respondents had not taken the green building course because the sustainable construction course is generally offered at junior or senior level in their curriculum.

General Questions for Sustainability Education and Environmental Concern

The second part of questionnaire in the general section addressed the level of sustainability and environmental concern. Questions of section 1 in part II were about general environmental concern with water, air pollution, and water usage. Seven point Likert-scale were used and the results are shown in Table 1. Environmental concern is often identified as a general attitude (Dunlap & Van Liere, 1978; Arcury & Christianson, 1990 cited in Fransson and Garling, 1999). Although most respondents expressed high levels of concerns selecting Likert scales from 4 to 7 mainly on questions, the result does not indicate that they always perform sustainable consumer behavior. The average score of sustainable consumer behavior was 5.31 out of 7.0.

Table 2

Summary of the Survey Results: Questionnaire Part II-Section 1: Level of Environmental Concern

Questions	Level of Environmental Concern						
	Very Unconcerned (1)	2	3	4	5	6	Very Concerned (7)
General Environment	2 (2.11%)	3 (3.16%)	6 (6.32%)	19 (20.00%)	29 (30.53%)	22 (23.16%)	14 (14.74%)
Water and Air Pollution	1 (1.05%)	4 (4.21%)	4 (4.21%)	15 (15.79%)	25 (26.32%)	28 (29.47%)	18 (18.95%)
Extravagant Water Usage	3 (3.16%)	6 (6.32%)	6 (6.32%)	26 (27.37%)	18 (18.95%)	18 (18.95%)	18 (18.95%)

An independent two-sample t-test was conducted to compare the level of environmental concern among students who have engaged in sustainable education and students who have not. In contrast to our expectation that sustainable construction education would result in a higher level of concern for the environment, statistical results showed that the level of environmental concern of students who have engaged in sustainable education ($M=4.82$, $SD=1.36$) were significantly lower than that of students who have not ($M=5.33$, $SD=1.04$); $t(92)=2.09$, $p=0.04$. This may indicate that educational background is not a strong factor in shaping attitudes toward sustainability issues.

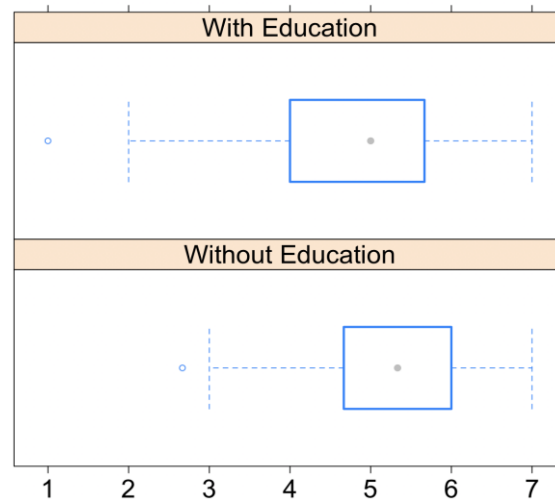


Figure 2: Statistical Distribution of Level of Environmental Concern

Objective Knowledge

The second section of Part two explored students' knowledge retention based on their experience of taking the sustainable construction course using true/false and multiple choice questions. Questions that were used to measure objective knowledge were directly taken from LEED Green Associate Exam Prep Course – Sample Questions from GBC Council in Illinois Chapter. Although 44 percent of students have not taken a sustainable construction course directly as indicated in the previous section, the overall result was disappointed. The average was only 54.0%. In addition, no statistical evidence was found to claim that the objective knowledge scores differ significantly between

the two student groups divided based on whether they have taken the sustainable construction course. The questions used were directly related to specific knowledge needed to pass the LEED Green Associates exam and limited to LEED certification rather than general sustainable construction education. The insignificant difference in objective knowledge scores may have been resulted from the limited ability of our instrument to assess students' knowledge level. As seen in Figure 2, there was little difference in objective knowledge between two groups. From the independent two-sample t-test results, we also confirmed that the difference is insignificant- students who have engaged in sustainable education ($M=0.53$, $SD=0.27$) and students who have not ($M=0.51$, $SD=0.20$); $t(92)=-0.57$, $p=0.57$.

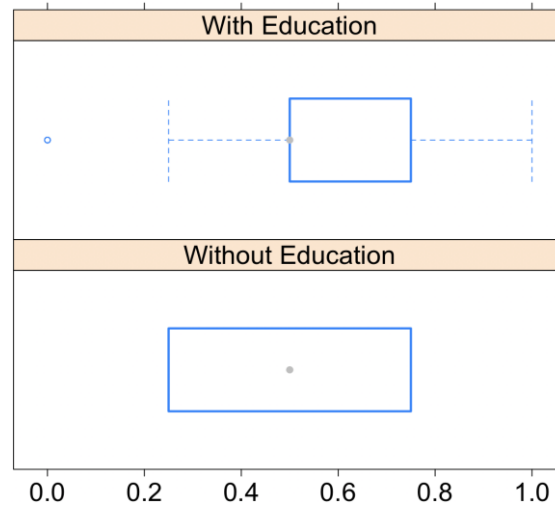


Figure 3: *Statistical Distribution of Objective Knowledge*

Subjective Knowledge

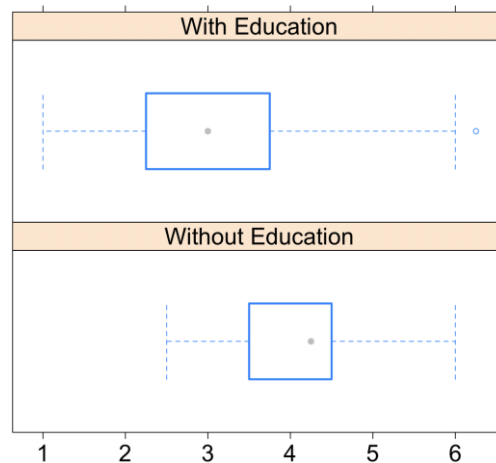
This section of the survey was measured by respondents' self-assessment of knowledge and familiarity toward sustainable design and construction for USGBC LEED, Green Globe and Envision. The results are shown in Table 2. Unlike responses reported in part II-section 1 regarding level of environmental concern, the distribution of subjective knowledge scores was found to be skewed toward the negative perspective. Respondents seem to lack confidence in sustainable design and construction, in spite of the fact that they expressed high levels of environmental concern, as evidenced by an average score of 3.52 of subjective knowledge.

*Table 3**Summary of Survey Results: Questionnaire Part II-Section III: Level of Subjective Knowledge*

Questions	Self-Assessment of Sustainable Design and Construction						
	Strongly Disagree (1)	2	3	4	5	6	Strongly Agree (7)
Knowledge	9 (9.47%)	18 (18.95%)	28 (29.47%)	24 (25.26%)	12 (12.63%)	4 (4.21%)	0 (0%)
Familiarity	10 (10.53%)	13 (13.68%)	17 (17.89%)	19 (20.00%)	15 (15.79%)	10 (10.53%)	11 (11.58%)
Confidence	13 (13.68%)	22 (23.16%)	22 (23.16%)	21 (22.11%)	7 (7.37%)	9 (9.47%)	1 (1.05%)
Technical Communication	12 (12.63%)	14 (14.74%)	21 (22.11%)	21 (22.11%)	11 (11.58%)	12 (12.63%)	4 (4.21%)

On the general section of Part II, about half of the respondents (44%) said that they had not taken any sustainable construction course at the time of the survey. The average score for subjective knowledge was found to be 3.52 leaning toward a negative perception of their own knowledge related to sustainability.

Similar to the previous sections, an independent two-sample t-test was conducted to compare subjective knowledge scores between the two student groups. As shown in Figure 3, there was a significant difference in subjective knowledge for students who have engaged in sustainable education ($M = 2.99$, $SD = 1.35$) and students who have not ($M = 4.14$, $SD = 0.99$); $t(92) = 4.78$, $p < .001$. Interestingly, the results suggested that students who have not taken any courses related to sustainable construction have higher levels of subjective knowledge than students who have.

*Figure 4: Statistical Distribution of Subjective Knowledge*

Sustainable Consumer Behavior

This section explored the hypothesis of this study, “Students who have engaged in sustainable education are more open to adopting sustainable consumer behavior than students who have not”. In other words, we believed that any academic curriculum, which is ultimately related to sustainability has the potential to influence individual’s behavior and attitude towards the environmental movement. Part III questionnaire developed measures for sustainable consumer behavior based on dimensions of environmentalism used in previous research (Stern et al., 1999).

An independent two-sample t-test was conducted to compare sustainable consumer behavior among students who have engaged in sustainable education and students who have not. Similar to the unexpected results in the previous sections including level of environmental concerns and subjective knowledge, statistical results showed that the scores of sustainable consumer behavior for students who have engaged in sustainable education ($M = 3.17$, $SD = 1.46$) were lower than those of students who have not ($M = 3.78$, $SD = 1.29$); $t(92) = 2.16$, $p = 0.03$.

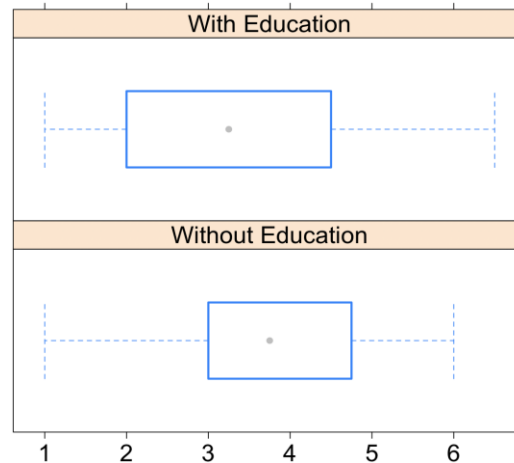


Figure 5: Statistical Distribution for Sustainable Consumer Behavior

Conclusion and Discussion

The environment is a major concern in communities around the world due to our growing awareness of global warming, climate change, air pollution, desertification, and the loss of biodiversity. Considerable efforts are being devoted to encouraging the adoption of the concept of sustainability to minimize our impact on the environment and maximize the resulting social and economic benefits. In the light of the challenges and issues associated with construction activities, the building industry has begun to develop more sustainable construction methods. Many construction related programs in the U.S. are also developing and offering courses that highlight sustainable design and construction practices. In spite of the growing interest, very little has been known about the effects of sustainability education on students' perception on related issues. Understanding college students' perceptions of sustainability is important because they will shortly become the generation who is responsible for driving the economy and maintaining a sustainable society (Jeong et al., 2016).

The findings of this study suggests that the following statement cannot be supported "a person who has engaged in sustainable education is more open to adopting sustainable consumer behavior than a person who has not". This suggestion would be especially true if sustainable education in construction related majors mainly focus on the improvement of technical knowledge and career development.

The relationship between attitude and behavior is imperfect until knowledge of a certain fact has influence on attitude (Fransson and Garling, 1999). In the other words, students who engaged in sustainable construction education may not have a specific factor that contributes or motivate themselves to perform sustainable consumer behaviors. However, students will not have a negative attitude towards sustainable consumer behavior because there is a social consensus on the need for sustainable behavior in the global community. The study's findings suggest that sustainable construction education in engineering related courses needs to incorporate sustainable philosophy and ethical concepts in conjunction with sustainable related technology and its implementation in the construction industry. It is very important to obtain technical knowledge of sustainability as a construction professional, but we also need to understand the original concept of sustainability that encompasses ideas, aspirations and values that

continue to inspire public and private organizations to become better stewardship of the environment and that promote positive economic growth and social objectives. These results imply that sustainable education in engineering-related courses is in need for further enhancement in regard to sustainability. In particular, the education necessitates focusing more on incorporation of sustainable philosophy and ethical concepts that can possibly increase students' awareness/ familiarity on environmental and other ethical issues. Pursuit toward sustainability will create and maintain the conditions under which humans and nature can exist in productive harmony in order to support present and future generations (US EPA, n.d.). The improvement and social consensus of sustainable consumer behavior can contribute to what we need for our survival and well-being in sustainable development indirectly or directly.

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