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Research

Assessing the sustainability literacy of undergraduate students in a first-year writing course

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Abstract
With sustainability becoming a familiar concept in society, higher education institutions have also started playing a more active role in this field, showing an increasing interest in students' comprehension of sustainability. This interest has led to the need for developing methods of assessing students' sustainability knowledge, as observed in many scholars' and institutions' research efforts. To this end, this study aims to evaluate the sustainability literacy levels of students enrolled in a first-year composition course using a mixed-method sequential explanatory design. The quantitative phase involved 221 students who completed a questionnaire assessing their knowledge, skills, attitudes, and familiarity with sustainability concepts and topics. Following this, 60 students were asked to write an essay identifying Kuwait's significant sustainability challenges and proposing solutions. The results showed that gender, high school type, grade point average (GPA) value, and whether they heard about the term sustainability before caused significant differences in students' knowledge, skills, and attitudes about sustainability. Also, the students primarily associate sustainability challenges with environmental problems; social and economic challenges are rarely mentioned in essays.

Keywords Sustainability literacy · Content analysis · Sequential explanatory mixed method · Composition instructors

Abbreviations

AASHE	The American Association for the Advancement of Sustainability in Higher Education
ESD	Education for sustainable development
HEIs	Higher education institutions
GCC	Gulf Cooperation Council
KNDP	Kuwait National Development Plan
GPA	Grade point average
SDGs	Sustainable Development Goals
STARS	Sustainability Tracking Assessment Rating System

1 Introduction

The concept of sustainability has been around for quite some time; however, it started gaining significant attention in the post-Industrial Revolution due to factors like population growth, increased consumption, and the realization that essential resources like wood, coal, and oil could be exhausted. This awareness led to a growing understanding of the importance of utilizing resources in a sustainable manner. Concerns about the ability of both current and

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future generations to maintain their living standards prompted a shift in thinking, ultimately leading to the rise and acceptance of the concept of sustainable development [25].

In the beginning, sustainability primarily emphasized the environmental aspect, with researchers considering it to be of greater significance compared to other dimensions. However, over time, the economic and social dimensions began to receive similar recognition and interest from researchers. As a result, the concept of sustainability expanded to encompass three pillars: the social, economic, and environmental [38].

The worldwide initiatives to redefine sustainability began after the inaugural UN Conference on the Human Environment in 1972, which focused on addressing environmental issues. Various definitions of sustainable development have emerged, but the most cited is from the Brundtland Report, also known as Our Common Future, published in 1987, according to which, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [16].

The United Nations' 2030 Sustainable Development Agenda, which comprises 17 Sustainable Development Goals (SDGs), represents a significant effort to address the intricate global challenges of our time. These challenges include the destruction of ecosystems, species extinction, depletion and degradation of vital resources, various forms of pollution, and widespread extreme poverty affecting millions of people.

Scientists argue that our lack of awareness regarding the limits of Earth's resources has greatly contributed to the occurrence of these challenges. Thus, education is critical to achieving the world's sustainable development (SD). The Education for Sustainable Development (ESD) framework, a roadmap for institutions and educators to reform curricula and pedagogies around sustainability principles, is utilized by numerous universities worldwide [50]. ESD has gained political and institutional support in many parts of the world recognizing the fact that promoting sustainability literacy can foster innovative solutions to global problems. Thus, education is a critical tool for achieving sustainability goals and can help us create a more sustainable world by empowering individuals and communities to take action and make informed decisions that protect the environment and promote social and economic development.

The concepts of sustainability and sustainability literacy have emerged recently in academic literature and practical endeavors. These ideas continue to evolve because of the advancements in environmental, economic, and social domains. Sustainability literacy is defined by the UN [48] as "the knowledge, skills, and mindsets that allow individuals to become deeply committed to building a sustainable future and assisting in making informed and effective decisions to this end."

It is widely agreed that higher education institutions (HEIs) should support sustainable development through research and activism. HEIs have a responsibility to teach sustainability literacy and produce environmentally conscious citizens, given their ability to shape students' attitudes and perspectives [46]. According to Leal Filho [33], the university cannot excuse itself from meeting one of the most significant challenges of humanity. ESD is most crucial at the university stage because students will soon pursue careers in diverse professions, and they will need to know what impact their professions can have in solving sustainability problems.

Sustainability and sustainable development are interdisciplinary concepts that might lend themselves easily to composition studies, that serves a cross-disciplinarity function in students' academic lives. Composition instructors have more leverage for encouraging students to explore a variety of themes than academics who teach in more specialized areas [39].

This research was conducted to assess the sustainability literacy of undergraduate students in a first-year writing course. The main research questions that will guide the study are:

1. How do personal variables, such as gender, high school type, grade point average (GPA) and whether they heard about the concept of sustainability affect students' sustainability literacy?
2. How informed are students about the major sustainability challenges their country of residence is facing and the solutions required to overcome these challenges?

2 Background

2.1 Sustainability literacy

The importance of sustainability education is gaining recognition as a key to achieving a sustainable future, and organizations across various sectors are prioritizing initiatives to enhance public understanding of sustainability. In

recent years, international organizations, cities, private businesses, and particularly higher education institutions have placed significant emphasis on the importance of sustainability education. This increased focus on sustainability education has also sparked a renewed interest in creating a reliable measure of sustainability knowledge and literacy.

Several approaches have been attempted to develop a valid assessment tool for sustainability literacy. One notable example is the Sulitest (Sustainability Literacy Tools & Community), which was established after the Rio + 20 Conference [23]. Sullitest is an online platform consisting of a standardized set of multiple-choice questions that can be used globally, along with specialized modules that consider specific national, regional, and cultural contexts Décamps et al. [23] outlined the structure of this tool and highlighted its potential for measuring sustainability literacy on a global scale, recommending its adoption by educational institutions.

Similarly, Zwickle et al. [54] developed a web-based survey tool to assess the sustainability knowledge of undergraduate students at Ohio State University, involving 1000 participants and featuring 16 multiple-choice questions. In the United States, the American Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking Assessment Rating System (STARS) was introduced in 2010 and has seen participation from over a thousand institutions by 2022. STARS evaluate the sustainability efforts of colleges and universities in the United States and reward institutions that offer a greater number of sustainability-related courses or even require students to complete at least one sustainability course as part of their general education requirements [17]. The participating institution assesses the sustainability literacy of its students, focusing on the knowledge of sustainability topics and challenges.

Kuehl et al. [31] suggest that as higher education institutions and society at large increasingly prioritize the importance of individuals' comprehension of sustainability, the need for accurate assessments of sustainability knowledge becomes more significant. Thus, the development of improved measures of sustainability knowledge is expected to enhance sustainability education and, in the long run, foster a population with higher levels of sustainability literacy.

2.2 Sustainability efforts and literacy in Kuwait

Kuwait is one of the wealthiest countries in the world due to the revenues generated from the oil sector. The country enjoys an abundance of wealth from the oil sector which make up more than 90% of Kuwait's export earnings, a dependence that makes it difficult to diversify the economy and develop other industries that are less reliant on fossil fuels [26]. Kuwait faces several challenges in achieving sustainability which are mainly resulting from the country's heavy reliance on oil revenues [7]. Some of the major environmental challenges Kuwait faces include air pollution, water scarcity, and waste management. The country has high levels of air pollution due to its petro-chemical industry activities and transportation. Water scarcity is also a significant issue in Kuwait, as the country relies on desalination plants to meet its water needs. Despite this, Kuwaitis consume 520 L of freshwater per capita per day, one of the highest in the world [32]. Waste management is another challenge, with large amounts of waste generated in the country due to high mass consumption, that require proper disposal and recycling [12, 30]. Currently, the consumptions of water and energy, and the production of waste per capita in Kuwait are among the highest in the world.

The nation has introduced several endeavours to advance sustainable development, and the most notable one is the Kuwait National Development Plan (KNDP), which serves as a roadmap for sustainable development within Kuwait. The KNDP places emphasis on the significance of economic, social, and environmental sustainability, establishing targets for reducing carbon emissions, enhancing waste management, and promoting renewable energy [32]. Other institutions involved in these efforts include the Kuwait Green Building Council and the Kuwait Foundation for the Advancement of Sciences, which has developed initiatives such as the Kuwait Institute for Scientific Research and the Kuwait Green Energy Forum. The State of Kuwait officially adopted the SDGs in September 2015 and subsequently integrated them into its Vision 2035 plan. As a result of these initiatives, Kuwait currently holds the 101st rank among 163 countries, with an overall score of 64.53 [40].

Despite the introduction of these initiatives, there remains some challenges in the implementation of sustainable practices by government agencies, as well as a lack of sustainable awareness among the public. Although only a limited number of studies have been conducted in this field, the prevailing message in most of them underscores the need for greater awareness of sustainability in Kuwait. For instance, a study conducted by Al Qattan and Gray [8] found that government policies and practices are insufficient in addressing pollution, particularly in Kuwaiti waters. Similarly, Al Sanad's study [10] revealed that a lack of awareness serves as the primary obstacle to the adoption of sustainable construction approaches in Kuwait. The study further emphasized the necessity for the Kuwaiti

government to take the initiative in introducing standards, policies, and incentives to promote sustainability in the country. Other studies highlighted the general public's limited awareness regarding sustainable waste management practices in Kuwait, as well as the absence of municipal strategies for waste prevention, reduction, and recycling [1, 11, 30]. In short, while there is a growing recognition of sustainability among businesses in Kuwait and efforts from the government to foster sustainability, there remains a requirement for increased awareness and implementation of sustainable practices. Additionally, there is a need for stronger action to tackle the country's dependence on oil and to actively promote a more sustainable future.

There is a lack of research conducted on the assessment of sustainability literacy or awareness among undergraduate students in Kuwait, with the only existing studies in the literature focusing on the environmental literacy of teachers or the public. One study examined science teachers in secondary schools in Kuwait and found low levels of environmental literacy among them [29]. Another study evaluated the environmental awareness of high school teachers, revealing that 60% of the teachers exhibited a high level of environmental concerns. These concerns were observed to increase with age, years of experience, the education level of their spouse, having children, and being non-Kuwaiti [14]. A more recent study investigated the awareness of climate change and its impact on Kuwaiti society, indicating that climate change is not extensively discussed or deeply engaged with in the country [42]. The researchers demonstrated that the coverage of climate change in Kuwaiti media and school curricula is limited, government officials lack substantial knowledge on the subject, and there is generally weak awareness among the public. However, young people between the ages of 15 and 24 express greater concern about climate change compared to the older generation, primarily due to their use of social media [42].

This research is significant as it represents the first known study on sustainability literacy conducted within a higher education institution in Kuwait. By investigating undergraduate students' awareness and practices, this study aims to contribute to the development of effective sustainability education programs in Kuwait and the wider Gulf Cooperation Council (GCC) region. The findings have the potential to inform the creation of targeted educational strategies, policies, and initiatives that foster a culture of sustainability within higher education institutions across the Gulf.

3 Methodology

This study has a mixed-method sequential explanatory design, which implies collecting and analyzing quantitative and then qualitative data in two consecutive phases in one study. Using mixed methods helps to provide a more comprehensive framework of the phenomenon by enabling rich and informative data and to validate and triangulate the data by analyzing the same issue through both quantitative and qualitative methods [21, 45].

3.1 Research population

The research population was the first-year composition students enrolled in the course during Fall 2022. 240 students registered in the first-year writing course in the institution were asked to complete the literacy assessment form in class, in class, in the first week of December 2022. Due to absences for various reasons, 221 completed the survey.

For the qualitative part of the study, the researcher invited the same research population to write essays in the last week of December 2022. Out of 240 students, only 60 students agreed to write an essay on the sustainability issues of Kuwait.

3.2 Data collection

The quantitative phase of the study involved gathering data using an adapted version of the Sustainability Literacy Assessment, which was originally developed by a committee at the University of Wisconsin-Oshkosh for assessing the university's sustainability performance within the Sustainability Tracking, Assessment & Rating System (STARS) framework [47]. A committee of faculty from various disciplines developed a set of questions that addressed essential learning outcomes related to sustainability. The assessment form consisted of four sections, which included five multiple-choice questions to measure knowledge levels, as well as Likert scale questions to evaluate students' self-reported skills, attitudes, and familiarity with various sustainability topics and concepts. The research obtained Institutional Review Board (IRB) approval with the assigned case number 278674. The Cronbach's Alpha reliability

scores for the different sections of the data collection tool are 0.84 for Skills, 0.72 for Attitudes and 0.92 for Familiarity with topics and concepts which indicates good internal consistency and reliability of the scale used.

During the qualitative data collection phase, students were instructed to write an essay in which they identified the primary sustainability challenge faced by Kuwait and proposed potential solutions to address this issue. This activity took place within a 50-min class session, with the instructor present to provide supervision. Students were required to sign a consent form and were informed that the essay would not be graded but solely collected for research purposes. The essays were written on computers as per the designated setup.

3.3 Data analysis

Quantitative data analysis was performed using SPSS software. Descriptive statistics (numbers, percentages, means, medians, standard deviations) were used to summarize the data. Chi-square analysis assessed group homogeneity. Normality was checked using Q-Q plots and skewness/kurtosis values. For normally distributed data, independent t-tests compared two independent groups, while dependent t-tests compared two dependent stages. One-way ANOVA compared more than two independent groups. Bonferroni correction was applied for significant differences among groups.

The data obtained in the qualitative research were examined both qualitatively and quantitatively. Student essays were imported into the MAXQDA 2022 software for analysis. The quantitative content analysis was conducted using the MaxDictio function of the software for demonstrating the most frequent words and word combinations in the essay. The qualitative content analysis adopted a combination of inductive and deductive approaches. The researcher carefully reviewed the data multiple times and generated initial codes. Codes that were related to each other were grouped under relevant themes and labelled accordingly. Subsequently, the obtained themes were explained in detail. Finally, the researcher interpreted the findings and supported them with various visual representations.

4 Results

4.1 The effect of personal variables on students' sustainability literacy

The first research question investigated the impact of gender, high school type, GPA, and whether they heard about sustainability on students' literacy levels. Table 1 summarizes the participants' demographics.

Table 2 displays the statistics of where students heard about the word *sustainability*.

Table 1 Personal characteristics of participants in the quantitative part

Variables	n	%
Gender		
Female	131	59.3
Male	90	40.7
High school type		
Abroad	11	5.0
Private (Arabic/Bilingual)	39	17.6
Private (International)	49	22.2
Public (Arabic)	122	55.2
Grade Point Average (GPA)		
Below 2.00	54	24.4
Between 2.00 and 3.0	95	43.0
3.00 and above	72	32.6
Have you heard about the term sustainability before?		
Yes	168	76.0
No	53	24.0
Total	221	100

Table 2 Where the participants heard about sustainability

Source of information	n	%
Social media/internet	116	52.5
University course/lecture/course book	106	48.0
TV/ Radio/Newspaper	43	19.5
Conference, seminar	34	15.4

Table 3 General achievement of students on the assessment scale

	Minimum	Maximum	$\overline{X}$	Sd
Knowledge	1.00	5.00	1.33	1.16
Skills	1.00	5.00	3.35	0.77
Attitudes	1.00	5.00	3.66	0.63
Familiarity with topics and concepts	1.00	5.00	3.10	0.75

To investigate the participants' scores based on their demographic characteristics, an independent t-test comparing two independent groups, and one-way analysis of variance comparing more than two independent groups were conducted (Table 3). For a better comparison, general achievement levels of students on the assessment scale were also provided in Table 4.

A statistically significant difference was observed in the scores of the participants' familiarity with topics & concepts based on their genders ($p < 0.05$), which demonstrated that female participants had higher scores in familiarity with topics & concepts compared to male participants.

A statistically significant difference was detected in the knowledge scores and familiarity with topics & concepts scores based on the type of high school attended by the participants ($p < 0.05$). When Bonferroni correction was applied to determine the differentiating group, it was seen that participants who studied high school abroad and in a "Private (International)" had higher scores in knowledge compared to participants from the "Public (Arabic)" high school type. Participants from the "Abroad" high school type also had higher scores in familiarity with topics & concepts compared to participants from the "Public (Arabic)" high school type.

Participants' GPA values also showed a significant difference in the knowledge scores ($p < 0.05$). Bonferroni correction result demonstrate that the differentiating group was the participants with a GPA value of 3.00 and above who had higher scores in knowledge compared to participants with a GPA value below 2.00.

Whether the participants had previously heard about the term "sustainability" ($p < 0.05$) resulted in a significant difference in the scores of knowledge, skills, attitudes, and familiarity with topics & concepts. Participants who had heard about the term "sustainability" had scored higher than those who had not, in all sections of the questionnaire. However, it should also be added that regardless of the personal variables, the knowledge score among the participants is quite low, the highest score obtained out of 5 is 2 (by graduates of high schools abroad) and the lowest is 0.8 (by participants who never heard about sustainability before and those who have a GPA below 2).

4.2 The awareness level of students about the major sustainability challenges and their solutions

The second research question of the study analyzed whether students were able to identify major sustainability challenges Kuwait is facing and offer solutions to overcome these challenges both quantitatively and qualitatively. In the quantitative content analysis, the word frequency function of MaxDictio was used to scan the student essays for the most frequently used words in student essays and the results for the most frequent 15 words are displayed in Table 5.

The most frequent words show a focus on environmental issues, and particularly pollution, resulting from oil and the country's dependence on cars. When we look at the top 5 words with frequencies and the number of student essays mentioning these words, environment, car, oil, pollution, and air give us a clear picture of the country's biggest challenge.

To be able to understand what these may mean in a larger context, MaxDictio was run again for word combinations and the word combinations with a frequency of 4 and above are shown below:

Table 4 Difference analysis results according to variables

Variables	n	Knowledge		Skills		Attitudes		Familiarity with topics and concepts	
		$\overline{X}$	Sd	$\overline{X}$	Sd	$\overline{X}$	Sd	$\overline{X}$	Sd
Gender									
Female	131	1.26	1.26	3.37	0.72	3.71	0.57	3.18	0.72
Male	90	1.42	1.42	3.34	0.84	3.59	0.71	2.98	0.78
t		−1.020		0.287		1.406		1.977*	
Effect size		0.136		0.038	0.186	0.266		0.136	
High school type									
Abroad (1)	11	2.09	0.83	3.75	0.42	3.73	0.59	3.63	0.59
Private (Arabic/ Bilingual) (2)	39	1.36	1.14	3.25	0.88	3.78	0.56	3.12	0.64
Private (International) (3)	49	1.65	1.39	3.50	0.74	3.73	0.81	3.29	0.72
Public (Arabic) (4)	122	1.11	1.05	3.29	0.75	3.59	0.57	2.96	0.78
F		4.412*		2.087		1.324		4.422*	
Bonferroni		1 > 4, 3 > 4						1 > 4	
Effect size		0.280		0.129		0.081		0.181	
GPA value									
Below 2.00 (1)	54	0.87	1.01	3.16	0.70	3.54	0.59	3.02	0.58
Between 2.00 and 3.0 (2)	95	1.33	1.09	3.40	0.72	3.75	0.60	3.11	0.75
3.00 and above (3)	72	1.67	1.27	3.44	0.86	3.64	0.69	3.14	0.85
F		7.645*		2.324		1.998		0.455	
Bonferroni		**3 > 1**							
Effect size		0.299		0.112		0.084		0.046	
Whether they heard about sustainability before									
Yes	168	1.48	1.16	3.46	0.70	3.74	0.65	3.18	0.71
No	53	0.83	1.05	3.03	0.88	3.42	0.51	2.83	0.81
t		3.651*		3.636*		3.259*		3.063*	
Effect size		0.587		0.540		0.548		0.459	

*$p < 0.05$

Table 5 15 most frequent words in student essays

Word	Frequency	Documents
Environment	226	36
Car	131	31
Oil	122	29
Pollution	90	24
Air	85	23
Factory	64	20
Clean	46	17
Pollute	32	17
Weather	40	16
Plastic	51	13
Energy	49	13
Healthy	21	13
Water	54	12
Economic	45	12
Trash	38	12

Table 6 Frequent word combinations in student essays

Word combination	Frequency	Documents
Fossil fuel	27	4
Air pollution	24	7
Global warming	18	6
Solar energy	17	6
Renewable energy	14	4
Electric car	11	7
Environmental sustainability	11	4
Marine pollution	8	1
Plastic straw	8	1
Sustainable source	8	2
Mental health	6	1
Air quality	5	3
Car accident	5	2
Renewable resource	5	1
Carbon emission	4	1
Environmental pollution	4	2

Table 7 The codes of sustainability problems in student essays

Codes of problems	Frequency of codes
Economic sustainability problems	
Overdependence on oil	10
Donating money to other countries	5
Social sustainability problems	
Health and wellbeing	
Mental health	1
Obesity	1
Car accidents	1
Respiratory problems	4
Heat related problems	1
Lack of quality infrastructure	6
Discrimination & Inequality	1
Environmental sustainability problems	
Pollution and littering	46
Climate change and global warming	16
Loss of biodiversity	2
Limited resources	4
Sum	98

According to Table 6, the most frequently used word combination was fossil fuel by 27 times and in 4 essays. Air pollution was the 2nd most frequent word combination with 24 frequency and 7 essays. Global warming is another frequent word combination with 18 frequency and 7 essays. These results suggest that students were more concerned with environmental challenges than social or economic ones.

Table 7 shows the results of the qualitative content analysis investigating student perspectives of the major sustainability challenges in Kuwait. According to the results, dependence on oil and donating money to other countries are the major issues in the economic area. Social sustainability issues in Kuwait as per student views could be listed as health & wellbeing problems (mental health, obesity, traffic accidents, respiratory, and heat related problems), lack of quality infrastructure, and discrimination and human rights issues in Kuwait. In the environmental dimension, pollution and

littering was the most frequently mentioned problem, followed by climate change. Loss of biodiversity and scarcity of resources were the other two major environmental sustainability challenges as per student essays.

In the same data collection tool, students were also asked to propose solutions to the major sustainability challenge they identified. The table below shows the codes of these solutions in the student essays.

Table 8 displays the content analysis and the frequencies of the solutions participants have expressed in their essays. Table 7 showed a clear tendency for students to emphasize the environmental problems their country is experiencing, likewise this table shows the students' priority as solutions to the environmental problems in the country. Oil industry, carbon emissions from fossil fuels and overall pollution and littering were seen as the major problems by students, thus, their solutions target these problem areas. Switching to clean energy such as electric cars and solar energy is the most frequently mentioned solution by students. The 2nd most frequent solution is raising awareness, which is closely followed by imposing penalties on violators.

In the economic area, overdependence on oil as the country's only income was identified as a major problem, hence, seeing diversification of country's revenues as a frequent solution in the economic sustainability area is not surprising.

Social sustainability solutions are mainly limited to improving the infrastructure (particularly roads & motorways) and implementing a more efficient decision-making system in the governmental institutions.

5 Discussion

The findings of the study reveal that students' personal characteristics have resulted in statistically significant differences in their sustainability related knowledge, skills, attitudes, and familiarity with sustainability. Female students were more familiar with sustainability than male students. The high school type played a role in participant scores, with graduates of High School Abroad and private schools (with American or British Curriculum) scoring better than public school graduates in the knowledge test and familiarity. Students with a higher GPA (3 and above) scored higher in the knowledge test than those with a GPA 2 and below. Also, participants who reported they had heard about the term sustainability, scored significantly higher than those who had not in all sections of the questionnaire.

The results of the quantitative analysis are aligned with other studies in literature. For example, gender is one of the variables that made a difference in student perception in environmental and sustainability related topics. According to other scholars, women tend to exhibit stronger environmental attitudes and behaviors compared to men and display a higher level of sustainability-related attitudes [3, 43, 51]. The researchers attribute these disparities to gender

Table 8 The codes of sustainability solutions in student essays

	Codes of solutions	Frequency of codes
	Economic sustainability solutions	
	Diversifying revenues	11
	Social sustainability solutions	
	Improving the infrastructure	7
	Fighting malnutrition and obesity	1
	More efficient government and institutions	4
	Environmental Sustainability Solutions	
	Switching to clean energy	23
	Raising awareness	16
	Imposing fine and penalty on violators	11
	Conserving and Recycling	8
	Improving public transportation	8
	Better waste management	8
	Moving industry outside residential areas	7
	Planting trees	7
	Laws to reduce carbon emissions	5
	Tax and Price increase on oil	1
Sum		117

socialization. Women are generally reported to be more concerned with environmental welfare than men and this lack of concern (and/or perhaps even knowledge) may lead to a dismissal of such topic question by men in studies [44].

The type of high school students graduated from also played a role in different perceptions and knowledge scores of students. Students who completed high school abroad or graduated from a private international school in Kuwait had higher scores than the graduates of public schools and private schools with a bilingual education. Public school graduates consistently scored the lowest across all sections of the questionnaire. This underperformance could be attributed to the fact that Kuwait's education system falls significantly below international standards. Research conducted by Al Hashem and Al Kandari [6] on Kuwait's low performance in TIMSS assessments over the past 20 years revealed inefficiencies in the education system, including an inadequate curriculum, insufficient teacher training, ineffective pedagogical methods, and assessment tools that fail to meet students' needs. Al Hashem [5] also highlights the social capital gap in education between public and private schools in Kuwait, spanning from early stages to higher education. She emphasizes the need for interventions targeting students who have unqualified teachers and an outdated educational paradigm. To improve the education system, it is suggested to incorporate more technology, enhance the educational curriculum, and raise recruitment standards for teachers while focusing on their teaching skills [2, 4, 35]. A Kuwait-based study seems to confirm this gap between public and private school graduates [42]. The research involved conducting focus group interviews with students and graduates from both public and private Western schools. Participants from public schools emphasized the lack of climate change education in their curriculum. In contrast, those from private schools noted that climate change was partially covered in their curriculum and addressed through extracurricular activities such as after school clubs and events like 'Earth Day'.

Another significant difference was observed between students with high (3.00 and above) and low (2.00 and below) GPA. Students with a higher academic performance scored higher in the knowledge test about sustainability. These students knew more about the definitions of sustainability and its three pillars, namely, environmental, economic, and social. It is not surprising that higher grades correlate with a higher level of sustainability literacy, since such students might be willing to invest more time into learning about the complex challenges of sustainable development. Briens et al. [15] found out that honors students (those with a high school GPA of 3.75 out of 4.00) studying in a first-year university program achieved higher sustainability knowledge score compared with general student population. Honors students have the highest academic performance, highest graduation rates and shortest time to degree completion when compared to non-honors students [20]. It is expected such students to have more intrinsic motivation and potential personal interest in sustainability, which may explain why higher achievers outperformed the students with lower GPAs in this study as well.

The last variable assessed on students' literacy levels was their familiarity with the term "sustainability". When they were asked whether they heard about the term before, those who said "yes" scored significantly higher in all aspects of the questionnaire. Their knowledge, skills, attitudes and familiarity with sustainability related terms and concepts were higher than those students who said they did not hear the word before. Another important detail regarding this variable is the source of their knowledge of the concept. More than half of the students said they heard about the word "sustainability" on social media. University courses and lectures also were selected by 48% of the participants, which shows the term sustainability has started making being mentioned by university faculty or the curriculum designed by them. This is an interesting finding since the participants are only first year students and students are not offered a course named Sustainability in the first year. The only mandatory course that may expose students to sustainability is Environmental Biology (BIOL 103) that has the following course description on the website: *Examines the organization of natural ecosystem as it relates to the human community. Basic ecological principles are applied to current environmental issues. Among the topics to be examined are past and present uses and abuses of natural resources; environmental ethics and public policy; global environmental problems; human population growth; pollution; waste disposal; habitat loss; species extinction; and strategies for attaining a sustainable earth.* [27].

This is the only course in the university course catalogue that has the word sustainability in its course description, which may mean if students heard about the word before, they probably took this course or the instructors of other courses they have taken have selected teaching materials that have included the topic of sustainability. Social media as the main source of information with regards to students' sustainability awareness is also mentioned in Sharp et al.'s study [41] in which young participants emphasized the fact that mainstream Kuwaiti media ignores climate change. They explained that their use of social media made them more aware of climate change incidents such as the wildfires in Australia, the climate change activist Greta Thunberg which encourage them to get more involved with climate change.

There has been a dramatic increase in social media usage among young people. Social media has also changed every aspect of our life, however, the influence of social media on the younger generation's behaviors regarding sustainability is hardly discussed in the literature. Some studies have started analyzing how young people's consumption habits have changed with social media. For example, Xie and Madni [49] found that information shared on social media via blogs, opinions, news, and advertisement have an impact on young people to go for green purchases and green consumption. Nekmahmud et al. [36] suggest social media plays a crucial role in shaping consumers' purchasing intentions for green products and services, which could result in sustainable consumption practices.

The qualitative part of the study found out that students are quite familiar with environmental problems of the country they are living in, such as pollution (air, water, sea), littering and climate change being the most urgent ones. Some students also expressed scarcity of the resources such as water and land of Kuwait and loss of biodiversity (mainly because of pollution) as major environmental sustainability challenges. In the economic pillar, some students indicated Kuwait's dependence on oil as the only income as a sustainability problem. The social sustainability problems were identified by a few students only, with some of them mentioning health and wellbeing issues (mental health, obesity, and respiratory problems) and some others mentioning the low quality of the infrastructure in the country (mostly motorways & roads).

It would not be wrong to say that participants were able to identify the environmental problems of their country accurately, which are easy to observe. This finding is consistent with the other findings in the literature which suggest that students are more familiar with environmental sustainability [24, 37, 52]. Interestingly, not only students, but also researchers largely focus on environmental domain, failing to address the economic and social domains [53], the reason for this unbalance is that the environmental dimension is easier to understand and observe, compared to economic and social sustainability. Environmental sustainability is a straightforward term, sustainable use consists of withdrawing the resource at a rate equal to or less than the rate of replacement whereas examples of economic and socially sustainability may vary based on an individual's political, ideological, or even cultural values (in case of gender equality in religious societies).

However, in Sharp et al.'s study [42] when participants were asked about the problems they were experiencing in Kuwait, they brough up issues such as gender equality, the harassment of women and corruption, their frustration at being silenced by the older generation and the government's focus on 'the economy' rather than quality of life. However, these social sustainability issues did not emerge as a result of the content analysis of the essays in the qualitative part of the study.

Kuwait has indeed some serious issues other than the environmental ones, as per the Sustainable Development Report, by UN [40]. In gender inequality (SDG 5) Kuwait scores particularly low in indicators such as 'ratio of female-to-male labor force participation' and 'seats held by women in national parliament'. Kuwaiti women face challenges in social, cultural, and political arenas [13] which hinder their participating in the socio-political development of Kuwait. Corruption is also defined as a significant challenge indicator in the UN Report, which has become an existential threat to the country, so much so that it has "become a staple of governance and a feature of everyday life in Kuwait" [9].

The reason why these challenges were not brought up in a sustainability essay could also be related to the students' lack of sustainability knowledge to the extent that some university students strongly associate recycling and sustainable living, and in many cases, believe these two concepts to be the same thing [18]. The participants in our study were also not aware of the economic and social pillars of sustainability.

Colantonio [19] suggests social sustainability has recently gained recognition as a fundamental component of sustainable development, with the notions of governance, social capital, and corporate social responsibility. However, despite social capital is often included in sustainable development policies, the implementation of this concept is still limited.

To ensure the long-term sustainability of any endeavor, policy, or society, it is crucial to prevent any detrimental effects on the environment, economy, and social well-being of the individuals involved. The concept of sustainability, as defined by the Brundtland Commission, acknowledges these three distinct yet interconnected dimensions. In order to progress towards a sustainable society, it is imperative for this interdisciplinary field to expand its focus to encompass the social and economic aspects.

6 Conclusions and recommendations

This study investigated the sustainability literacy of first-year students in Kuwait. Gender, high school type, GPA, and their previous interaction with the word impacted students' knowledge and attitudes. While students identified environmental challenges and proposed solutions, their awareness of social and economic sustainability was limited. This highlights the need for improved sustainability education, particularly considering the low literacy levels among public school graduates. Social media seems to keep students informed about environmental issues, but a more comprehensive approach is needed.

It is important to note that this study was conducted on a small number of students, so the results may not be representative of the overall knowledge level of undergraduate students in the country. The data collected focused on students' knowledge and familiarity with sustainability at the time of data collection, and the essays were written within a limited timeframe and based on a specific prompt, limiting the students' flexibility to explore various sustainability issues in their country. However, the study still provides valuable insights into the perceptions and awareness levels of undergraduate students regarding sustainability. These findings could be used as a baseline to make a needs assessment that is highly needed to be able integrate sustainability into the curriculum in academic departments.

Currently, sustainability education in Kuwait is limited. Universities lack courses that cover all three pillars of sustainability. To equip students with the necessary knowledge and skills, educational institutions must strategically integrate sustainability across all programs and years of schooling (16). This requires adequate resources, development of learning materials that address environmental, social, and economic concerns and faculty training. Faculty often lack knowledge of sustainability concepts and have limited experience in teaching sustainability [22, 34, 42]. To address this, faculty members should learn how to incorporate environmental, social, and economic issues into their subject matter and be encouraged to develop activities that facilitate integrated teaching [28, 29, 37].

By prioritizing sustainability education, higher education institutions can empower students to become agents of change, capable of solving the complex challenges facing current and future generations.

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Declarations

Ethics approval and consent to participate This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Review Board of G..University for S & T (Case number 278674). Informed consent was obtained from all individual participants included in the study.

Competing interests The author declares that they have no competing interests.

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