

## Article

# Students' Assessment of Campus Sustainability at the University of Dammam, Saudi Arabia

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**Abstract:** Higher education institutions are major drivers of change in achieving environmental sustainability both within college campuses and beyond campuses in communities at large. However, achieving campus sustainability is not possible without the involvement of students as one of the major stakeholders of a university. Based on survey of 152 students of the College of Architecture and Planning, University of Dammam, Saudi Arabia, this study explores students' assessment of campus sustainability components: curriculum and research; campus operations; and community involvement. The results show that even though the students indicate a great deal of awareness and concern about campus environmental sustainability, they lack interest and willingness to participate in initiatives towards achieving sustainability. Apart from some sustainable landscaping and waste recycling practices, there are few sustainability initiatives in transportation and energy and water conservation on the campus. Offered courses and student projects have also been reported to have modest focus on sustainability. The article concludes by highlighting the roles of incorporating sustainability into campus operations, and training university students in promoting environmental sustainability in Saudi Arabia and the Middle East.

**Keywords:** sustainability; environment; Dammam; university students; education; campus

## 1. Background

As a result of the realization of the importance of higher education institutions (HEIs) in promoting environmental sustainability, numerous universities around the world have within the last two decades been implementing initiatives to become sustainable. Universities are now restructuring their curriculum, research agenda and community services to focus more on sustainable development (SD) and have incorporated sustainability into campus development and daily operations [1–3]. This is based on the realization of the need to reduce the impacts of campus activities and operations on the environment and to train students to gain sustainability literacy and embrace sustainable behaviors [4,5]. In the US alone, over 300 HEIs have conducted campus sustainability assessments within the period of five years and hundreds more have planned to do so [6]. Commitments to sustainability by HEIs also resulted from voluntary decisions by university management (through pledges and signing of declarations) as well as from pressure mounted by regulatory agencies, funding organizations, student activism, NGOs, and parents [7,8].

Nevertheless, few universities in the developing countries, especially in the Middle East, are making the necessary adjustments to reduce the negative impact of campus operations on the environment and incorporate sustainability into their systems. Even in the few cases where attempts are being made to implement some sustainability initiatives, the efforts are highly centralized without students' and other stakeholders' involvements, which render the initiatives insufficient to insufficient

to contribute to the transition to a sustainable society [9]. Thus, several scholars have called for a more inclusive and “whole-of-university” approach to achieving sustainability and to rethink how higher education can address sustainability issues not only within the curriculum and research, but also via community outreach, collaboration, as well as through the participation of the various university stakeholders [10–12].

Indeed, achieving campus sustainability more effectively is not possible without the cooperation and involvement of all stakeholders such as students, faculty and staff, university management, funding agencies, and the community [13,14]. In developing countries the training and involvement of university students in environmental education have been largely neglected, leading to some scholars criticizing higher education for producing graduates who are ill-equipped to tackle the serious sustainability problems humanity now faces [15,16]. Given that students are among the key university stakeholders, understanding their perceptions about and their involvement in environmental sustainability may give insight into whether or not and how a university is likely to employ sustainable practices [17,18]. The importance of students’ involvement in “campus greening” has led to interesting initiatives such as the “Platform Information, Awareness, and Assessment of Sustainability at the University” and the “Sustainability Test”, which originated from a cooperation project between the Autonomous University of Madrid and the University of São Paulo in Brazil (<http://www.projetosustentabilidade.sc.usp.br/index.php/eng>).

Previous studies that investigated college students’ perception and assessment of environmental sustainability or their roles in promoting campus sustainability are largely concentrated in the West and developing countries outside the Middle East. Examples of such studies were conducted in several universities in USA [4,17,19], Europe—such as in Germany [15] and UK [13,20]—and in Australia [21]. In all these studies, students are quite aware about and are willing to support and participate in sustainable initiatives at their colleges/universities. The studies also reported that the HEIs have implemented sustainability issues related to campus operations that include energy efficiency and waste recycling, building construction and renovation based on green design principles, and have promoted sustainable transport for students. Whereas in the developing countries, similar studies include an assessment of students’ perceptions of some factors contributing towards higher education for SD in a university in China [9], research about the perceptions of students of a Malaysian university towards factors of a sustainable university [22,23], and a survey of students’ perceptions of sustainability and changing life styles of a technical university in Turkey [24].

Despite the importance of university campuses in promoting environmental sustainability, there is no known study in Saudi Arabia that explores students’ perception about environmental sustainability or their involvement in campus sustainability efforts. As such, this study attempts to fill this gap using University of Dammam as a case study. This study is very important because of the ongoing ambitious projects of establishing HEIs to cater for the country’s rapidly growing younger population that constitute more than half of the national population. Given that most of these Saudi HEIs are in infancy, it is high time to utilize the educational sector to play a key role in realizing the goals of achieving SD and protecting the environment and natural resources as part of the ninth five-year National Development Plan. Further, given that the education system and campus sustainability efforts in the country are largely top-down without sufficient regards for students’ involvement in sustainability decision making, this study thus presents an opportunity to convey the best practices of universities in more developed countries into the Saudi Arabian context.

The article has been organized in the following way. The next section reviews the role of HEIs in promoting environmental sustainability and presents a brief overview of the Saudi Arabian university system. This is followed by the methodology and then the results and discussion sections. The paper concludes by highlighting the role universities in Saudi Arabia could play in training future decision makers to confront the environmental challenges of the 21st century.

## 2. Higher Education for Sustainable Development (SD)

The 1987 Brundtland Report defines the term sustainable development (SD) as the development that “meets the needs of the present generation without compromising the ability of future generations to meet their needs” [25]. The concept is often used interchangeably with that of sustainability, which strives to promote the continuity of ecological, economic, institutional, and socio-cultural aspects of our societies. Sustainability is envisioned to be an avenue for preserving natural ecosystems and biodiversity while meeting our material needs, transforming cultures and solving some of our society’s complex problems while collectively planning and acting to maintain the societal aspects far into the future [26]. Sustainability affects every level of organization, from the local neighborhood to the entire planet.

Not just for cities and towns, incorporating sustainability into university systems has become a necessity given the significant environmental impacts of complex and large-scale activities and operations taking place on campuses, whose costs need to be avoided, hence universities are no longer overlooked in terms of environmental responsibility [8]. The specific roles of universities in promoting SD have been highlighted in several significant declarations such as the Talloires Declaration in 1990, Agenda 21 in 1992, the Kyoto Declaration in 1993, Global Higher Education for Sustainability Partnership in 2000, the Luneburg Declaration in 2001, the Sapporo declaration in 2002, Graz Declaration in 2005, Abuja Declaration on Sustainable Development in Africa in 2009, the Rio+20 Higher Education Sustainability Initiative, as well as the UN Decade for Education for Sustainable Development. According to UNESCO, Education for Sustainable Development (ESD) fosters a process of learning how to make decisions that consider the long-term future of the economy, ecology, and equity of all communities [27]. As such, universities worldwide are now becoming more proactive in becoming sustainable and in promoting sustainability via teaching and research, community outreach, and in campus operations [28,29].

A sustainable campus according to Cole and Wright is a community that “acts upon its local and global responsibilities to protect and enhance the health and wellbeing of humans and ecosystems” and advances some ways of addressing our present and future ecological and social challenges ([14] p. 30). Other scholars consider a sustainable campus as a healthy environment with an efficient environmental management and prosperous economy based on energy and resource conservation and waste reduction, and promoting equity and social justice in its affairs and exporting these values at community, national, and global levels [30]. These definitions indicate that campus sustainability requires inclusion of key SD principles not only in the curricula, but also in research and community services. Campus sustainability is also unachievable without incorporating such principles as sustainable water use, energy efficiency in buildings and operations, green transportation, efficient waste management, resource conservation, equity, and minimizing environmental pollution into campus operations [31]. It also requires participatory teaching and learning methods that motivate and empower students and the community to change their behavior and take action for SD [4,28].

The literature review indicates that universities that are committed to becoming sustainable have undertaken several initiatives, which include: (a) formulating and implementing policies and strategies to ensure that environmental issues are managed consistently and systematically throughout the campus in order to reduce environmental impacts and increase operations’ efficiency; (b) greening the curricula and restructuring research such that both focus more on key SD principles such as environmental protection, pollution and climate change, global warming, biodiversity, equity, and poverty reduction, and sustainable energy and resource consumption and training of students to acquire the knowledge, skills, attitudes, and values necessary to shape a sustainable future; (c) community outreach and partnering/collaborating with SD stakeholders (students, employees, other universities, public and private sectors, NGOs) so as to motivate and empower the entire society to change their behavior and take action for environmental sustainability; and (d) sustainability assessments and reporting [8,14].

As highlighted above, higher education is a major driver of change to achieve environmental sustainability, sustainable living, economic opportunities, health, and equity as well as in instilling students with a sense of being responsible global citizens not only on their campuses but also at the societal level [2]. Universities world-wide have been significantly contributing to the promotion of sustainability in many ways. First, they play a leading role as agents of change by preparing most of the professionals that develop, teach, work in, manage, lead and influence society's institutions. Future leaders, entrepreneurs, and decision makers are also educated and prepared by universities. Hence, university campuses are effective avenues for "communicating the value of environmental sustainability to a wide variety of audience" ([30] p. 43). Second, they help coordinate, promote, and enhance the engagement of local authorities, the private sector, NGOs and the public to design and implement local and regional sustainability plans by acting as sources of technical expertise [32]. Lastly, universities contribute to environmental sustainability by implementing sound environmental management systems that reduce the negative environmental impacts of campus operations and improve the efficiency of their systems (transportation, buildings, energy, utilities, *etc.*).

Therefore, developing countries can utilize the ample opportunity presented by HEIs to train their youth and guide their population to understand the importance of sustainability and take action towards a more sustainable future. In Saudi Arabia, there are currently 25 public and 8 private universities, which are supervised and coordinated by the Ministry of Education. As of 2013 a total of 669,271 students, comprised of 62.9% females and 37.1% males, were enrolled in the public universities [33]. The growth of universities, as indicated in Table 1, from just seven about two and half decades ago to the present 33 is a response to the population that is increasing at the rate of 2.9% per annum since the era of oil boom (<http://www.cdsi.gov.sa/english/> retrieved 22 February 2015). Between 2000 and 2010, the number of universities increased by 230% (from 10 to 33), unlike in the preceding decade where the increased was by about 50% (7 to 10). This dramatic increase can be attributed largely to the government's efforts to develop higher education and promote knowledge-based economy in the country as stipulated in the seventh and eighth Saudi Arabia's National Development Plans, coupled with increased national revenue from high oil prices. Thus, the funds earmarked for higher studies, mainly in constructing new and expanding the existing HEIs, have also jumped from approximately 10 billion Saudi Riyals (US\$ 2.67 billion) in 2005 to about SR32 billion (US\$ 8.53 billion) in 2009 ([34] p. 110).

**Table 1.** Growth of universities and colleges in Saudi Arabia, 1990–2010 [33].

Year	Universities			Colleges		
	Public	Private	Total	Public	Private	Total
1990	7	0	7	83	0	83
2000	8	2	10	203	6	209
2010	25	8	33	495	45	540

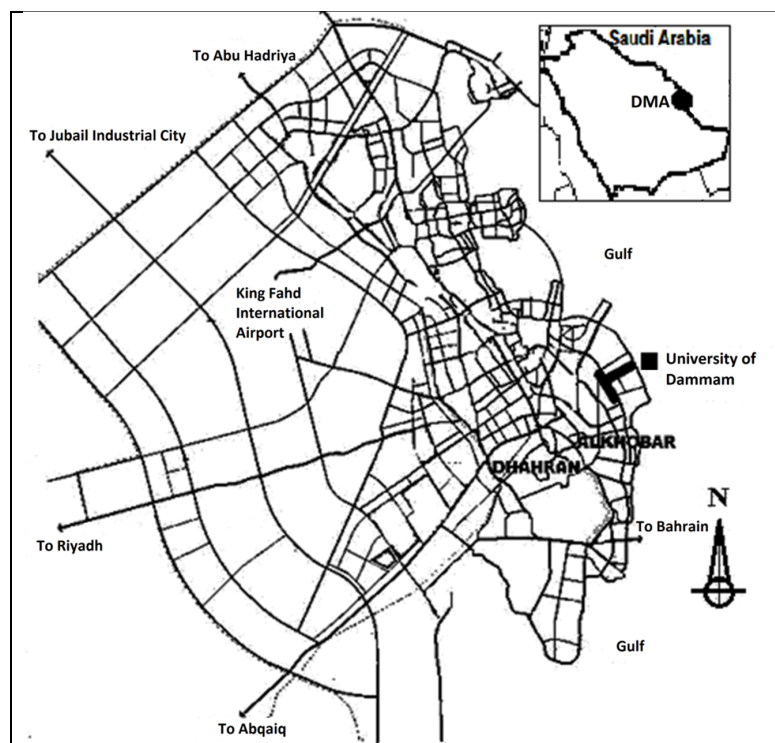
The consequences of rapid and low-density urban growth that Saudi Arabia is experiencing is increasing demand for shelter, energy, and means of livelihood, which calls for the need for sustainable urban development that would not only be harmonious but advances energy efficiency, waste reduction, and intergenerational equity and minimizes natural resource depletion, environmental pollution, and degradation of ecosystem [35]. Hence, one of the ways of achieving environmental sustainability of cities and regions in the country is by integrating sustainability learning opportunities across all higher education subject areas, so that students can be better equipped to deal with sustainability issues in all aspects of life and participate in practices that have widespread influence on global-local futures [36,37]. However, the task of integrating sustainability into HEIs will not succeed without involving the students. Thus, this study aims to use University of Dammam as a case study to explore (a) University students' awareness and concern about environmental sustainability; (b) the extent to which the offered courses are related to sustainability; (c) students' assessments of

whether campus operations and practices are moving toward sustainability; and (d) the availability of on-campus sustainability opportunities to students. The research methods in the following section outlines the way in which this study was undertaken.

### 3. Methods

#### 3.1. Study Area

Founded in 2009, University of Dammam, with a total student population of 34,278 studying in 21 colleges, is the seventh largest university in Saudi Arabia and it is contributing in training about 5.1% of the country's total college graduates [33]. The main campus of the University, covering about 353.69 hectares, is located in Dammam city (Figure 1), the capital of Eastern Province and at a distance of about 5 kilometers from the Arabian Gulf. In its effort to promote campus sustainability, the university has established a Deanship of Community Services and Sustainable Development in 2012. The Deanship is responsible for realizing the University's vision of improving the campus environmental sustainability; motivating faculty members to direct their research towards SD issues; supporting community service; and building strategic partnerships with government bodies organizations and the private sector to foster SD (<http://www.ud.edu.sa/en/administration/deanships/deanship-of-community-services-and-sustainable-development/about>, retrieved: 2 October 2014).



**Figure 1.** Location of University of Dammam in Dammam Metropolitan Area (DMA).

Similarly, the College of Architecture and Planning in the University aims to promote sustainability by educating students to confront the environmental challenges facing the rapidly growing urban centers in the country. The specific vision of the College in this regard is to train “competent professionals in the areas of planning, design and construction of sustainable built and urban environments ... ” as well as to encourage research in these areas (<http://www.uod.edu.sa/en/colleges/college-of-architecture-and-planning/about>, retrieved 12 February 2015).



### 3.2. Data Collection and Analysis

In order to investigate students' awareness/perceptions about sustainability issues and students' involvement in campus sustainability efforts, a survey using a self-administered questionnaire in Arabic was conducted between April and May 2014 in the College of Architecture and Planning of the University. We restricted the study to this college because courses related to sustainability are mainly taught there and the specific attitudes and skills which students of the college are expected to develop are related to planning and designing a sustainably built environment, as highlighted in the college's vision above. Thus, the students of this College are supposed to be more aware about and more willing to participate in campus sustainability initiatives than students from other colleges. This makes this College an exemplary case, and its students worthy of being studied. Another reason for focusing on this college is that a review of implementation of SD in higher education from a survey found that among the least implemented campus sustainability initiative worldwide is the integration of sustainability into courses offered at colleges [8].

The instrument used in the survey is based on the Sustainability Assessment Questionnaire (SAQ) [38], modified in order to remove questions not related to students and to optimize its validity for the Saudi context. The questionnaire assesses students' perception about their university's achievements on some important dimensions of campus sustainability. Apart from the section on demographic information, the modified questionnaire consisted of four main sections. After presenting our working definition of environmental sustainability, the first section explored students' awareness of and concern about environmental sustainability in general (four items). The second section, consisting of three items, investigated the aspect of offered courses and learning that address the issue of environmental sustainability. The third section (five items) examined the perception of students on the extent to which campus operations and practices conform to sustainability principles—garbage recycling, energy conservation, water conservation, landscaping, and transportation. The questions in sections 1–3 were close-ended, requiring responses on a five-point Likert scale (from none to a great deal). The last section (five dichotomous items requiring a “yes” or “no” responses) explored the availability of opportunities of involving students, as stakeholders, in campus sustainability efforts. Indeed, the SAQ questionnaire is an efficient data-collection mechanism when the researcher identifies exactly what is required and how to analyze the variables of interest [39].

Before conducting the survey, the questionnaire was revised by colleagues in the college for suggestions that helped improve the instruments. Also a pilot survey was done with a small sample to check the validity of the questionnaire, which resulted in modifying some of the questions for better clarity. Given a total of 434 students in the college, we intended to cover as many students as possible. Therefore, questionnaires were administered to students by a trained research assistant during their classes to take home, complete, and return to the same assistant or the college secretary. We decided to use classes for distributing the questionnaires because classes are the best avenues for getting access to the students. A total of 271 questionnaires were distributed but only 152 completed the survey and returned the filled questionnaires, resulting in a 56% response rate. The possible reason why only a little over a half of the administered questionnaires were returned is lack of incentives, the need to send reminders, and people's lax attitudes when it comes responding to surveys. The voluntary nature of participation in the study and respondents' confidentiality had been assured.

The survey data were coded (0—don't know; 1—none; 2—a little; 3—quite a bit; 4—a great deal; and 77—missing) and entered into SPSS software for analyses. The ordinal data were analyzed using descriptive statistics, which provided not only explanation of the key variables of the research, but also allowed further analyses. Frequency distributions were converted to percentages to provide a standardized way for comparison between and among the categories.

## 4. Results and Discussion

### 4.1. Demographic Characteristics of Respondents

About 26% of the survey respondents are from the department of Landscape Architecture, 23% are from Urban and Regional Planning, 21% from Building Technology, 16% from Interior Architecture and 14% from Architecture (Table 2). The participants are largely third year (41%), followed by fourth year (39%), and final year undergraduate students (12%). While master's students constitute 9% of the sample, we could not find a PhD student to participate in the survey.

**Table 2.** Distribution of students by departments in the college.

Department	Student Population	Survey Sample
Urban and Regional Planning	104 (24.0%)	35 (23.0%)
Building Technology	93 (21.4%)	32 (21.1%)
Landscape Architecture	61 (14.1%)	40 (26.3%)
Architecture	133 (30.6%)	24 (15.8%)
Interior Architecture	43 (9.9%)	21 (13.8%)
Total	434	152

The distribution of the samples in the college as shown in Table 2 conforms, to some extent, to the population distribution of the students except in the case of Architecture department where the students constitute about 31% of students in the college but form only 16% of our sample. Interior Architecture students also comprise about 14% of the sample though they amount to 10% of the students' population. Lack of representation from PhD students is not surprising given that only the Department of Urban and Regional Planning offers PhD program, the students are very few in numbers and they have individualized schedules.

### 4.2. Students' Awareness and Concern about Environmental Sustainability

This section asked questions about environmental sustainability in general. This is important because appreciating students' awareness, concern, interest and willingness to contribute to sustainability initiatives may give some perspective into the extent to which a university and its students are likely engaged in sustainable practices. The results in Table 3 showed that a large proportion of the respondents (65.0%) expressed quite a bit or a great deal of concern about environmental sustainability. Also, nearly three-quarters (71.5%) and over half of the respondents (57.1%) have reported from a little to a great deal of knowledge about and interest in environmental sustainability respectively. These findings support earlier studies such as a survey of students of a Turkish university that found general awareness of the meaning of SD and some 75% of the respondents perceived that environmental sustainability should be given the highest priority [24].

**Table 3.** Students' awareness and concern about environmental sustainability.

Sustainability Awareness and Concern	Responses				
	Don't Know	None	a Little	Quite a Bit	a Great Deal
Knowledge about environmental sustainability	14.4%	9.2%	30.3%	35.5%	10.5%
Concern about environmental sustainability	6.6%	1.3%	17.1%	29.0%	46.0%
Interest about environmental sustainability	16.3%	14.3%	22.8%	18.6%	15.7%
Willingness to participate in sustainability initiatives	18.4%	30.3%	25.0%	17.1%	9.2%

The most striking result to emerge from the data, and which has never been reported by any previous studies, is when the students were asked about their willingness to participate in planning

and implementing sustainability initiatives, about a third of the respondents (30.3%) answered in the negative, while only about a quarter (26.3%) indicated quite a bit or a great deal of willingness to do so. Possible reason for this finding is the top-down system of decision-making that results in less citizen participation in planning and implementation of urban development projects. Therefore, in essence there seems to be little “knowledge gap” or lack of concern among the respondents when it comes to environmental sustainability, but there is apparently less interest (as only 34.3% of the respondents indicated quite a bit or a great deal of interest in the issue) and less willingness to participate in sustainability efforts on campus. The implication of this is that any effort towards promoting campus sustainability should aim to disabuse the minds of the students to be more active in participating in issues affecting not only the HEIs they are attending but also the communities they live in. Contrary to our findings, a comparative study of two USA universities found that students showed willingness to support and participate in sustainable initiatives [17]. This differing result is not surprising given the top-down system of campus administration and lack of students’ involvement in campus affairs in the developing countries, more especially the Middle East. Cultural differences may also play a role because some students might say they will do something, while not doing it in practice, but some might feel more obliged to do something after saying they would do so.

Most of the survey respondents also appeared to place the responsibility for sustainability on mainly the private sector among the stakeholders of the built environment (Figure 2). Surprisingly, about (51%) believe that the private sector should be responsible for promoting environmental sustainability, followed by the government (22.4%), then everyone (15.8%), and universities (9.2%). About 2.6% of them answered that they “don’t know”. This finding contrast with a comparable study [17] of two U.S. States (Alabama and Hawaii) where more than half of the surveyed college students stated that they agreed or strongly agreed that HEIs and every one should take responsibility for sustainability.

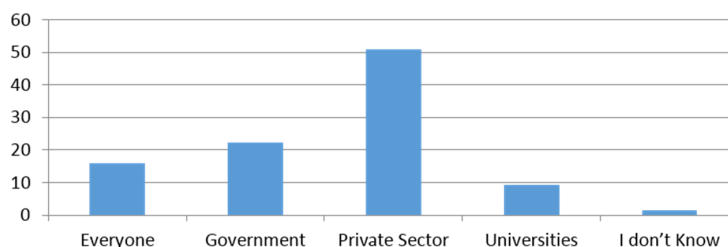


Figure 2. Responsibility for Promoting Environmental Sustainability.

A possible reason for this contradictory result is the dominance of the private sector in real estate, infrastructure construction, and other civil engineering, planning, and architectural works going on in the study area. This might be due to a narrow view of sustainability that does not acknowledge the role of public participation in promoting sustainability and excludes social and institutional issues that the private sector has less role to play compared to the public sector.

#### 4.3. Teaching and Research Related to Sustainability

HEIs aim to educate students to assist in finding solutions for our unsustainable ways of living by embedding environmental education into their system [40]. As such, in order to investigate respondents’ perception about the extent to which teaching and research in the college are related to sustainability issues, three questions were asked. The results in Table 4 indicate that a little over a third of the respondents (36.7%) believed that “quite a bit” or “a great deal” of courses they are being taught address topics related to sustainability. An interesting finding is the perception of close to half of the students (45.2%) that research and projects in their colleges and departments do not contribute to the practices of sustainability, while only 22.6% of the respondents believe that quite a bit or a great deal of the research and projects do so.



**Table 4.** Curriculum and research covering sustainability.

Sustainability in Curriculum and Research	Responses				
	Don't Know	None	a Little	Quite a Bit	a Great Deal
The extent to which your college/department offers courses which address topics related to sustainability	18.4%	13.2%	31.6%	30.1%	6.6%
The extent to which sustainability is a focus integrated into your Bachelor's/Master's/PhD program	15.8%	6.6%	35.5%	30.3%	11.8%
Involvement of your college/department in research and projects related to environmental sustainability	6.8%	45.2%	25.4%	9.7%	12.9%

In terms of the extent to which sustainability is a focus integrated into students' individual degree programs, over three-quarter (77.6%) of respondents acknowledged that "a little" or "a great deal" of sustainability issues have been integrated into their degree programs (Table 4). The implication of these results suggest that there is the need to adjust the curricula of the Bachelor and Master's programs offered in the College to focus more on sustainability by integrating more sustainability courses into the programs [13] and as Chapter 36 of Agenda 21 recommends "reorienting education towards sustainable development" [41]. This is very vital because an educated public is required to carry out informed sustainability decisions that would affect the entire society. There is empirical evidence that even a single course, that encourages more active learning and involves an inquiry based approach, has been effective in positively changing students' perceptions of sustainability [21]. Also, courses must be not only instruments of delivering ESD, but instructors must be centrally involved in developing the concepts, content, pedagogy, evaluation, and research that will support the creation of ESD [7]. Another effective way of implementing sustainability in education at the college and the university levels is to allow students to take elective classes on sustainability, inviting sustainability guest lecturers, fostering the link between the natural sciences, and the social sciences and providing sustainability education to educators [8]. On the area of research, given that the University has established a Deanship of Scientific Research that sponsors research by providing grants, the Deanship should promote more research in the area of environmental sustainability since less than half (45.2%) of the respondents reported that research and projects at college/departmental levels contribute to sustainability practices.

#### 4.4. Campus Operations and Practices Moving toward Sustainability

Students' perception of the extent to which six campus operations and practices (garbage recycling, energy conservation, water conservation, landscaping, and transportation) are moving towards sustainability is reported in Table 5.

**Table 5.** Campus operations and practices moving toward sustainability.

Campus Operational Practices	Responses				
	Don't Know	None	a Little	Quite a Bit	a Great Deal
Energy conservation practices (including lighting, heating, cooling, ventilation, windows)	9.9%	32.2%	23.7%	21.7%	12.5%
Recycling of solid waste (including paper, glass, plastic, metal)	23.0%	26.3%	20.4%	13.8%	16.5%
Water conservation practices (including efficient toilets, minimal irrigation, harvested rainwater)	21.7%	30.9%	19.7%	18.4%	9.2%
Sustainable landscaping (e.g., emphasizing native plants, biodiversity, minimizing lawn, integrated pest management)	7.9%	14.5%	26.3%	27.6%	23.7%
Sustainable transportation program (such as bicycle and pedestrian friendly systems, car pools, bus programs, biodiesel projects)	9.9%	43.4%	21.1%	17.8%	5.3%

Landscaping got the highest assessment score of 23.7% and even after merging the percentages for “quite a bit” and “a great deal” responses, landscaping still ranks at the top with 51.3%. This is not surprising given the visibility of landscaping projects implemented throughout the campus and the daily watering of lawns. A more sustainable approach is landscaping with native plants adapted to arid environment. On the other hand, 43.4% of the students indicated that there is no sustainable transportation program on the university campus, as they commute to the university and move around the campus using their private automobiles. About a third (34.2%) of the respondents agreed that renewable energy generation and utilization is absent on campus. After combining campus operations ranked as moving towards sustainability “a little” or “none” at all, campus transportation still came at the top with 64.5%, followed by waste recycling (59.2%) and then energy conservation practices (55.9%). In contrast with this study, a survey [8] found that energy efficiency and waste recycling are among the main campus operations issues implemented in campuses of most (80%) European HEIs.

The major implication of these findings is the need for the University to improve its operational sustainability performance by designing and implementing interventions that could reduce its institutional ecological footprint [10]. First, based on the survey response about sustainable transportation and authors’ observation, the University management should create a “green” transportation system in the campus. Provision of bus services and pedestrian walkways within the campus, encouraging carpooling and bicycling (when the weather is mild) among the university community and charging for on-campus parking are some of the features of green transportation system that the University should implement. This could mitigate the traffic jam experienced around 7–9 AM around the University campus, and could reduce the emission of greenhouse gases into the atmosphere and the demand for land to provide more parking spaces as students, staff, and faculty travel to the campus by car.

Also, since very few respondents reported that garbage recycling, as a means of fostering environmental sustainability, exist on campus, the university could promote recycling or reuse of everything from paper and plastic bottles to student furniture. Strategically placing bins in residence halls, academic buildings, and along sidewalks to collect recyclable materials, and end-of-semester events for students to pass on used books and furniture to future students are efforts reported to not only promote environmental sustainability but to also inculcate sustainable behaviors among students [18].

Similarly, as participants stated that building construction and renovation are not adequately based on green design principles and that there exists little energy conservation practices on campus, there is the need for investment to improve on these areas. This is because these issues have been identified as key factors of a sustainable university [23]. Another way to move campus operations and practices closer to sustainability is for the University to create opportunities where students could participate in greening of campus initiatives such as recycling by themselves [16].

#### *4.5. Sustainability Opportunities Available to Students*

Given that a university that is committed to sustainability provides students with specific on-campus opportunities and experience to participate and contribute in making the institution more sustainable [20], this section reports students’ assessment of these issues. Out of the six listed sustainability opportunities the only opportunity that more than half of the respondents (61.8%) reported being available to them is job fairs and career counseling focusing on sustainable enterprises (Table 6). A possible reason for this finding is that based on authors’ observations the job fairs organized annually by the University are dominated by private sector companies that deal with green buildings construction.

**Table 6.** Sustainability opportunities available to students.

Sustainability Opportunities Available to Students	Response	
	Yes	No
Student Environmental Center	26.3%	73.7%
Ecology Hostel/House or Sustainable Dormitory	28.3%	72.7%
Orientation program(s) on sustainability	39.5%	60.5%
Student Group(s) with an environmental or sustainability focus	25.0%	75.0%
Job fairs and career counseling focused on work in sustainable enterprises	61.8%	38.2%

Conversely, the survey results show that more than two out of three of the respondents revealed that none of the five other opportunities exist on the University campus. Specifically, three-quarters (75.0%) indicated that there is no student group(s) with an environmental or sustainability focus, 73.7% indicated that there is no student environmental center and 72.7% agreed that there is no ecology/sustainable hostel in the University. This is not surprising given that student organizations are generally not encouraged on campus in the country and orientation program are ceremonial events that mainly introduce the principal officers of the University and colleges and their responsibilities. Also, the higher education system in the country is highly centralized with mainly top-down decision making process, similar to the situation in some universities in China [9].

Based on the findings about lack of sustainability opportunities, which is corroborated by the authors' experience, the University should formulate effective and culturally situated strategies to encourage the engagement of students in environmental sustainability, such as sustainable dormitories and orientation programs on sustainability for all new students, given that students indicate a lack of interest in participating in sustainability efforts on campus, one way of getting around this apparent disconnect between importance and interest is to use the campus as a "living learning laboratory"—a kind of sustainability education tool. In this way, the campus could be more sustainable and the students get to work on "real world" projects [42]. Other strategies are on-campus life experiences for students, as suggested by Lozano [8], which include: student workshops and groups on energy efficiency; waste reduction and sensitization actions; and promotion of sustainable transport for students. These activities could help build the foundations of a sustainable university (and society), in which socioeconomic development incorporates the principles of biodiversity conservation and promote social justice.

## 5. Conclusions and Recommendations

This study set out to explore students' perceptions about, and their involvement in environmental sustainability at the College of Architecture and Planning, University of Dammam in Saudi Arabia. The noteworthy findings are that while there is greater concern and substantial knowledge about environmental sustainability among the respondents, they generally indicated lack of interest and willingness to participate in initiatives towards achieving sustainability. On the issue of curriculum, students were largely of the opinion that offered courses, research and student projects have little focus on sustainability. In terms of campus practices for fostering environmental sustainability, respondents reported that, apart from limited sustainable landscaping and waste recycling, there exist very few initiatives in sustainable transportation, and energy and water conservation. Lastly, only job fairs were reported to provide the students with an opportunity to partake in sustainability issues.

Therefore, in trying to achieve the third and tenth goals of the country's ninth five-year national development plan (sustainable development and protecting of the environment and natural resources respectively), there is the urgent need to transform Saudi universities into sustainable campuses so that they can become role models and play a leading role in promoting sustainable urbanization in the Arabian Gulf region. In order for Saudi universities to become more sustainable, the following key recommendations should be followed:

- (a) The Ministry of Education should mandate university managements to commit to sustainability by integrating sustainability into the HEI's policies and strategies and to establish office/center for SD, with qualified personnel and budgetary provisions. The sustainability office should conduct campus sustainability assessments in collaboration with other stakeholders so as to establish the extent to which the university is moving towards sustainability in terms of campus environmental management, infrastructure and transportation, campus operations and services, energy and resource consumptions and waste management as well as the extent to which teaching and research relate to sustainability issues. This will ascertain the existing strengths, weaknesses, opportunities, and threats in embedding sustainability in the institution.
- (b) The ministry should establish a set of indicators, standards, best practices, and policy guidelines required for the universities to become more sustainable and to increase the efficiency of campus environmental management practices, and to promote sustainability in teaching and research. A road map that would allow their universities to become more sustainable and play a leading role in promoting sustainable urban development in the country and at the regional level should be established and followed.
- (c) Saudi Universities should be utilized to also serve as laboratories for teaching environmental sustainability to students as well as for enlightening the entire society about the importance of and contributing towards achieving sustainability. This can be achieved by focusing more on training and educating the youth who are the country's future decision makers on how to think strategically and act sustainably that would allow them to design and plan more sustainable cities. Training students to design for energy and water conservations, waste reduction, and green transportation is also highly recommended.
- (d) Universities should also realize the need for more inclusive campus management and decentralized decision making because ESD is an important mechanism in achieving strategic goals of higher education. It is a dynamic concept that involves students' training and public awareness and capacity building to assume responsibility for creating and enjoying a sustainable future. It also seeks to empower students, faculty, and staff and the wider society to act for positive environmental change, implying a participatory and action-oriented approach.

In conclusion, as Saudi Arabia is rapidly urbanizing with increasing demand for shelter, energy, and means of livelihood and with increasing investment in building new universities there is the need for developing sustainable campuses so that they can help create a pattern of urban development that would be compatible with a safe environment, energy efficiency, waste reduction, and intergenerational equity. Saudi universities could learn from the campus sustainability initiatives and best practices of the universities of more-advanced countries. However cultural and environmental implications of any proposed sustainability initiatives must be taken into account.

This is the first study of this sort to be conducted in Saudi Arabia, which would not only assist in making cross-cultural comparative studies, but it could also be influential with respect to real-world decision-making at the university level in the country. Given that the study looks only at perceptions of students from a single college, it can be regarded as a first stepping-stone along a path towards campus sustainability. Future research covering other disciplines and universities could show whether students' awareness and attitudes towards sustainability varies for different disciplines and between campuses. There is also need for a study with wider scope of sustainability program and best practices such as economic health and equity, and sustainable living opportunities in Saudi Universities. Further research is also needed to explore the role of faculty and staff (involved in campus operations) in promoting campus sustainability in Saudi Arabia and the Middle East.

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