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Level of Sustainability Awareness among University Students in the Eastern Province of Saudi Arabia

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Received: 22 February 2020; Accepted: 10 April 2020; Published: 14 April 2020



Abstract: In recent years, there has been a tremendous interest and increased awareness about sustainability and its related issues globally. The literature reviewed presented the positive role of sustainability education and how it affects students' levels of sustainability awareness and influences behaviors. Therefore, to measure that level of current students' awareness and knowledge of sustainability, a questionnaire was developed and conducted in seven universities within the Eastern Province of Saudi Arabia, targeting a sample of 500 students from different study programs. The results show that high percentages of participants have heard the term "sustainability" from educational sources, but they lack the knowledge of sustainability, especially when it comes to recognizing recycling materials or renewable materials and energy consumptions measures. It is also noticed that the majority of students are not involved in any type of recycling anywhere. Other results reflecting students' behaviors and lifestyles pertaining to sustainability showed high percentages of involvement in sustainability and conservation actions. The study concludes that in order to promote sustainability awareness among students, other stakeholders such as universities, schools, governments and local municipalities need to take part in the process. Recommendations introduced include actions to be implemented by educational institutes in sustainability literacy and behaviors such as offering mandatory sustainability courses, demonstrating and supporting students' activities in-campus and off-campus to promote sustainable behavior, and to take some measures toward resources conservation and the necessary educational methods to influence students' behaviors. Recommendations are also broadened to include other stakeholders that hold great influence on individuals' sustainable knowledge and behaviors.

Keywords: sustainability knowledge; student awareness; student sustainable behavior; sustainability education; sustainable lifestyle

1. Introduction

Over the past decades, the desire to care for the environment and to sustain the earth's resources has grown significantly [1]. Concerns over the growing population globally, and the influence of social structures, economic trends, and changes in the environment, have affected global awareness in terms of sustainability knowledge and practices [2]. Even though widely known, applied and used by individuals and institutions worldwide, developing countries around the world have shown low levels of knowledge and actions when it comes to preserving environmental resources and sustaining them [3]. Looking closely at the Arab regions, previous research indicated the poor levels of sustainability knowledge in the region, diving deeply into the interest in conflicts and war, leading to degrading levels of social, economic and environmental sustainability, and resulting in overall instability of

the system [4]. Saudi Arabia is a developing country in the Arab region with a population over 33.4 million [5], known mostly for its oil production and for being the world's largest exporter of petroleum and leader of the Organization of the Petroleum Exporting Countries (OPEC) [6].

In 1992, the United Nations released Agenda 21, a blueprint of actions toward contribution to global sustainability in the 21st century. Local governments are encouraged to promote local environmental, economic and social sustainability initiatives [7]. In addition, the UN (2015) established 17 Sustainable Development Goals (SDG) to be achieved worldwide by the year 2030 [8]. Following on the steps of the UN and the global transformation, Saudi Arabia announced and issued Vision 2030 [9], where it aims to improve its social, environmental, and economic systems for the future and in a sustainable way [10].

"Sustainability is a concept that focuses on the condition of Earth's biophysical environment, particularly with respect to the use and depletion of natural resources" [11], whilst sustainable development is defined by the Commission on Sustainable Development (CSD) as "the development that meets the needs of the current world's population without compromising the needs of the world's population in the future" [7]. However, many consider sustainability as a complex term that lacks a shared understanding of causes, effects, roles, and strategies between environmental, economic and societal views [12,13].

This research focuses on measuring the awareness level of university students in the Eastern Province of Saudi Arabia. Most of the studies conducted were in the universities' campuses only, and yet no full-scale study of the Eastern Province universities was done. The Eastern Province of Saudi Arabia is receiving research attention as it represents the largest province in terms of area, it has seven universities, and is considered as the country's backbone of oil and gas industries. This paper is organized in Seven sections; literature review of related work in sustainability awareness and role of education, followed by the methodology section, results and discussions section, and lastly the research conclusion, limitations and future recommendations.

2. Literature Review

Studies conducted in sustainability focused on many disciplines such as education, economy, societies and individual behaviors as it pertains to sustainability. The review of the literature concerning the role of education in teaching sustainability and measuring sustainable knowledge and behavior among college students have revealed conclusions that vary from the role of education to explore the environmental, economic and societal influences that shape sustainability knowledge, to perceptions and attitudes of students towards sustainability [14–16].

2.1. Sustainability and Sustainable Development

Sustainability is introduced in the literature alongside the three pillars involving the aspects of economic, environmental and social domains [17,18]. The three pillars are essentially complementing one another as the economy operates within the society that resides within the environment [19]. Following the steps of previous work, the three pillars can be defined using a developed framework; environment reflects the availability of resources, the physical environment and the awareness of their vulnerabilities; economy represents limitations, economic growth and their impact on environment and society; society consists of a system based on democracy, citizen's participation and free expressions of opinions [20–23].

From an economic point of view, sustainability can be summarized to include natural resource protection as an essential element of sustained economic growth. It is believed that markets do not automatically function effectively to maintain "natural capital" [24] but may continue to drain and reduce it [25,26]. Taking into consideration the effects of the macroenvironmental forces intertwined on markets [27], modern advocates of sustainability economics say that policies on environmental protection are likely to promote innovation that could result in economic achievement [28]. Both the environment and the economy will benefit from new technological innovations designed to reduce

emissions and improve productivity efficiency. Good environmental policies which receive public support can therefore stimulate new technological innovations, which in return will improve production and energy efficiency while protecting our environment [29]. Therefore, the economic factor of sustainability should involve a backup system which meets present levels of utilization without sacrificing future needs [30]. Following the concept of sustainable development, it is important to promote the improvement of the human condition, economic growth, and finding the right balance between economic growth and protecting the environment [31].

Environmental sustainability is considered one of the biggest challenges that need immediate attention and reaction nowadays [32]. An environmentally-friendly system must maintain a secure resource base, invest in alternative assets, while preventing over-exploitation of both renewable and non-renewable resources [26] and maintaining the ecosystem and air environment stability. With the world's increasing population alongside the continuous influence of these populations on nature, attention and concerns are arising with regard to the sustainability of natural resources on our planet [32]. It is assumed that a balance needs to be struck between the population and the amount of total resources required in order to maintain the integrity of habitats and species diversity [26].

Notwithstanding its late incorporation into the debate of sustainable development, social sustainability represents the elements of social equity, justice, security, sustainable economic process, and Eco presumption (production and consumption modes, renewable energy, reduction, recycle) [30,33]. Other types of social sustainability include social capital, socialization, community or societal stability of collective communities and networks, and fulfillment of basic health [28,30]. They are seen as critical elements of sustainable development, but are also interrelated with sustainability for the environment. To achieve social sustainability, specific conditions must prevail, including individual freedom and recognition of human ability, democratic participation, equality, good citizenship and contribution to others, development of knowledge and the tools to support it. [28,30,33,34].

While the three pillars are explored heavily in literature, education is also represented alongside economy, environment and society as a key dimension for sustainability studies [35,36].

2.2. Role of Education

Education is crucial for the delivery of knowledge and in supporting sustainable development. It is essential for developing the necessary awareness, values, and attitudes to achieve sustainable development [35]. Educational institutes are major players in the development of human intellect and behaviors [37], and higher education is seen as a platform to transform problems confronting humanity into solutions [38]. Schools are now striving to fulfil the visions of UNESCO by developing the societal skills needed to perform work in a sustainable manner through specialized training programs [39], while attention for Education for Sustainable Development (ESD) is increasing [35]. ESD may be defined widely as:

"Education for Sustainable Development allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future. Education for Sustainable Development means including key sustainable development issues into teaching and learning. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and take action for sustainable development. Education for Sustainable Development consequently promotes competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way. Education for Sustainable Development requires far-reaching changes in the way education is often practiced today" [40].

Many schools are adapting to the global changes and are implementing sustainability practices at the campus level, such as the green campus concept [41], at a strategic level [42] and enriching curriculum and pedagogy efforts with sustainability education [9]. Higher education institutes transform and reinforce students' values, principles, morals and behavioral development [43]. Furthermore, higher education is viewed as a "site of socialization for sustainability" [44] and expectations are formed

with regard to its role in developing "the capability of students to be future generations of sustainable value" [45].

Formal education increases the students' knowledge on sustainability, and hence, it will significantly influence the level of sustainability awareness and practices along the way [41]. Hay and Eagle [46] found a positive relation between enriching curriculum with sustainability education and the level of student awareness and behaviors regarding sustainability. Furthermore, a study by Lindgren, Rodhe & Huisingh [47] showed a negative relation between the graduates' lack of inclusion of sustainability education and their desire to contribute to sustainability in their professional lives, as Lukman & Glavic [48] suggested the direct and indirect impact of higher education on graduates and their future decisions. On the other hand, a study by Qureshi [14] examined student engagement in sustainable living practices and revealed a positive relation on improving their sustainability literacy and behaviors. Practical experiences in an educational atmosphere have evidently resulted in enhancing students' sustainability and environmental education by creating opportunities for students to learn about interdisciplinary environmental issues [49].

Global game changers in education, such as the quality assurance organizations, in particular the Association to Advance Collegiate Schools of Business (AACSB), are including sustainability measures into their core values and guiding principles [50]. In the United Kingdom, the Higher Education Academy (HEA) developed a framework for universities to follow, providing specifications on how to embed sustainability in curricula [51]. In addition, the Saudi Vision 2030 has issued educational goals to be delivered by the Ministry of Education Vision Realization Offices (VRO's) with the focus to bridge the gap between higher education and the job market and global market requirements, thus nurturing sustainable development [10]. However, a study by Alghamdi & El-Hassan [52] indicated that the preparatory programs offered by Saudi universities remain focused on math, language and study skills and do not teach sustainability courses to foundation-level students.

2.3. *Sustainability Knowledge, Behaviors and Attitudes*

Societal behaviors and perceptions in any society are affected by a variety of factors such as education, age, home, culture, etc. [53]. These behaviors in return affect the interaction between individuals and their societies, environments, and economy and shapes societal behavior in a given community [2]. It might be worthwhile to explain the concepts of knowledge, behaviors and attitudes and how they all intertwine and influence each other. Knowledge is defined as the awareness of something, and as the range of one's information or their understanding; behavior represents the manner of conducting oneself, including anything that an organism does in response to stimulation and the response of an individual, group, or species to its environment; attitudes are a mental position, feelings, or emotions with regard to, and toward, a fact or state [54]. The literature reviewed discussed how gaining knowledge influences behaviors and attitudes, while other studies observed how students' attitudes may impact other psychological variables [35]. More studies explored students' knowledge, behaviors and attitudes toward sustainable development and applied them to evaluate students' consciousness on sustainability [22,55]. Moreover, Education for Sustainability Development tools are focused on the three dimensions of sustainable knowledge, behaviors and attitudes [22,35,36,39,55].

Education serves as a source of knowledge. As mentioned in the previous section, there is an emphasis on the role of educational institutes in enriching student's knowledge and the responsibility of sustainability teaching. It is important to stress the roles that the educational stakeholders play in this equation. Students, faculty, staff, policy-makers, leaders, and other stakeholders must be involved and do evidently affect the process of implementing sustainability education and practices [17,56]. Basically, education, with its different approaches and methodologies, can effectively improve the quality of knowledge and attitudes among students toward sustainability [36,57]. Engaging in the traditional 'deficit model' of science communication, the original belief is that if people only knew more, they would indeed embrace more sustainable behaviors. Certainly, sometimes environmental education alone, together conducted in official (i.e., courses) [58] and non-official (e.g., campaigns) [59] settings, can lead

to behavioral changes. Learner-centered methodologies can improve the environmental quality of knowledge and attitudes [57]; pro-environmental attitudes and behaviors can be developed and influenced using short-term field educational experiences [60]. A study by Biasutti confirmed the effect of educational intensive programs where a positive relation was found between the delivery of the intensive program method and the participants' awareness and skills on managing environmental and sustainability issues [36]. Another study conducted on university students also revealed the existence of training techniques' impact on promoting personal engagement [61]. While the theoretical education on sustainability matters and has revealed positive results, integrated programs where education and practice are present had a greater impact on students [36,62].

A related study was conducted at the University of Dammam in the Eastern Province [63], based on a survey distributed within students in the College of Architecture and Planning. The results of the study showed that there is a great concern about campus environmental sustainability and there is a lack of interest among students towards achieving sustainability.

To preserve the environment and to achieve sustainability standards, university students must possess the awareness and knowledge about sustainability before graduating and getting engaged in the marketplace. This paper merely aims to measure the level of sustainability awareness for university students and to reflect on the current situation as it pertains to global standards.

2.4. Research Questions

1. To what level do students in universities within the Eastern Province of Saudi Arabia understand the concept of sustainability?
2. Are students in universities within the Eastern Province of Saudi Arabia aware of sustainability measures?
3. Are students in universities within the Eastern Province of Saudi Arabia behaving in a sustainable manner?

3. Methods

In order to investigate student's awareness and perceptions about sustainability issues and student's involvement in sustainability, a survey using a self-administered questionnaire was conducted between December 2019 and January 2020 on university students in the Eastern Province of the kingdom of Saudi Arabia. The Eastern Province is the largest region in terms of area in the kingdom and it was chosen as it has the largest oil company in the world, Saudi Aramco. The region also has Jubail industrial city which is one of the biggest petrochemical industrial cities in the world, in addition to other hundreds of national and international companies working mainly in the oil and gas industry.

3.1. Research Sample

The Eastern Province has seven universities, including five state universities and two private universities. The seven universities almost cover all study programs, and the intent was to target students in higher education who reside in the Eastern Province regardless of their areas of study. With the diversity of programs in universities, some programs may not use English as a medium of study, and therefore, the survey was generated in two versions: Arabic and English.

The survey collection was closed at 500 responses, as it was intended to cover a sample of 500. The possible reason why responses did not exceed 500 easily is that students would do it quickly if there were incentives, and the majority of students do not pay attention to voluntary tasks. As a result, there should be many reminders to get responses, although the voluntary nature of participation in the study was confidential and the survey was completed anonymously.

3.2. Instrument

The questionnaire was designed to have general to more specific questions to cover different levels and studying programs of students and assessing their level of awareness of sustainability.

Some of the questions were adopted from a sustainability survey conducted at Boston University [64], while other questions were developed by the authors based on the study objectives.

The majority of the questionnaire's questions were chosen to be qualitative to measure the level of students' awareness of sustainability in general; therefore, only four of the questions were chosen to be quantitative.

The types of questions include multiple choices and "yes" and "no" questions, in addition to an answer of "do not know". The questionnaire consists of three parts, namely demographics and general, level of awareness, and behaviors and lifestyle. Each part has a range of five to sixteen questions for a total of twenty-seven questions with some open-ended questions. Before conducting the survey, the questionnaire was revised by colleagues in Prince Mohammad bin Fahd University for suggestions and comments to help review and improve the instruments. Also, a pilot survey was conducted in a small sample of students consisting of ten students to check the validation of the questionnaire before being administered on a larger scale. The response from the survey started to increase gradually in the first two weeks as it reached about 300 respondents. The survey response after that became slower in early January and by the end of the month it reached 500.

3.3. Data Collection

The survey was distributed to students in all universities in the Eastern Province using Google Forms, and students were notified through emails. The questionnaire link in Google Forms was distributed to students by emails in different universities through official points of contact or through faculty colleagues who are employed in some of the universities in the province.

3.4. Data processing and Analysis

All data were analyzed using Google Forms, which is an online tool that allows collecting information from users via survey or quiz. The information is then collected and automatically analyzed by the tool.

4. Results and Discussion

4.1. Demographic and General Characteristics of Respondents

In total, 100% of survey respondents were university students as the target was to exclude any non-student respondents at university from the survey such as graduates, faculty members or administrators. Regarding ages of participants, the biggest percentage, 59.8% were of age between 19 and 22 years old, and that is acceptable as the four years of undergraduate study in the university should be within that range of age. Others who may come young to university in the range of 15 to 18 years represent only 7%, whereas the older ones in the age range of 23 to 26 represent 26.4%, and those who are 27 years and above represent 6.8%. Those whose age is 23 and above most probably are graduate students and doing Master's or Ph.D. studies.

When asked about participants' gender, there were 38.8% males and 61.2% females. Possibly, this gives an indication that female students are keener of doing voluntary tasks than male ones. Next question in the section is: "When was the first time you heard the term sustainability"? 44.6% of respondents answered in university, 22.6% heard about sustainability in high school, 9% from in or elementary school, and 23.8% of respondents never heard about sustainability.

When respondents were asked about the source that they heard about sustainability from, the highest answer by respondents was 42.4%, who heard about it from school or university. That sounds reasonable as students are supposed to learn and get educated in educational institutes.

From the result showing above, it has been found that to some extent the majority of students have already heard about sustainability mainly at college and school levels.

The rest of the answers varied as in Table 1.

Table 1. Sources from which respondents heard about the sustainability term.

Source	%
Schools/University	42.4%
Social Media	18.4%
Friends and Family	7.6%
Entertainment Channels	4.4%
Books	3.6%
News	2.2%
Others	21.4%

4.2. Students' Level of Knowledge in Sustainability

This section asked questions about sustainability in general, and the goal was to test students' levels of awareness on sustainability. The first question in this section asked the students to choose one strategy among the list of strategies that are not considered as good ones for making the earth more sustainable. Over half the respondents' (55.6%) chose burning more fossil fuel, where 5.4% went to crop rotation, 20.2% for using recycled materials and the rest of 18.8% of respondents do not know the answer. There is an obvious indication of a lack of sustainability awareness among respondents, because crop rotation and using recycling materials are good strategies for making the earth more sustainable.

The second question in the section was a general and simple one, which was asking if students knew what it means to repair a product. The majority (79.2%) of respondents think it means to return the product to its working order, which is the correct answer. The rest of respondents think the answer is either to improve the looks (9.6%), change the packaging (2%), or reprint instruction leaflet (1.4%), and 7.8% of respondents do not know the answer.

The third question in the section asked participants to indicate which of the given materials are considered renewable. In total, 16.4% of participants think it is wood, 52% think it is plastic, 26.6% think it is metal, and the remaining 5.4% do not know the answer. This question is a knowledge one, not a traditional one. If students are not educated in sustainability, the answer will be wrong. The only renewable item in this question is wood, as when it is cut, it grows. Whereas, plastic is nonrenewable as it is made from fossil fuel, which itself is nonrenewable. Metal is also nonrenewable as it is naturally-degrading.

The following question in the section was: "What does the term disposal mean to you?" In total, 17.9% of participants think the answer is to sell a product onto someone else, which means participants had no idea about the meaning of the term disposal. Also, 38.3% think of the right meaning, which is to throw away. Also, 4.2% think to keep the product, 14.9% think to only use it once, and the remaining 24.9% do not know. There are different levels of awareness of participants presented from this question, while 24.9% of participants had no idea about the term.

The next question in the section asked for participants' opinions whether more companies should endorse the use of recycled and sustainable materials to promote them as a good and moral company. In total, 84.4% of participants agree, 4.6% do not agree and 11% have no answer.

Another question asked was a technical one asking which takes more energy: a five-minute shower or twelve hours of computer use. This was a calculable question as it depends on the power rating of the shower, which is quite high in contrast to a computer, which is very low. So, the correct answer could be either shower or computer if different power ratings of showers are to be considered. Also, 30% of participants think the answer is shower, 54.5% think the answer is computer, and 15.5% do not know the answer.

The last question in this section asked participants if they need to rinse recyclables before throwing them in the bin, or if that is a myth. In total, 18% of participants think that there is a need to rinse recyclables before they are thrown, 37% think that it is a myth, and 48.8% had no answer to this. The answers obtained by participants reflect some awareness and thought, as the question was open-ended because we can only rinse recyclables if they are solid, otherwise it is a waste of water.

Students in this section showed some awareness level as nearly 50% of the answers were correct, while the other half were based mostly on qualitative questions which have many possible answers.

4.3. Students Behaviors and Lifestyle in Different Aspects of Sustainability

This is the last section of questions, which focuses on behaviors and lifestyles of students in relation to sustainability. This is an important part as it may include information about students' habits, behaviors and lifestyles at home, university and public places. The section includes sixteen questions, and among these eight closed-ended questions that have an answer of yes or no as they are easier and quicker for respondents to answer. These questions and their answers are shown in Table 2.

Table 2. Closed-ended questions in different behavioral aspects of sustainability.

Survey Question	Yes
Do you get a ride in a car to university?	87.6%
Do you ever carpool?	60.3%
Do you turn lights off when leaving the room?	79.6%
Do you apply any measures to reduce electricity use?	67.7%
Do you leave water running while brushing teeth?	44.7%
Do you apply any measures to reduce water use?	57%
Do you prefer buying environmentally-friendly appliances over other types?	67.9%
Do you pay attention to energy stars when buying appliances	55.3%

From the answers of first and second questions in Table 2, it is noticed that the majority of students, if not all, are riding to university whether on their own, shared, or the university's transports. In total, 12.4% of students who are not using any kind of transportations to university are possibly students who live in the dormitory of a university which is walking distance from classrooms. This result is expected, as in Saudi Arabia, the majority of students have cars and as the country has a geographically-large area even within cities. Most universities' campuses are built in the outskirts of the cities due to the large size of campus needed. Therefore, students will find it difficult to walk for long distances. In addition, the fuel price in Saudi Arabia is considered low compared to many other countries in the world, which makes it affordable for students to use their own cars.

The remaining questions in Table 2 focus on sustainability awareness among students by asking a direct question in electricity, water and environment domains. For electricity-saving related questions, 79.6% of respondents are turning lights off when they leave the room, also about 67.7% do apply some measures to reduce the use of electricity at home or university. These percentages give an indication that students are caring about electricity saving in general. That also showed in the question when they were asked if they pay attention to energy stars when buying electrical appliances. The majority of students, or 55.3%, have answered with a yes. This is also expected as the government of Saudi Arabia has taken the initiative of educating people about energy saving through a center called the Saudi Energy Efficiency Center (SEEC), which was established in the year 2011. One of the many activities the center conducted since its launch was the awareness campaigns for people in the kingdom at all ages, including children.

In water-saving-related questions, students were asked if they turn off the water while brushing their teeth. About 44.7% answered no, while the majority or 55.3% of students turned the water off. In the current times, dentists are advising patients to brush their teeth for two minutes, twice a day for adults, as this practice ensures oral hygiene health and is considered preventive care [65], while also being advertised globally through many channels. Based on that, there are about four minutes per day

for every person to brush their teeth. One can imagine the amount of water that can be saved from turning the water off for the duration of this process by all users across the country.

The other question in the water domain was asking students if they apply any measures to reduce water use at their university or at home. The majority of students answered yes (57%), which indicated that there is some sort of awareness among students when using water. As in electricity, the government of Saudi Arabia is launching many awareness campaigns to reduce water abuse, especially the ones conducted by the National Water Company.

The remaining question in Table 2 was related to the environment; students were asked if they prefer to buy environmentally-friendly appliances over other types. In total, 67.9% of students answered yes, which indicated that students pay attention to the stars rating in these appliances and reflects their care for the environment.

The next three questions in the section were quantitative ones used to measure the duration of energy usage of some appliances. When students were asked about hours of daily use of computer, 42.2% think that they use it from 1 to 4 h, 29% use it between 5 and 8 h, 12% for 9 to 12 h, 7% for 13 h and more, and 9.7% do not use computer. The average range of use for computers is expected to be 1 to 4 h, including accessing online learning resources such as Blackboard, using software packages, and doing computer-based homework. Regarding students who do not use computers, it is possible for those who do a lot of reading and research in some areas such as social studies, including religion studies, where hard copies of reference books are still in use.

When participants were asked about how often they use a TV in a day, the answer with the highest rate was for users between 1 and 4 h (31%), which is reasonable. Also, 30% use it for 5 to 9 h and those two rates between 1 and 9 h, representing almost 61% of respondents, which might be the average range of daily use of TV in every household. The remaining rates are distributed between less than 4 h, greater than 13 h, or no use.

When participants were asked how long they spend taking showers, this was an important question, as the instant shower has a very high-power consumption, and answers will give an indication if students are aware of the power used. About a third of participants use the shower from 5 to 10 min, another third for 11 to 15 min, and also about a third for more than 15 min. Less than 10% of participants use the shower for less than 5 min. The two-thirds of those students who use showers for more than 10 min might be considered high, especially the ones that use showers for more than 15 min. Definitely, many students are not aware that instant showers can consume a high amount of power in the range of 6000 to 10,000 W and that high power is needed to allow shower unit to generate the required hot water instantly.

The remaining four questions in the survey were designed to measure the involvement of the participants in sustainability at home, dormitory, university or any public places.

One question asked the participants if they recycle at home. About one-third of participants (38.2%) answered with "not usually", and participants who have never done any recycling in their lives represent 27.8%. The two results add up to an average of two-thirds (66%) of participants that have not been involved in any form of recycling, which is quite a high percentage. As university students, the expectation was possibly to have recycling stations at least in universities and some public places.

The next question asked participants about the quantity of trash that their households create in a week. Answers varied from one can, two cans, more than two cans or even no answer as participants do not know. Almost half of participants (48.7%) answered by more than two cans a week. Other answers were at 31.7% for one to two cans. If we take a look at trash collections in some western countries, we will find that the local municipality assigns one day per week for trash collection. In Saudi Arabia, trash collection is implemented every day, in which the public will not find any restrictions to control the amount of their trash.

Next, participants are asked a question if they use recycling stations (for papers, glass, plastic, cans) at university. This is a specific question targeting universities as it is a place of education and learning with many degree programs including science, engineering and medicine. The majority of

participants or 65% answered that their university does not provide any recycling stations, where 19.4% answered yes and 15.6% answered no. The only positive answer to this question representing 19.4% of participants indicated that one-fifth of universities that survey was conducted in is using recycling stations. That may sound good in a way that the recycling practice is applied in the Eastern Province universities but still not enough, and universities need to take measures to increase recycling use.

The last question in the survey asked participants about the sustainable actions they do and asked them to check all that apply among nine different items (Figure 1).

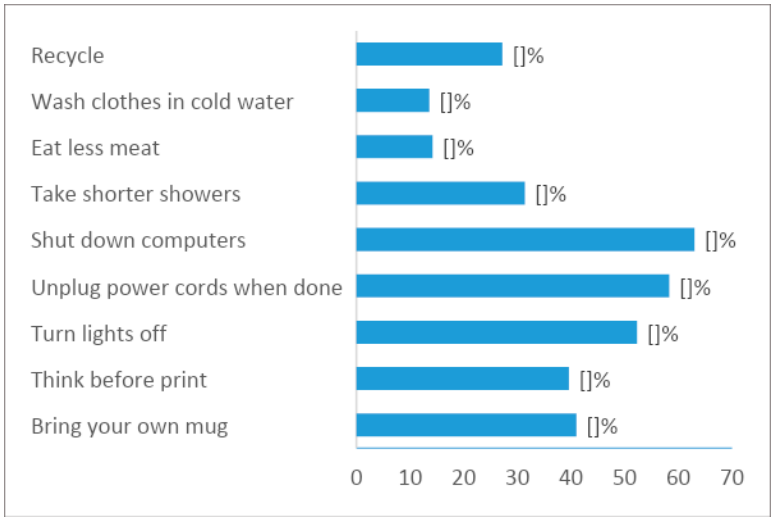


Figure 1. Participants' responses regarding their sustainable actions.

Participants' answers to this question indicated that there is some awareness among students mainly in three practices, which are shutting down computers, unplugging power cords when done, and turning lights off. These answerers range between 52% to 63%, which is an optimistic result. Other items were selected among answers that students do as sustainable actions such as thinking before printing, taking shorter showers, recycling, and bringing their own mugs. The percentage rate, ranging from 27% to 41% is considered acceptable. Students seemed to be not interested in actions such as eating less meat and washing clothes in cold water, with only 13% to 14% of returned answers indicating this.

As a result, the answers to the ten qualitative and two quantitative questions indicated that the majority of participants, or about 80%, have good behaviors in aspects of sustainability.

5. Conclusions and Recommendations

This paper attempted to measure the awareness and perceptions of students in higher education institutions in the Eastern Province of the kingdom of Saudi Arabia on sustainability through a questionnaire including 27 questions. The survey was designed in a way to cover the majority of aspects in students' lives while studying at universities, including their awareness, behaviors and lifestyles in relation to sustainability.

The study found that participants have a lack of awareness of sustainability, especially when it comes to recognizing recycling materials or renewable materials which forms a part of our daily lives. Other findings from the survey indicated that nearly half of students who participated in the survey do not bother with water and electricity conservations, though some students showed interest in saving energy but have little real involvement. It is also noticed that students are not involved in any type of recycling anywhere, as nearly 66% of participants were never involved in any form of recycling activities, though 65% of participants blamed universities as they do not offer any recycling stations on campus.

It is obvious from the results of the survey that the majority of students do not care due to the lack of awareness about sustainability in general. Some students care about the environment, energy-saving, and practicing recycling, and that is reflected in their answers. The awareness of sustainability has to be provided to students through many channels, including government programs, universities' initiatives, and media. The survey focused only on one stakeholder in the sustainability awareness process represented in students. Other stakeholders include governments, schools, universities, industry, local municipalities, many public service providers and the rest of the community.

The role of relevant policy sectors, in general, is to guide the integration of sustainable measures and the application of sustainability policies, where applicable, to impose and reflect the impact of individuals, societies, nationally and internationally with regard to achieving sustainability goals.

6. Recommendations and Future Implications

(a) Universities have the biggest role to take in promoting sustainability awareness among students; introducing courses in sustainability to educate students and these courses must be required by all university students and not offered as electives.

(b) Teaching should be in alignment with the social, economic, and environmental trends, as this practice is soon to be crucial for the development and preparation of the next generation of professionals and future leaders.

(c) Universities should apply recycling stations on campuses and that will allow students to practice recycling while they are on campus. Universities should encourage students to choose their final year projects in sustainability, possibly by funding the project or giving incentives. Currently, many projects initiated by students involve renewable energy, green buildings and clean environment, but universities still need to do more.

(d) Universities should host regular workshops and lectures in sustainability by inviting expert speakers or host conferences in sustainability and encourage students to participate.

(e) The government of Saudi Arabia needs to expand the initiatives that started in energy saving and water conservation in line with vision 2030, which focused on using energy resources other than oil, including renewable and electricity tariff reforms to reduce energy consumption. However, the government still needs to do more by launching more awareness campaigns in public places such as shopping centers and through media, especially social media. Knowledge about sustainability in general can be introduced to early-level students at schools. Although this is currently applied to high school students, it needs to be assessed and reviewed.

(f) Local municipalities need to take part in sustainability awareness by providing recycling stations in public places. They can also introduce to residents the use of colored recycling trash bins following the steps of developed countries, and can use three colored bins to collect papers, plastics and general wastes. Also, it is recommended to reduce the waste collection to lesser numbers as it is currently almost on a daily basis.

7. Limitations to the Study

A limitation of the study may be represented in the interpretation of respondents' data and the measurement of effective implementation of educational recommendations. To illustrate, the study only focused on participants who are current university/college students and related higher percentages of sustainability knowledge and behaviors to educational efforts and sources (regardless of whether the source was higher educational institutions or primary and secondary schools). Therefore, we cannot possibly use the results of this study to assume lower levels of sustainability knowledge and behaviors for secondary or elementary schools.

The study focused on the role of education in enriching students' sustainability literacy and influencing sustainable behaviors. However, other variables can possibly have an impact on students' knowledge and behaviors as presented in survey question five, "What was the source you heard about

sustainability from?" Answers differed between social media, entertainment channels, news, readings, society and others, which has not been explored further.

In conclusion, as the study was conducted only within universities of the Eastern Province, the results can be extended for other parts of Saudi Arabia. This study can be used as a gateway to conduct further studies to measure sustainability awareness among students in other universities and areas to cover all of Saudi Arabia and, possibly, countries in the Arab's region. Also, a follow-up method by other researchers could possibly improve the participants' professional behavior in sustainability to include other parameters to survey, such as the program of study, year of study, and gender.

Author Contributions: Conceptualization, D.E.-N., S.E.-N. and T.A.; methodology, S.E.-N.; software, S.E.-N. and T.A.; validation, T.A., D.E.-N. and S.E.-N.; formal analysis, S.E.-N.; investigation, T.A.; resources, T.A and D.E.-N.; data curation, S.E.-N.; writing—original draft preparation, T.A.; writing—review and editing, T.A., S.E.-N. and D.E.-N.; visualization, T.A. and S.E.-N.; supervision, D.E.-N.; project administration, D.E.-N., S.E.-N. and T.A.; All authors have read and agreed to the published version of the manuscript.

Funding: This research is funded by Prince Mohammad bin Fahd University, Deanship of Research Development.

Acknowledgments: The authors acknowledge the support provided by Prince Mohammad bin Fahd University, Saudi Arabia.

Conflicts of Interest: The authors declare no conflict of interest.

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