

## Article

# Assessment of Knowledge, Attitude and Practice towards Sustainability Aspects among Higher Education Students in Qatar

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**Abstract:** Sustainable development necessitates that societies design activities to meet human needs while protecting the planet's life-support systems in consideration of depleting natural resources and concern for the state of the resources and climate. Sustainable development emphasizes the conservation and enhancement of natural resources by modifying how they are utilized, highlighting the role of nations in meeting their basic needs for employment, food, energy, and water. Higher education institutions (HEI), such as universities, should be able to produce a workforce that satisfies the demand for competent stakeholders and contributes to the successful implementation of the United Nations Sustainable Development Goals (SDGs) by integrating Education for Sustainable Development (ESD) and sustainability principles into their institutional strategy and organizational culture. This research evaluates the sustainability consciousness of higher education students and the effect of ESD on higher education students in Qatar. The study employs the sustainability consciousness questionnaire (SCQ) to assess HEI students' sustainable development knowledge, attitudes, and behaviors while considering educational system characteristics such as curriculum, community, and the campus. The questionnaire was distributed among students from different fields and universities in Qatar. Results were analyzed using statistical tools to show that over 80% grasp sustainability-related knowledge. This value gradually decreases in attitudes and behaviors based on evaluating the pro-sustainability student responses. Further, over 60% of the surveyed students indicate external factors excluding the educational system characteristics to have the most profound effect on providing and developing the student's knowledge, attitudes, and behaviors towards sustainable development. Understanding the current state of sustainability education in HEI can lead to an improved preparation of the global youth with the necessary skills to meet the sustainability challenges and to be involved in establishing and sustaining long-term progress that can aid in achieving SDG goals and drive sustainability action.

**Keywords:** education for sustainable development; higher education institute; Qatar education system



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## 1. Introduction

The 1987 Brundtland Report defines Sustainable Development as the development that meets current generation needs with no cogeneration on future generations' ability to meet their needs with a focus on the three dimensions of sustainability environmental, social, and economic [1,2]. Sustainability is a multifaceted subject that, in practice, is defined by the relationship of humans to their surroundings [3]. Likewise, "Sustainable Development" (SD) leads to a variety of responses [4]. The notion of Sustainable Development is more dynamic than static and can be interpreted through different cultures and perspectives [5]. In basic terms, environmental sustainability entails issues such as resources, energy, and transport, and social sustainability involves poverty, human settlements, and human rights issues. Finally, economic sustainability examines wealth, consumption, and welfare concerns [1].

Sustainable Development promotes limiting the current generations' impact on all the dimensions of sustainability [1]. A shift in current methods of thought and actions on the current way of living would need to be considered to solve the significant sustainability problems [6–8]. In an attempt to create a common global framework for addressing sustainability across all dimensions, in 2015, the United Nations introduced the Sustainable Development Goals (SDGs) at the United Nations Conference on Sustainable Development in Rio de Janeiro [9].

### *Sustainable Development Goals*

The United Nations (UN), during the 2030 Agenda for sustainable development, adopted the Sustainable Development Goals (SDGs) in 2015. The SDGs document proposes a fifteen-year framework for empowering people, safeguarding prosperity, and protecting the planet [10]. Education and educational institutes are encouraged by UNESCO to adopt competency-based education, which can promote lifelong learning and produce future generators equipped to face critical global challenges. The 17 SDGs, as a part of the 2030 Agenda, identify the important challenges for human sustainable development and recognize that actions within these goals hold interwoven outcomes and should balance social, economic, and environmental sustainability [10]. As SDGs focus the search for sustainable development appropriately into a strategy of actions that can be deployed within classrooms, the comprehension and utilization of SDGs in an educational system establish the Education for Sustainable Development concept.

## **2. Sustainable Development in Education**

The United Nations Educational, Scientific and Cultural Organization (UNESCO) suggests Education for Sustainable Development (ESD) in response to the current global sustainability crises [10]. ESD is education that enables informed and responsible actions towards environmental, economic, and social reliability and responsibility for current and future generations [10–12]. As a universal approach, ESD addresses education through learning outcomes, content, and the environment [10].

### *2.1. Education for Sustainable Development*

In promoting sustainable development by the year 2030, it becomes the role of ESD to ensure that students obtain the essential sustainability knowledge [10]. ESD aims for the success of students in careers by providing the needed abilities and incentives which contribute to future generations' ability to cooperate during complicated and ever-changing global challenges such as climate change, loss of biodiversity, and growing social inequality for the worldwide community's wellbeing [13–15].

Employing ESD as a holistic approach would entail the collaborative effort of teachers and researchers through inspiration and pioneering ways of thinking [16–19]. The traditional teaching method would be inadequate to address the totality of knowledge, morals, and abilities essential to sustainability. To allow for a productive sustainability educational approach, the educational journey shall aim to be a collaborative process between the students and the educators in an interdisciplinary and transdisciplinary manner [20,21].

Several gaps remain between the notion of ESD and sustainability are discussed even though decades of conversations had taken place [22]. ESD in research is discussed holistically within two views, considering all three dimensions in an individual method [23]. Another is considering an integrated method with noted conflicts between the two [24]. A holistic adoption of ESD forces students to focus on the economic and social elements, which could be a distraction from vital environmental issues [25]. The discrepancy between educational practices and dialogue exists throughout the educational system [22,26,27]. A disparity between localized worldviews and means of addressing sustainability on a global presence [22]. Understanding widespread culture and societal practices in education are required to allow for effective approaches to addressing sustainability education, which can lead to new and innovative interpretations of ESD [22,28].

Universities are expected to prepare students to develop the ability to integrate sustainability in decision making, as the need for ESD is more apparent in the last decades [29,30]. Integrating ESD in Higher Education Institutions (HEIs) is vital to allow for teaching knowledge and inspiration, encouraging students to be future change agents in their education [31]. A reimagining of HEIs to integrate sustainability is presented in various levels of changes, from educational reform to a whole system design [32]. Such reimaginings of HEIs are needed if any organizational change is to occur for the effective integration of sustainability [31].

## 2.2. Education for Sustainable Development in Higher Education Institutes

Higher Education Institutions (HEIs) perform a vital national role in educating citizens. Many agreements and declarations have addressed the commitment of HEIs in the sustainable development field, such as Rio+20 and the UN Conference [33]. Since Stockholm in 1972, many HEIs globally have been practicing sustainability initiatives and integrating sustainability education into their core systems [34–36]. SD initiatives should incorporate the entire university system, such as education, research, community outreach, and operation [37].

Unsustainable human consumption is directly linked to environmental degradation, such as pollution, which is suggested to be improved by introducing sustainable consumption behaviors [38]. Throughout the educational sectors, sustainable consumption is an increasingly important topic in pedagogical discourse, providing paradigms for sustainable consumption practices. Several policy reports call for the need for an educational response. It is believed that sustainable consumers can be created through education that would equip students with the appropriate knowledge and skills [39]. ESD is frequently considered an influential policy tool in enabling the creation of a democratic and deliberative responsible society [40,41]. Several endeavors which promote sustainable consumption through education institutions have been realized during the United Nations World Decade on Education for Sustainable Development (2005–2014). Additionally, to assure the achievement of the 17 SDGs, suggestions for sustainability-conscious teaching methods within UNESCO's Education for Sustainable Development Goals: Learning Objectives are made available. Goal 12 (Responsible Consumption and Production) within the 17 SDGs is the ESD's primary interest in sustainable consumption. For achieving any aspect of SD, such as SCP, HEI is critical in preparing their students with the necessary knowledge, skills, and understanding to attain environmental, social, and economic sustainability for future generations [42]. Likewise, HEI can support education by providing a positive setting for the students, faculty, and staff towards a sustainability attitude within varying issues, whether environmental or cultural [43]. Besides acquiring the necessary subject-specific knowledge, ESD teaches students how to apply knowledge, make decisions, understand the context around them, and the effects of power and global interconnection within their activities and lifestyles to become change agents for sustainable development [42,44].

To achieve sustainable development in HEIs to make them into organizations that encourage innovation and entrepreneurship, action from all aspects within HEIs are needed by individuals who will engage the holistic education with the values of sustainable development on many levels within the HEIs framework such as in teaching, research, and university activities [45–47].

Sustainability in HEIs can be achieved by embedding continuous communication, systems support, and leadership into the institute structure [48]. Another study addressed the importance of clear and consistent communication, proactive leadership, multidisciplinary research, and engagement of students and staff to promote sustainability practices [49]. Thus, ESD can be applied to a condensed extent within higher education organizations from the point of view of the student, the faculty, and the curriculum.

### 2.2.1. Students and Faculty Engagement

HEIs are intended to improve students' SD skills so they may be active agents of change. It is argued that traditional higher education methods fail to prepare students to adapt to current and future sustainability concerns [50]. Several studies say that appropriate education for HEIs students is required to provide future leaders with problem-solving skills that contribute to sustainable development [51]. HEIs must prepare students to address such issues by incorporating sustainability into their activities [52]. Feedback and engagement are essential for improving student SD skills literacy and creating sustainable campuses [53]. The learning environment and course content are critical motivators for students to engage in sustainable development within their education [54].

Faculty and university staff must change agents who can foster ESD within the educational journey regardless of the perception of sustainability as peripheral to their primary tasks [55–57]. Empowerment of educators, researchers, employees, and sustainability advocates within HEIs can be a significant motivator for effective change on an organizational level within HEIs with aid in the integration of the sustainable development [58,59]. The support of field-based research is understood to benefit the integration of academic research and local agencies within sustainable development in the HEIs [60]. HEIs faculty and staff need to hold the necessary circumstances and capabilities to provide students with crucial SD skills and ensure they get opportunities to develop integrated SD competencies in their education [44].

### 2.2.2. Curriculum and Learning Environment

Sustainable Development Competencies (SDCs) as a component of ESD are utilized by applying these metrics in the HEIs curriculum. Learners should achieve specific knowledge and abilities concerning sustainable development, categorized as the Sustainable Development Competencies [61]. For ESD education, learner-centered, collaborative, interdisciplinary, transdisciplinary, real-world, and value-based teaching and learning are advised, enabling SDCs development [62–65]. HEIs must equip these students to deal with such issues by incorporating sustainability into their curricula, ensuring that future leaders contribute to local, state, and regional economic growth [52]. The added benefit of HEIs is that there is an opportunity for ESD values to be physically demonstrated on campuses, which can be expressed in several dimensions of HEIs, such as education and research [66–69].

Integrating sustainability into organizations and missions has become an international effort [70] to address global sustainability issues. HEIs can promote sustainable development internally and externally through their curriculum, faculty, campus, research, etc., and the values of sustainable development to future generations to address growing environmental concerns [71]. ESD in HEIs aims to incorporate many concentrations that enable significant impacts on sustainability fostered through the change in educational priorities and concern for the global future betterment [72].

Embedding sustainability concepts within universities goes beyond discovering the concept. It implies integrating the sustainability concept into the organization's activities, processes, and routines. Integrating the concept of sustainability into the daily activities of a student in the university can result in having a conscious user. Students tend to practice sustainability when it's a part of their responsibility. Therefore, universities should provide students with the opportunities to participate in sustainability efforts [73]. Moreover, maintaining an environmentally sustainable university infrastructure raises awareness of sustainability concepts [74]. Learning programs and teaching techniques that involved sustainability initiatives on campus were found to be related to the overall success of the university [74]. Green Campus (GC) is a concept where environmental awareness and sustainability practices are integrated into the culture of HEIs [75].

GC can be defined as one that encourages and employs sustainability practices in all the processes and activities, such as teaching, research, community outreach, energy and waste management, and land use through continuous monitoring and maintenance. Such

initiatives can improve individuals' values and guarantee the development of sustainability practices within society [76]. GC initiatives raise sustainability awareness in universities among participants in their implementation of sustainability practices, for instance, through environmentally friendly technology and energy efficiency management, which direct their behavior toward the sustainability [77,78]. It was verified that applying sustainability strategies at universities helps students obtain more knowledge and realize the importance of sustainable development. This result indicates that universities that apply sustainability initiatives such as GC can provide graduates with sufficient tools to build up sustainability practices and initiatives. However, a student's sustainable development knowledge and proactivity do not necessarily correlate with GC initiatives. Therefore, universities should include sustainable development concepts in their curriculum and establish sustainability initiatives within university processes and students' routine [79].

### 3. Methods

This study was conducted to measure the awareness of HEI students about sustainable development and to figure out the most effective approach by which student students conceive sustainability (i.e., through curriculum, community, and campus). The study was conducted by employing educational system factors such as the learning material (curriculum), individuals involved in the learning process (community), and the learning environment and facilities (campus) in the sustainability consciousness questionnaire (SCQ) [80]. SCQ was designed to measure individuals' awareness of sustainability. The questionnaire focuses on individuals' knowledge, attitude, and behavior towards sustainable development. This study used SCQ to build upon another questionnaire that includes educational system factors. This study was designed to measure HEI's effectiveness in embedding sustainable development in students' habits. Moreover, the study was designed to guide through the sources by which students learn more about sustainable development.

#### 3.1. Aims and Objectives

An extensive literature review was conducted to design the survey (Section 1) [81]. The field explored for potential survey items was sustainability education for graduate and undergraduate students in Qatar. Three questions guided the survey design:

1. To what extent do students in HEI understand the effectiveness of SD aspects under the three learning outcome domains (i.e., knowledge, attitude, and practice) in Qatar;
2. Where do higher education students consider it most effective to include SD in their educational experience through the three-learning outcome domains;
3. To what extent does HEI introduce SD aspects in Qatar;

#### 3.2. Survey Design

A Likert scale questionnaire was designed beginning with the definition of the respondents' profiles [82]. Respondents' profile includes age, nationality, gender, HEI name, current occupation (graduate/undergraduate student), specialization field, and level of education (e.g., first year). The rest of the questionnaire assessed students' awareness of sustainable development topics. It was divided into three sections. In each section, the students were asked to answer questions and statements linked to one or more research questions (Table 1).

The survey was created by combining and modifying other surveys of the same topic [2,80,83,84]. Statements on the survey were categories based on UNESCO learning objectives for SDG responsible consumption and production. UNESCO learning objectives for SDG responsible consumption and production consist of the cognitive domain, the socio-emotional domain, and the behavioral domain [10]. The cognitive domain comprises the knowledge and thinking skills of the students; the socio-emotional domain includes social skills, values, attitudes, and motivation of the student toward sustainability; and the behavioral domain focuses on the sustainability actions of students. These domains were used to create frameworks such as in the sustainability consciousness survey [2].



The sustainability consciousness survey focused on students' knowledge, attitude, and behavior. This survey followed a similar framework where statements of the survey were classified according to the three domains. Some collected survey statements were omitted, added, or modified to fit the domains. The survey focuses on three main categories of consumption and production. The categories are electricity consumption and production, water consumption and production, and domestic consumption.

**Table 1.** Structure of the questionnaire.

Questionnaire Structure		
Section	Topic	Sample Question
1	Participant's agreement to participate in the survey.	Q: Do you agree to participate in this study? (Yes, I agree and would like to continue this questionnaire/I do not agree to participate. I would like to leave this page)
2	Participant's demographic information.	Q: Gender (Male/Female)
3	Assessing participant's knowledge about sustainability and sustainable consumption, and from where participants received this knowledge (Five questions out of fifteen questions are generated randomly to assess sustainability knowledge).	Q: Reducing, reusing, and recycling can reduce waste generation. (True/False) Q: Based on your answer, where would you say you have acquired this knowledge. (select all that apply) (From university's courses and textbooks/From faculty actions and behaviors and/or staff advise/From facilities on campus/Other (i.e., social media, relatives and friends))
4	Assessing participant's attitude towards sustainability and sustainable consumption and from where participants acquired this attitude (Five questions out of fifteen questions are generated randomly to assess sustainability attitude).	Q: I think that I should upgrade my phone or computer to a newer model even if my older model is still functional. (Strongly agree/Agree/Neither agree nor disagree/Disagree/Strongly disagree) Q: Based on your answer, where would you say you have acquired this knowledge. (select all that apply) (From university's courses and textbooks/From faculty actions and behaviors and/or staff advise/From facilities on campus/Other (i.e., social media, relatives and friends))
5	Assessing participant's sustainability and sustainable practices and from where participants learned these practices (Five questions out of fifteen questions are generated randomly to assess sustainability practices).	Q: I advise others (i.e., family, friends) to reduce consumption of electricity. (Always/Usually/Sometimes/Rarely/Never) Q: Based on your answer, where would you say you have acquired this knowledge. (select all that apply) (From university's courses and textbooks/From faculty actions and behaviors and/or staff advise/From facilities on campus/Other (i.e., social media, relatives and friends))

### 3.3. Sampling and Analysis

Universities in Qatar were taken as a case study, such as Texas A&M University Qatar (TAMUQ), Carnegie Mellon University Qatar (CMUQ), Weill Cornell Medicine in Qatar (WCMQ), Virginia Commonwealth University in Qatar (VCUQ), Georgetown University in Qatar (GUQ), Northwestern University in Qatar (NUQ), Hamad Bin Khalifa University (HBKU), Qatar University (QU), and the University of Doha for Science and Technology (UDST) previously named College of North Atlantic (CNA).

The survey was created using the Survey Monkey tool and circulated online and offline among university students, where samples were randomly selected (Table 2). It was sent out to undergraduate students, master's students, and Ph.D. students studying in universities in Qatar. The survey was distributed at the end of the spring semester and mainly during the summer. Thus, a limited number of responses were collected as most students were not on campus. The data collected from the survey was analyzed through descriptive statistics using a combination of statistical tools such as Excel.

**Table 2.** Several sample students from each university.

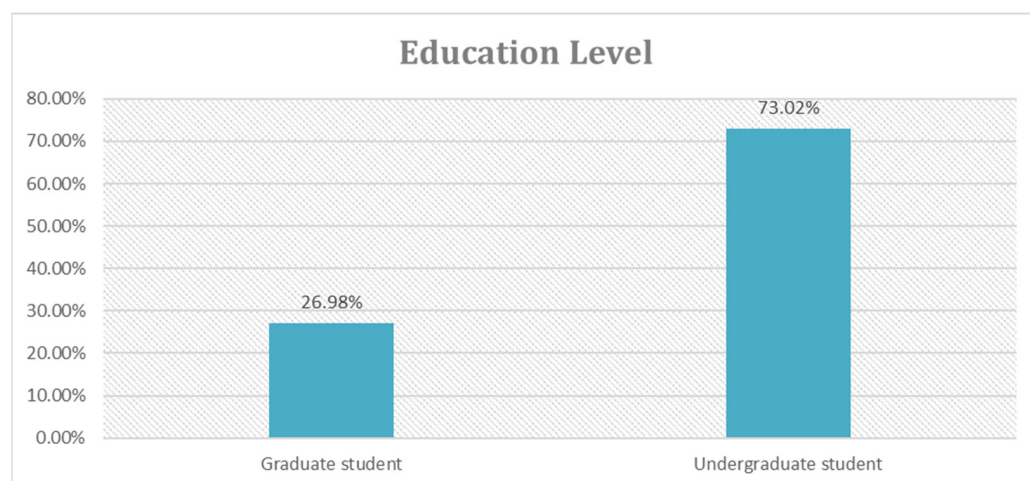
University	Population (2021/2022)	Sample	References
TAMUQ	575	12	[85–88]
CMUQ	439	6	[89]
WCMQ	323	3	[90]
VCUQ	363	13	[91]
GUQ	400	4	[92]
NUQ	291	2	[93]
HBKU	800	33	[94]
QU	23,939	113	[95]
UDST	5294	3	[96]

#### 4. Results and Discussion

The results and discussion sections present and discuss the main findings concerning the four themes observed within this study. The findings are presented as general demographics, knowledge, attitude, and practice of students, the effect of curriculum, community, and campus on students, and finally, the effect of curriculum, community, and campus within the sustainability knowledge, attitude, and practice domains. The data collection period was during the spring semester of 2022. The online questionnaire was distributed to the universities within Qatar. A total of 212 higher education students in Qatar participated in the questionnaire resulting in 472 responses about higher education and sustainability.

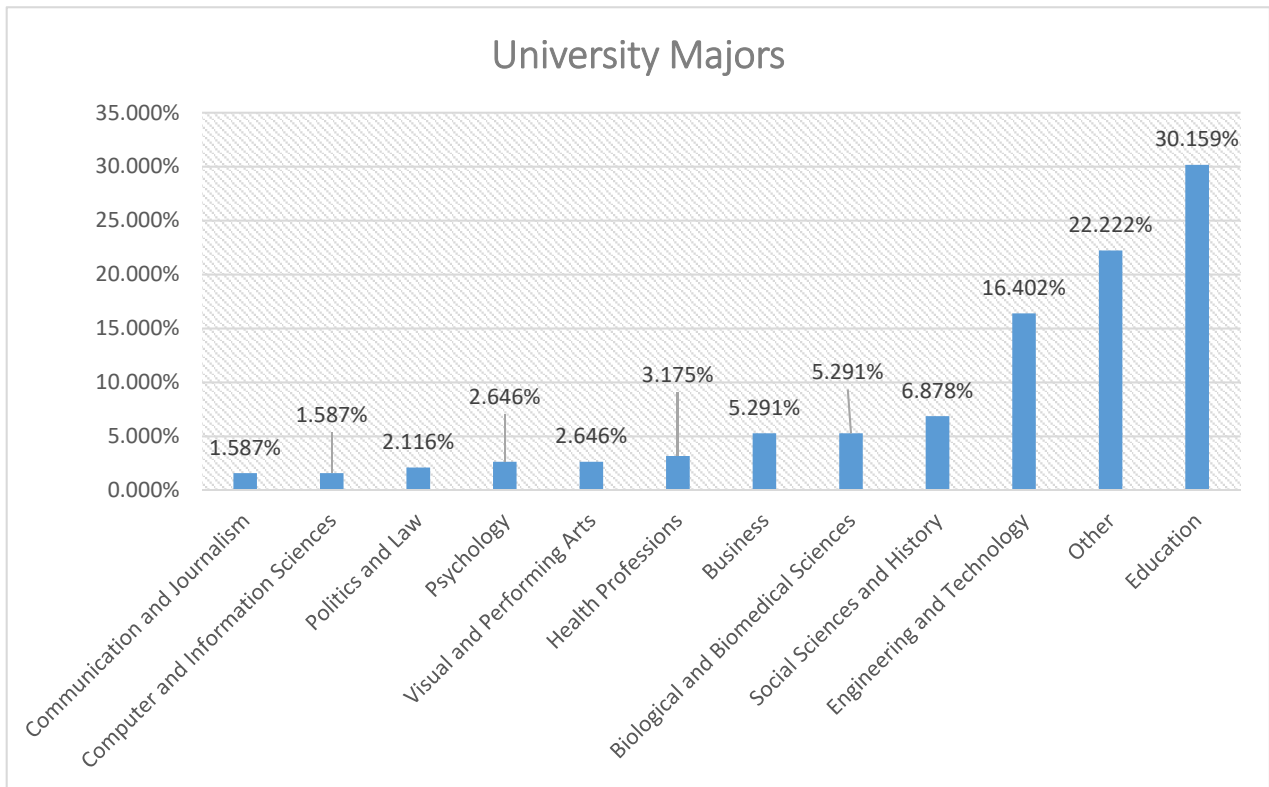
##### 4.1. Description of Participants

Most people participating in the questionnaire are undergraduate students. The proportion of students enrolled in undergraduate programs accounts for about 73% of the total (Figure 1), while the proportion of graduate students accounts for roughly 26% (Figure 1). The majority of universities in Qatar are relatively young, which has led to an increase in the number of undergraduate students enrolled in higher education, which accounts for about a 1:3 ratio between graduate to undergraduate students.

**Figure 1.** Education level of participants.

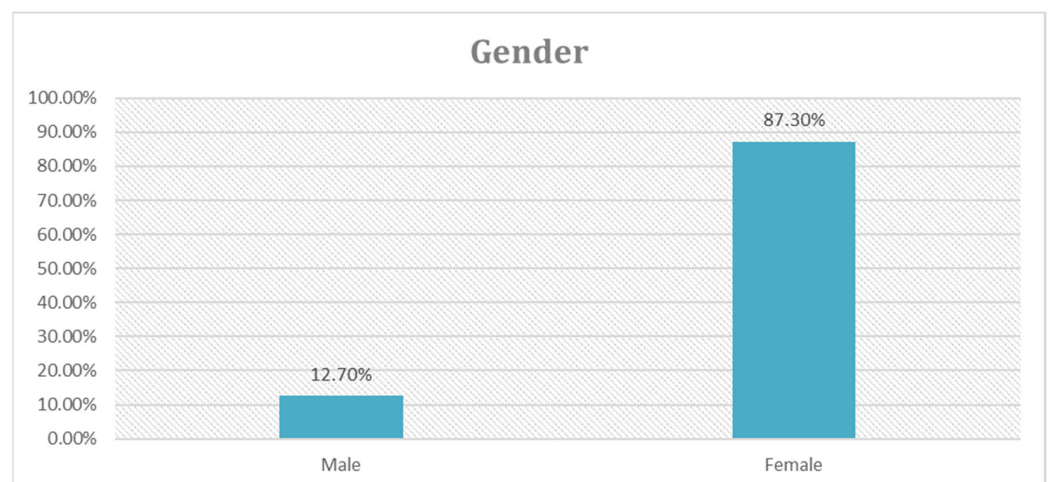
The questionnaire for this study included a list of the eleven majors that were found to occur most frequently in Qatar. The following subjects are included in this category: communication and journalism, computer and information science, politics and law, psychology, visual and performing arts, health professions, business, biological and biomedical sciences, engineering and technology, and education. If the respondent's primary concentration was not among the options provided, they were given the "Other" choice. According to the responses, most of the students who participated in the survey came from a background in

education, followed by a background in engineering and technology, social sciences and history, and biological and biomedical sciences (Figure 2). 22% of the students responded with “Other”. The proportion of the “Other” responses is the second highest after those who majored in education, followed by those who majored in engineering and technology (Figure 2).



**Figure 2.** University major of participants.

The questionnaire used in this study was mainly filled out by female students, making them the majority of the respondents. The responders are predominantly female students, making up over 80% of the total (Figure 3). On the other hand, the percentage of male students who responded to the survey was approximately 12% (Figure 3). This might be because most male students in Qatar pursue their education in a foreign country.



**Figure 3.** Gender of participants.

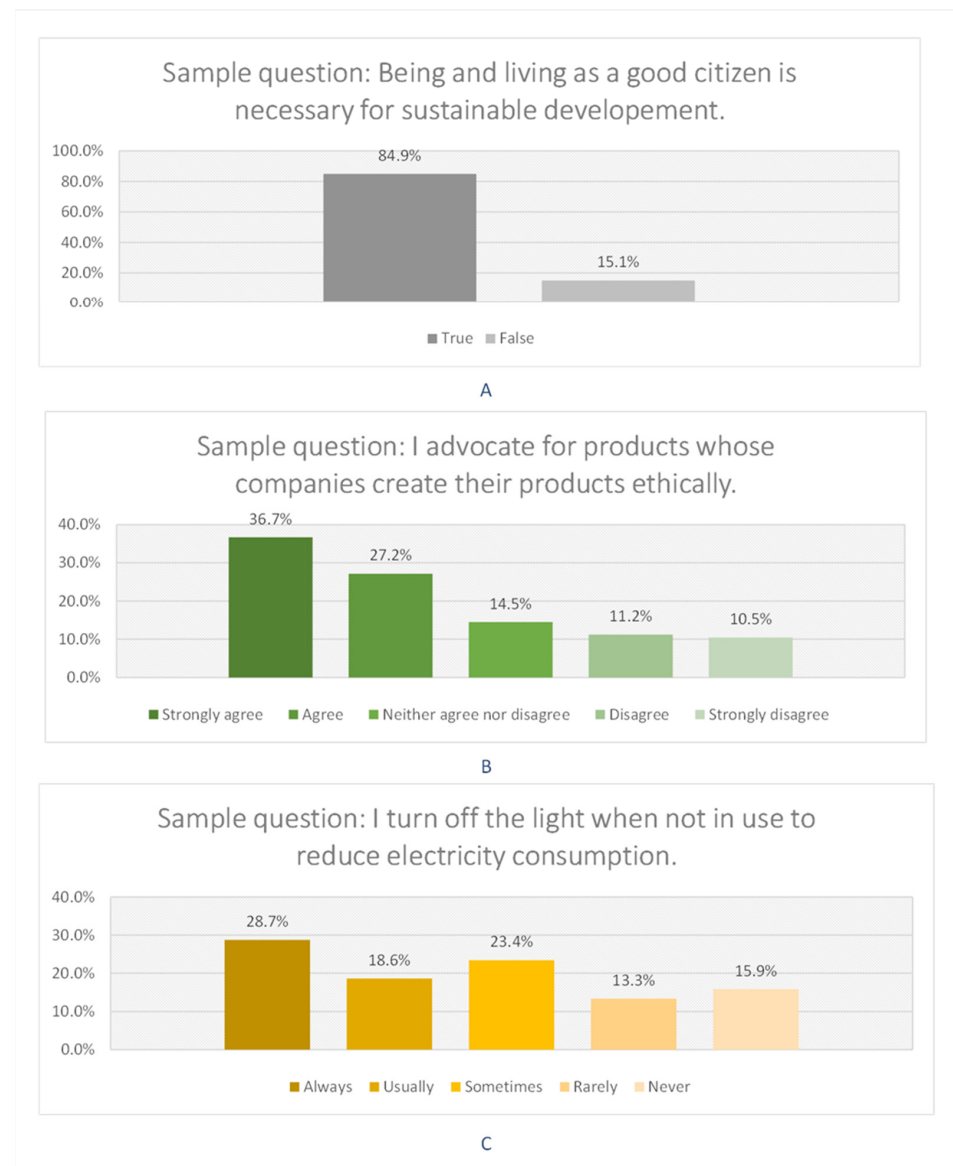


In total, 100% of survey respondents were university students as the target was to exclude any non-student respondents at university from the survey. When asked about participants' gender, there were 12.7% males and 87.3% females. This possibly indicates that female students are keener on doing voluntary tasks than male ones. More than 50% of respondents are Qatari students, followed by Arabian non-GCC students and Asian. The remaining 7.9% are GCC non-Qatari students, middle eastern non-Arab, African non-Arab, and European. The following question asked students how long they had been living in Qatar. Roughly 85% of respondents lived in Qatar for more than five years.

#### 4.2. Knowledge, Attitude, and Practice

##### 4.2.1. Student's Knowledge of Sustainability

Examining the level of knowledge across the surveyed higher education students, over 80% are observed to have an adequate understanding of sustainability-related knowledge (Figure 4A). This is followed when evaluating the student's answers and to what degree they correspond to the correct answer regarding sustainability.



**Figure 4.** (A) Percentage of student responses to sustainability knowledge collected from the questionnaire. (B) Percentage of student responses to sustainability attitude collected from the questionnaire. (C) Percentage of student responses to sustainability practice collected from the questionnaire.

#### 4.2.2. Student's Attitude towards Sustainability

Examining the students' attitudes toward sustainability, a high percentage of agreement is identified in the responses (Figure 4B). The overall trend of the students' responses is highest for strongly agree and gradually reduces until strongly disagree. The highest percentage on the five-point scale is observed for strongly agree and is evaluated at roughly 36.7%, and the lowest is for strongly disagree at about 10% (Figure 4B). Likewise, considering the responses that are in any degree of agreement, 64% of the responses are identified; however, in contrast, considering the responses that disagree to any degree, a significantly lower 22% is identified. This result illustrates that the surveyed higher education students represent a positive attitude towards sustainability.

#### 4.2.3. Student's Practice towards Sustainability

Students accounted for 28.7% of the total responses, representing the number of students who have always included sustainable practices in their day-to-day activities. While just 16% of students have ever integrated sustainable practices into their everyday life, 23% of students engage in sustainable living on at least a sporadic basis. On the other hand, in contrast to the responses for student attitude in Figure 4B, the responses for student practice do not decrease as evenly from the choice that is the most sustainable to the option that is the least sustainable (Figure 4C). The total responses for student practice that occur above the sometimes option (always, usually) account for a total of 47.3%, which is much higher than the total of responses who have selected an option below sometimes (rarely, never), which amounts to 29.2%, resulting in a difference of 18.1%. This implies that, on the whole, the responses from students suggest that the number of students practicing sustainability is more significant than the number of students not practicing sustainability.

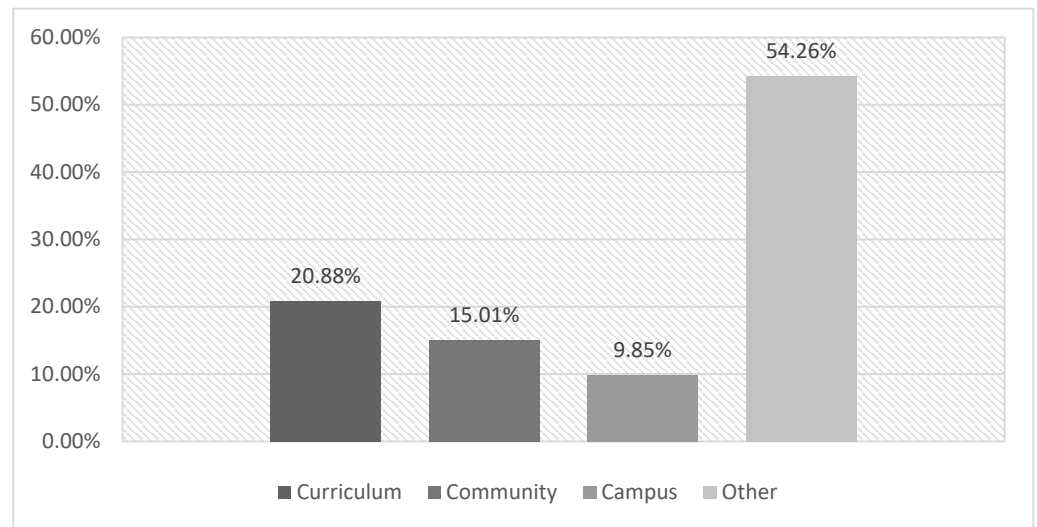
Using statistical analysis to examine the student's sustainably level within knowledge, attitude, and practice, knowledge was the most pro-sustainable dominion found among the respondents, followed by attitude and then practice. This result was found in the literature as it is often the case that to increase practice, the attitude and knowledge must be changed first.

#### 4.3. Curriculum, Community, and Campus

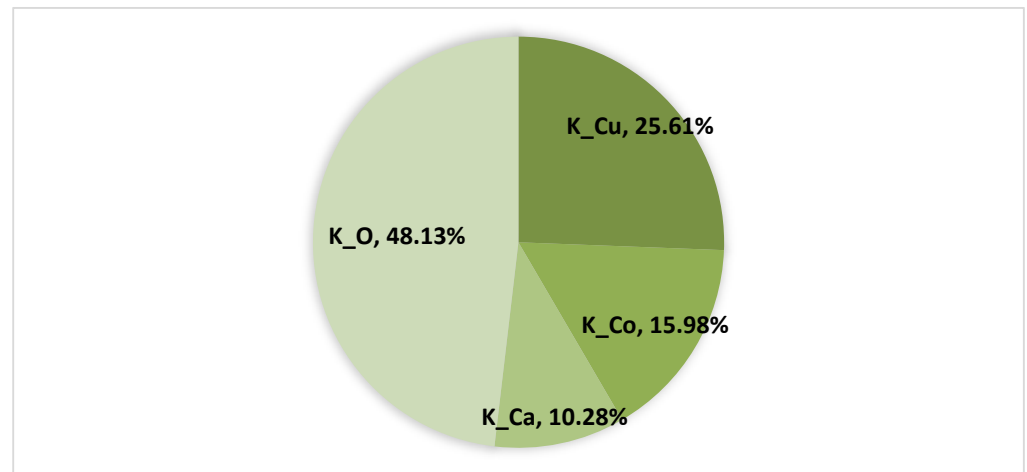
Each questionnaire asks the students to identify the source of this sustainability knowledge, attitudes, and practice from the curriculum, community, campus, or other. Out of curriculum, community, and campus, the curriculum is the highest at 20.88%. The community follows this at 15%, then campus at 9.85% (Figure 5). However, it is notable that the students selected other aspects as the most influencing factor for the notion of sustainability in all knowledge, attitude, and practice. "Other" can be social media, the news, advertisements, friends, relatives, etc. Based on the answers, "other" can be more effective than all the curriculum, community, and campus. This shows the importance of external factors in sustainability education just as much as in traditional educational settings.

#### 4.4. Sustainability Knowledge, Attitude, and Practice Taught through Curriculum, Community, and Campus

Regarding students' knowledge about sustainability, more than half of the students agreed that sustainability knowledge is obtained from other sources such as social media, news, friends, relatives, etc. This percentage represents more than 48% of respondents (Figure 6). The remaining half agreed that their knowledge about sustainability is mainly obtained from the curriculum, learning community, and campus facilities.



**Figure 5.** Percentage of sources from which students learn about sustainability.



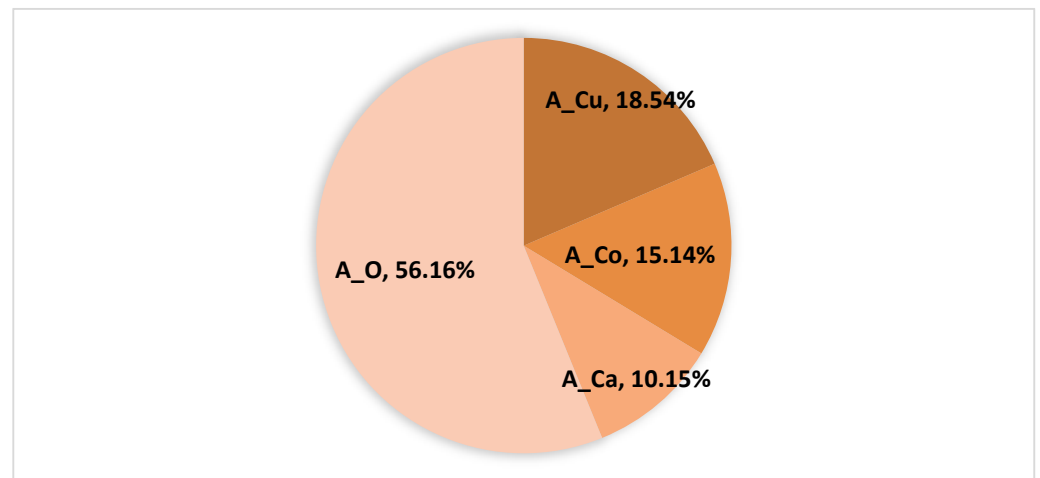
**Figure 6.** Percentage of sources from which students learn about sustainability knowledge, where K\_O denotes sustainability knowledge from other sources than educational institutes, K\_Cu denotes sustainability knowledge from the curriculum, K\_Co denotes sustainability knowledge from the learning community within the campus, and K\_Ca denotes sustainability knowledge obtained from campus facilities.

Based on the answers, students' attitudes and opinions toward sustainability are highly affected by external sources other than the educational system. However, within the education system, most students agreed that their attitude toward sustainability is highly influenced by the curriculum and learning materials, followed by the learning community with about 19% and 15% (Figure 7). The campus facilities have a minor effect on students' attitudes toward sustainability.

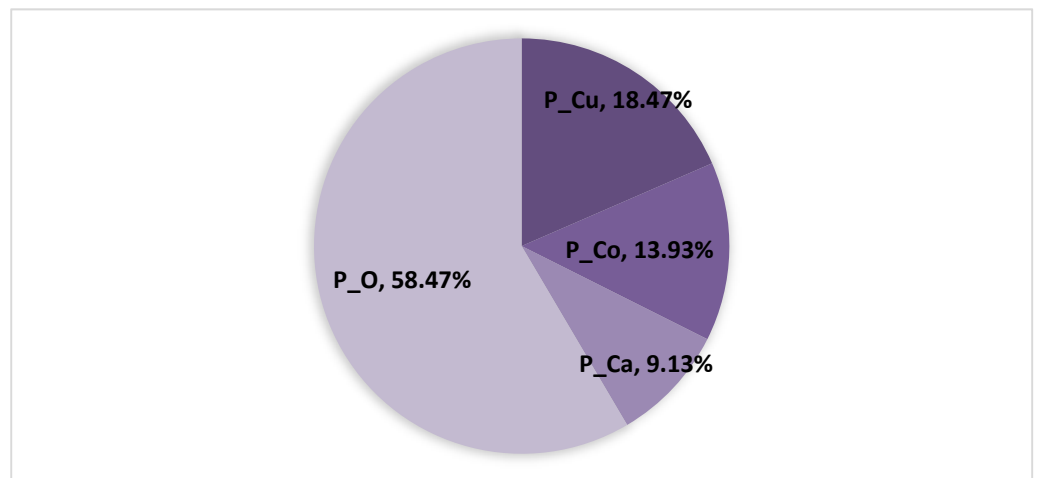
Sustainability practices of students are mostly gained from other sources, with about 58% (Figure 8). Subsequently, in the educational system, students learn about sustainability practices from the curriculum, followed by peers, and lastly, the campus facilities.

Investigating the areas where the student's responses to where their sustainability towards knowledge, attitude, and practice is most affected, other sources such as social media, news, friends, relatives, etc. are the most identified across all domains. Likewise, the curriculum is second across all domains, followed by community and then campus. However, the other sources are, on average, identified twice as frequently as the rest, which suggests further study into the nuances of how different sources can affect the education of

substantiality for students and how that will be presented across their knowledge, attitudes, and practices.



**Figure 7.** Percentage of sources from which students learn about sustainability attitude, where A\_O denotes sustainability attitude gained from other sources than educational institutes, A\_Cu denotes sustainability attitude obtained from the curriculum, K\_Co denotes sustainability attitude from learning community within the campus, and K\_Ca denotes sustainability attitude obtained from campus facilities.



**Figure 8.** Percentage of sources from which students learn about sustainability practices, where P\_O denotes sustainability practices gained from other sources than educational institutes, A\_Cu denotes sustainability practices obtained from the curriculum, K\_Co denotes sustainability practices received from the learning community within the campus, and K\_Ca denotes sustainability practices obtained from campus facilities.

## 5. Conclusions

This study was carried out to determine the degree to which HEI students in Qatar understand sustainable development within the three learning outcome domains of knowledge, attitude, and practice, in conjunction with an investigation of the educational system factors of the curriculum, community, and campus. The time frame for collecting the data was the semester of spring 2022. However, some of the data were gathered during the summer, which limited the number of responses collected. A total of 212 students in higher education in Qatar responded to the questionnaire, yielding 472 responses.

- Positive effects of sustainability are seen to decrease from knowledge to attitudes and practice.

Over 80% are reported to have an adequate understanding of the knowledge relevant to sustainability. 64% of the responses illustrate that higher education students have a favorable attitude toward sustainability. The replies from the students indicate that the students are engaging in positive sustainability practices approximately 47% of the time, which is characterized by the percentage of positive responses.

- Traditional educational settings are not the only factor in education and sustainability and would need to be considered in future explorations.

Observing the effect of positive sustainability outcomes in knowledge, attitudes, and practices that come either from the curriculum, the community, or the campus, the highest percentage originates from other (54.26%), followed by the curriculum (20.88%), the community (15.01%), and finally the campus (9.85%). Based on the responses, it is possible to conclude that “other” is more effective than the combined efforts of the curriculum, the community, and the campus.

The diminishing effect in pro-sustainability responses from knowledge to attitude and behavior from the surveyed students in HEI in Qatar is subject to future considerations. They understand why pro-sustainability responses from knowledge decrease in attitude and practice. They will address these factors in future research and implementation of ESD in HEI, allowing for increased pro-sustainability attitudes and practices.

- Other factors, such as social media, news, and family and friends, are the most responsible for providing the knowledge, attitudes, and practices of HEI students in Qatar.

Examining the source of the sustainability outcomes yielded that other factors (54.26%) are the most responsible for providing the knowledge, attitudes, and practices of HEI students in Qatar, further understanding of these factors is called for. Social media, as an example, in the age of internet connectivity and digital information, have a profound effect on societies and the general state of mind of the global population. Understanding the development of such factors will allow the initial quantification of such factors' impacts and serve as the basis of incorporating these other factors within the educational system characteristics, such as curriculum, community, and the campus, to maximize the effectiveness of ESD in achieving SDGs.

- There is a lack of understanding of the relationship between students' sustainability consciousness and educational system characteristics.

The consideration for expanding the current survey is not only to increase the scope of responses within HEI in Qatar but also to expand the assessment of different educational stages surveyed to understand the impact and development of sustainability consciousness and educational system characteristics through students' educational journey is desired. Different educational stages, such as primary education and secondary education, can be considered to allow the evaluation of how sustainability consciousness and educational systems develop over time, as well as understand the importance of the influencing factors within each education stage to allow the better implementation of ESD within education in general.

Understanding sustainable development in knowledge, attitude, and practice through the curriculum, community, and campus in higher education will yield and support the selection of the most appropriate strategy for realizing sustainability for students in higher education. The improvement in understanding sustainability in education allows for the maximization of efforts within ESD to address sustainable development within education, giving the future populations an improved opportunity for confronting future sustainability challenges and achieving sustainable development.



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