Assessment of University Students' Awareness Level of War's Environmental Effects and Other Environmental Issues: A Case Study at the University of Science and Technology, Sana'a, Yemen

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Abstract:

Drinking water pollution, climate change, soil pollution, resource depletion and other environmental issues are serious concerns worldwide. Many countries implement policies and educational programs to enhance environmental awareness in society aiming to achieve environmental sustainability. Developing countries, including Yemen, face significant challenges in raising environmental awareness, and ongoing wars contributed to political instability, economic hardships, weak enforcement of environmental regulations, and limited educational programs causing environmental concerns to be frequently overlooked. The environmental effects of the ongoing war in Yemen are a major concern. Assessing individual's knowledge of environmental issues possess regarding the environment is essential for establishing the sustainability of a community. This will foster a robust national environmental movement aimed at conserving the environment through the resolution of environmental issues. The present study intends to assess the students' awareness level toward national environmental issues including "environmental impacts of wars in Yemen" and global environmental issues. The study was conducted among undergraduate and postgraduate students of the University of Science and Technology (USTY), Sana'a, Yemen. The survey covered 407 students from 7 faculties having 30 undergraduate programs and 10 postgraduate programs. The questionnaire consisting of 25 questions to measure the students' knowledge and awareness level of national and global environmental issues. The study reveals that, around 42.71% of students being aware about national environmental issues while only 29.70% for global environmental issues. The study findings expose that the students'mean awareness level regarding national and global environmental issues falls within level 3, classified as, 'limited awareness' indicating that students may be aware of the problem but not aware of its causes and effects. The students' average awareness level toward national environmental issues are higher than that in global environmental issues. The students' awareness level for most of the national environmental issue including 'environmental effects of war' falls within level 4, classified as 'moderated awareness' indicating that students

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may be aware of the problem and its causes but not aware of its effects while, awareness of global environmental issue varies, with an average fall within level 3, classified as, 'limited awareness'. On the other hand, female shows higher awareness than male and the students from the Faculty of Medicine shows highest awareness, followed by those from Engineering. As for the academic level, third year students exhibit the highest awareness, followed by second year student. In terms of degree level, postgraduate students show highest awareness than undergraduate students. The results of the study are consistent with related studies pertaining to environmental awareness in Yemen and other developing countries. These findings highlight the necessity of improving environmental education and awareness programs at universities, where environmental understanding empowers students to respond to global environmental challenges and participate in sustainable efforts.

Keywords: environmental awareness, the environmental effects of war, University of Science & Technology, Sana'a, Yemen.

تقييم مستوى وعي طلاب الجامعات بالآثار البيئية للحرب والقضايا البيئية الأخرى: دراسة حالة في جامعة العلوم والتكنولوجيا، صنعاء، اليمن

الملخص:

يُعد تلوث مياه الشـرب، وتغير المناخ، وتلوث التربة، ونضوب المـوارد، وغيرها من القضايا البيئية من المخاوف الجسـيمة في جميع أنحاء العالم. تنفذ العديد من الدول سياسـات وبرامج تعليمية لتعزيـز الوعي البيئي في المجتمع بهدف تحقيق الاسـتدامة البيئيـة. تواجه الدول النامية، بما فيها اليمن، تحديات كبيرة في رفع مستوى الوعي البيئي، كما أن الحروب المستمرة تؤدي إلى عدم الاستقرار السياسـي، والصعوبات الاقتصادية، وضعف إنفاذ اللوائح البيئية، ومحدودية البرامج التعليمية، ما يجعل الاهتمام بالقضايا البيئية غالبًا ما يُغفل عنه. تُشكل الآثار البيئية للحروب الحاليـة في اليمن مصدر قلق كبير. يُعد تحديد المعرفـة التي يمتلكها الأفراد فيما يتعلق بالبيئة أمرًا أساسيًا لتحقيق اهداف الاستدامة في المجتمع. سيعزز ذلك حركة بيئية وطنية قوية تهدف إلى الحفاظ على البيئة من خلال حل القضايا البيئية. تهدف هذه الدراسـة إلى تقييم مسـتوى وعي الطلاب بالقضايا البيئية الوطنية، بما في ذلك "الآثار البيئية للحروب في اليمن" والقضايا البيئيـة العالمية. أجريت الدراسـة على طلاب البكالوريوس والدراسـات العليا في جامعة العلوم والتكنولوجيا، صنعاء، اليمن. شمـل الاستطلاع 407 طالبا من 7 كليات تضم 30 برنامجًا جامعيًا و10 برامج دراسـات عليا. يتكون الاسـتبيان من 25 سـؤالاً لقياس مسـتوى المعرفة والوعي لدى الطلبة بالقضايا البيئية الوطنية والعالمية. تكشـف الدراسـة أن حـوالي 42.71% من الطلاب على دراية بالقضايا البيئية الوطنية بينما 29.70% فقط على دراية بالقضايا البيئية العالمية. كما تظهر نتائج الدراسـة أن متوسـط مسـتوى وعي الطلاب بالقضايا البيئية الوطنية والعالمية يقـع ضمن المسـتوى 3 "وعي محدود" ممـا يشير إلى أن الطلاب قد يكونوا على دراية بالمشـكلة ولكنهم غير مدركين لأسـبابها أو آثارها. متوسط مستوى وعي الطلاب بالقضايا البيئية الوطنية أعلى من القضايا البيئية العالمية. يقع مسـتوى وعي الطلاب لمعظم القضايا البيئية الوطنية بما في ذلك "الآثار البيئية للحروب" ضمن المسـتوى 4 "وعي متوسـط" مما يشير إلى أن الطلاب قد يكونوا على دراية بالمشـكلة وأسـبابها ولكنهم غير مدركين آثارها، بينما يختلف بالنسبة للقضايا البيئية العالمية بمتوسـط المسـتوى 3 "وعي محدود". من ناحية أخرى، تُظهر الإناث وعيًا أعلى من الذكور ويُظهر طلاب كلية الطب وعيًا أعلى يليهم الهندسـة. أما بالنسبة للمستوى الأكاديمي، يُظهر طلاب المسـتوى الثالث وعيًا أعلى يليهم المستوى الثاني. من حيث الدرجة الأكاديمية، يُظهر طلاب الدراسات العليا وعيًا أعلى من طلاب البكالوريوس. تتوافق نتائج الدراسة مع الدراسات ذات الصلة المتعلقة بالوعي البيئي في اليمن والدول النامية الأخرى. وتسلط هذه النتائج الضوء على ضرورة تحسين برامـج التثقيف والتوعية البيئية في الجامعات، حيث يمكن الفهم البيئي الطلاب من الاستجابة للتحديات البيئية العالمية والمشاركة في الجهود المرتبطة بأهداف الاستدامة.

الكلمـات المفتاحية: الوعي البيئي، الأثار البيئية للحرب، جامعة العلوم والتكنولوجيا، صنعاء، اليمن.

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1. Introduction

With the advent of the 21st century, environmental challenges such as pollution, changes in climate, saltwater intrusion, and the exhaustion of resources have intensified. These pressing issues pose a significant threat to both the survival and sustainable development of the planet [1]. Tackling environmental issues is essential for protecting human health and improving quality of life. Problems like pollution, climate change, and the decline of wildlife directly and indirectly affect human health. These effects include respiratory problems and diseases spread through water, as well as hunger and mental health issues [2]. University students, as the next generation of leaders, professionals, and citizens, play an important role in tackling these issues. Understanding their level of awareness about environmental issues is critical for promoting a sustainable future. University students in developing nations demonstrate differing degrees of awareness concerning environmental issues, shaped by regional contexts, educational frameworks, and socio-cultural elements[3]. Research conducted across various countries indicates that while numerous students possess a fundamental comprehension of environmental challenges, substantial gaps exist in both knowledge and practical involvement. For example, students in Pakistan exhibit a strong relationship between ecological awareness and sustainable consumption practices, with significant distinctions observed between male and female students[4]. Similarly, in Vietnam, students demonstrate significant levels of environmental awareness, with 87. 64% indicating concern regarding matters such as pollution and climate change [1]. In the same context, in Colombia students prove low levels of environmental awareness [5]. A comparative study conducted in Montenegro and North Macedonia demonstrated distinct attitudes concerning environmental issues, shaped by regional socio-cultural factors [3]. In Bangladesh, students recognized global warming and the depletion of natural resources as pressing concerns, with education and media serving essential functions in enhancing awareness [6]. In Uganda, students registered in environmental management courses exhibited a significant awareness of climate change issues; however, their comprehension of anthropogenic causes differed [7]. However, in South Africa, despite the low levels of knowledge, students demonstrated a willingness to participate in recycling projects, indicating that motivation and incentives could improve participation [8]. Other research on environmental awareness among university students in developing countries reveals mixed results.

While some studies indicate positive impacts of sustainability education on students'environmental awareness [9] others suggest that awareness levels remain below Moderate [10].

Despite being extensively recognized, implemented, and used by individuals and institutions worldwide, developing countries have showed poor levels of knowledge and behaviors when it comes to protecting and sustaining environmental resources[11]. These findings underscore the importance of enhancing environmental education and awareness initiatives in developing countries'universities.

Yemen, as one of the least developed countries, has not been entirely successful in its economic development attempts. It has long-term challenges in maintaining and expanding its economy, and the present conflict has compounded those issues. Prior to the onset of hostilities in 2015, Yemeni development was challenged [12]. Limited studies on environmental awareness determination in Yemen. [13] conducted survey to examine the biodiversity awareness level among the students in the field of both Arts and Sciences from the University of Sana'a. Feedback was obtained from a total of 192 participants. The study reveals that around 55.7 % of the respondents had an acceptable level of environmental awareness and only 30.7% were fully aware of the environmental issues. 3.6% had an insufficient level of environmental awareness. Another study by [14] conducted survey to investigate environmental awareness level among student of faculty of agriculture, Sana'a university in the academic year 2019-2020. The number of accepted forms were 160. The study results showed that the participants'environmental awareness is low. Due to the prevailing circumstances in Yemen, it is necessary to incorporate additional environmental issues, such as the environmental impacts of war, and evaluate the students'awareness of this matter.

The objective of this study is to assess the awareness level of Yemeni university students at University of Science and technology (USTY) regarding national and global environmental issues. Its contribution lies in evaluating students'awareness of current national environmental concerns, particularly the environmental effects of war. Additionally, this study is conducted on a large scale, involving 407 students from seven faculties, encompassing 30 undergraduate programs and 10 postgraduate programs. Moreover, it examines a broad range of environmental issues (25 in total), covering

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both national concerns such as pollution resulting from non-treatment of wastewater and global challenges, such as climate change.

2. Methodology

The study was conducted in the University of Science and Technology (UST), the biggest private university in Yemen, which located in Sana'a, the capital city of Yemen, data were collected using online questionnaire survey. The survey covered seven faculties (Medicine and Medical Sciences, Pharmacy, Dentistry, Engineering, Computing and Information Technology, Administrative Science and Social and Humanitarian Sciences) offering 30 undergraduate programs and 10 postgraduate programs. The questionnaire consisting of 25 statements designed to assess students' knowledge and awareness level regarding national and global environmental issues. It was developed employing a 5-level Likert scale, which precisely express the level of the student awareness toward the environmental issue "I have never heard of the problem", "I have heard of the problem, but I don't know its details", "I know the problem, but I don't know its causes", "I Know the problem and its causes" and "I know everything about the problem, Its causes and effects". This type of questions was adopted by [15] which was modified to serve the purpose of this study. The accuracy of a research method relies on choosing the right sampling methods and determining a sample size that is strong enough [16]. Based on [17], the required sample sizes for various population sizes at 95% confidence level with margins of error 5%, is 370 for a population size of 10,000. The population size for this study was around 8,000 students and the sample size used was 407. In most social and administrative surveys, postal and email response rates surveys are rarely 100% [18]. The questionnaire consists of two parts:

The first part "General characteristics of the participants" which is used to gather the basic data about the participants e.g., gender, age, major, level and degree level. (7 questions) while the second part "Measurement of the awareness" which was used to evaluate the student's environment awareness and knowledge level towards the environmental issues. This part has two sections, the first section, 'measurement of the awareness regarding global environmental issues' (19 questions) (e.g., climate change) while the second section "Measurement of the awareness regarding national environmental issues" (6 questions) (e.g., environmental impacts of war). Based on the study conducted by [19], the level of environmental awareness based on the Likert

type questionnaire intervals are as follows: 1.00–1.80 "Never heard of the problem (Not Aware at All)"; 1.81–2.60 "Heard of the problem, but don't know its details (Poor Awareness)"; 2.61–3.40 "know the problem, but I don't know its causes (Limited awareness)"; 3.41–4.20 "Know the problem and its causes (Moderate Awareness)" and 4.21–5.00 "know everything about the problem (High Awareness)". The Cronbach's alpha reliability coefficient of the questionnaire was calculated as 0.9484. The statistical analysis using SPSS software was applied for this study.

3. Results and Discussion

General characteristics of the students: This part of survey aimed to gather the basic data about the participants' gender, age, faculty major, grade and degree level (Table 1). It shows that, 38.33% of the students was male while 61.67% was female. The largest group of students was female. Regarding the students' age, the percentages 16.22 %, 68.80%, 7.62%, 6.14% and 1.22% were from <20, 20-25, 26-30,31-40 and >40 ages, respectively. The largest group of students (68.80%) was between 20-25 years of age while the smallest group of students (1.22%) was above 40 years of age. As for the major, medicine & medical sciences accounted for 14.50%, pharmacy 20.64%, Dentistry 10%, engineering 31%, computing & information technology 5.66%, Administrative science 14.50% and social & humanitarian sciences 3.7%. The largest group of students (31%) was from engineering faculty while the smallest group of students (3.7%) was from faculty of social & humanitarian sciences. Regarding students' grade, 16.46%, 15.72%, 25.80%, 23.35%, 1.72% and 5.65% were from 1st, 2nd, 3rd, 4th, 5th and 6th grades, respectively, the largest group of students was 25.80% from the 3rd grade while the smallest group of students was 1.72% from the 5th grade. Finally, regarding the students' degree level, bachelor's degree accounted for 88.70% while master's degree accounted for 11.30% indicating that most of the students were undergraduate students.

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Table 1: General characteristics of the participants

Variable		N	%
Gender	Male	156	38.33
	Female	251	61.67
Age	<20	66	16.22
	20-25	280	68.80
	26-30	31	7.62
	31-40	25	6.14
	>40	5	1.22
Faculty	Medicine & Medical Sciences	59	14.50
	Pharmacy	84	20.64
	Dentistry	41	10
	Engineering	126	31
	Computing & Information Technology	23	5.66
	Administrative Science	59	14.50
	Social & Humanitarian Sciences	15	3.7
Grade	1st	67	16.46
	2nd	64	15.72
	3rd	105	25.80
	4th	95	23.35
	5th	7	1.72
	6th	23	5.65
Degree Level	Bachelor	361	88.70
	Master	46	11.30

Regarding the distribution of gender per faculty, as shown in Table 2, the number of females was higher than the number of males in most faculties.

Table 2: Gender distribution per faculty

Faculty	Female	Male	Total
Dentistry	36	5	41
Engineering	65	61	126
Medicine	23	36	59
Administrative	46	13	59

Table 2: Continued

Faculty	Female	Male	Total
Computing	12	11	23
Social	15	0	15
Pharmacy	54	30	84
Total	251	156	407

Measurement of the students' awareness level: This part of the survey aimed to evaluate the student's level of awareness toward national and global environmental issues. The percentages of students' scores for each environmental issue were calculated on the 5- level Likert scale as shown in Table 3. Regarding the national environmental issues, the results exposed that 51.84%, 50.61% and 47.91%, of students' state that they 'know everything about the problem, its causes and its effects' for the issues "pollution caused by the improper disposal of solid waste in non-designated areas', 'contamination of food by pesticides' and 'environmental effects resulting from wars', respectively. However, the percentages decrease to 38.57% for 'pollution resulting from random urbanization', 34.4% for 'pollution resulting from non-treatment of wastewater' and 32.92% for 'Pollution caused by raw sewage discharge'. That may be because some issues are common in most cities where the students come from, while other are less prevalent. The mean percentage for national environmental issues indicates that, 42.71% of students 'know everything about the problem, its causes and its effects'.

In contrast, the results for global environmental issues varied. These results were categorized into three groups based on the highest percentage value for each environmental issue. The first group where, 54.05%, 53.81% and 53.56% of students state that, they "know everything about the problem, its causes and its effects" for the issues "pollution from factories', 'air pollution', and 'drinking water contamination', respectively while these percentages were decreased 46.44%, 37.84%, 34.15%, 34.15% and 26.04% for the issues 'pollution from transportation', 'pollution of the seas and oceans', 'soil pollution', 'environmental effects resulting from natural disasters' and 'extinction of species of plants & animals" , respectively. The second group where, 31.45%, 30.47%, 29.98%, 28.75% and 28.01% of students' state that, they 'heard of the problem but don't know its details' for the issues 'climate change', 'genetically modified foods', 'flooding', "global warming', 'ozone layer depletion" and "electromagnetism", respectively.

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The third group where, 35.87%, 35.38%, 32.43%, 27.27% and 26.54% of students' state that, they 'never heard of the problem' for the issues 'food contamination by growth hormones', 'environmental effects resulting from biological changes',' food contamination by growth hormones', 'excessive depletion of resources',' polar ice melting',' environmental effects resulting from biological changes" and 'noise pollution', respectively. The mean percentage for global environmental issues indicates that, only 29.70% of students 'know everything about the problem, its causes and its effects'. Students in developing countries are more likely to personally experience national environmental issues, such as Pollution caused by the improper disposal of solid waste in non-designated areas, contamination of food by pesticides and environmental effects resulting from wars. These problems feel more immediate and tangible, leading to higher awareness compared to global issues that might seem distant. In addition, national media frequently covers local environmental issues more than global ones, reinforcing higher awareness levels. On the other hand, global environmental problems, such as polar ice melting or noise pollution, may receive less attention in semi-arid and sparsely populated developing countries like Yemen. The results of the study confirm the previous findings by [20] and [21] revealing that university students have greater awareness of local environmental issues than global ones. Overall, the mean percentage for both national and global environmental issues indicates that, 32.83% of students 'know everything about the problem, its causes and its effects' which is considered low. This result is in accordance with [10], [13], and [14] which demonstrated that university students in developing countries have a low level of environmental awareness.

Table 3: Rank order of the percentages of students' scores for each environmental issue

	Environmental Issue	I have never heard of the problem	I have heard of the problem, but I don't know its details	I know the problem, but I don't know its causes	I Know the problem and its causes	I know everything about the problem, Its causes and its effects
National	Pollution caused by the improper disposal of solid waste in non-designated areas	4.67	14.99	6.39	22.11	51.84
	Contamination of food by pesticides	5.65	12.78	7.62	23.34	50.61
	Environmental effects resulting from wars	5.41	18.67	7.37	20.64	47.91
	Pollution resulting from random urbanization	10.07	19.9	9.83	21.62	38.57
	Pollution resulting from non-treatment of wastewater	11.55	21.38	11.06	21.62	34.4
	Pollution caused by raw sewage discharge	19.66	18.18	10.57	18.67	32.92
Sub-mean		**9.50**	**17.65**	**8.81**	**21.33**	**42.71**
Global	Pollution from factories	4.18	11.55	6.39	23.83	54.05
	Air pollution	4.42	9.58	5.65	26.54	53.81
	Drinking water contamination	6.39	7.37	9.58	23.1	53.56
	Pollution from transportation	8.6	13.27	6.14	25.55	46.44
	Pollution of the seas and oceans	8.6	21.87	10.81	20.88	37.84
	Soil pollution	11.79	14.5	15.23	24.32	34.15
	Environmental effects resulting from natural disasters	10.57	24.08	12.53	18.67	34.15
	Extinction of species of plants and animals	11.79	31.2	15.23	15.72	26.04
	Noise pollution	26.54	22.36	10.32	16.46	24.32
	Ozone layer depletion	17.94	28.75	9.34	19.9	24.08
	Climate change	12.29	31.45	12.53	20.39	23.34
	Excessive depletion of resources	27.27	18.67	13.76	17.2	23.1
	Food contamination by growth hormones	35.87	18.92	9.34	14	21.87
	Flooding	9.83	29.98	22.11	16.95	21.13
	Genetically modified foods	26.78	30.47	10.07	12.04	20.64
	Global warming	15.23	34.15	14.74	16.95	18.92
	Polar ice melting	35.38	25.31	9.83	12.04	17.44
	Electromagnetism	26.54	28.01	13.02	16.22	16.22
	Environmental effects resulting from biological changes	32.43	29.48	11.3	13.51	13.27
Sub mean		**17.50**	**22.68**	**11.47**	**18.65**	**29.70**
Mean		**15.58**	**21.47**	**10.83**	**19.29**	**32.83**

The students' awareness levels were scaled based on their mean score values for the environmental issues, as shown in Table 4.

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Table 4: Awareness scale based on students mean score values

Mean Score range	1.00–1.80	1.81–2.60	2.61–3.40	3.41–4.20	4.21–5.00
	No awareness	Poor awareness	Limited awareness	Moderate awareness	High awareness
	Level 1	Level 2	Level 3	Level 4	Level 5

The students' level of awareness toward national and global environmental issues was measured after calculating the mean score value and SD for each question, the method of [22] and [23] was used to interpret the data gathered from each question in each section of the e-questionnaire.

The students' level of awareness of each environmental issue were measured as shown in Tables 5 and 6). Regarding the section on students' awareness level toward national environmental issues, the environmental issue 'Pollution caused by the improper disposal of solid waste in non-designated areas 'has mean scores value of 4.01 reflecting respondents have moderate awareness (Level 4), indicating that students are aware of the problem and its causes but they not aware of its effects. The 95% confidence interval is between 3.89 and 4.14, this indicates a consensus among those surveyed. A standard deviation of 1.27 suggests that although a sizable portion of the population has a moderated awareness level, some individuals have either a lower or higher level of awareness. Like the above result, the mean scores values for the issues 'contamination of food by pesticides', 'environmental effects resulting from wars', 'pollution resulting from random urbanization' and 'pollution resulting from non-treatment of wastewater' fall within level 4, classified as moderate awareness. However, the students' awareness level for the issue 'Pollution caused by raw sewage discharge' fall within level 3, classified as limited awareness indicating that students may be aware of the problem but not aware of its causes or effects. This variation might be because certain concerns are ubiquitous in most places where the students come from, while others are less prominent. This finding is in accordance with [24], [25], and [26] which revealed the varying degrees of students' awareness of national environmental issues.

Table 5: Rank order of students' awareness level toward national environmental issues

Environmental Issue	Mean	95% Confidence interval of Mean	Std. Deviation	Awareness Level
Pollution caused by the improper disposal of solid waste in non-designated areas	4.01	3.89 – 4.14	1.27	Level 4
Contamination of food by pesticides	4.00	3.88 – 4.13	1.27	Level 4
Environmental effects resulting from wars	3.87	3.74 – 4.00	1.33	Level 4
pollution resulting from Random urbanization	3.59	3.45 – 3.73	1.42	Level 4
Pollution resulting from non-treatment of wastewater	3.46	3.32 – 3.60	1.44	Level 4
Pollution caused by raw sewage discharge	3.27	3.12 – 3.42	1.55	Level 3
Mean	**3.70**			**Level 4**

As for the section on students' awareness level toward global environmental issues, The mean score values for the issues 'air pollution','pollution from factories', 'drinking water contamination', 'pollution from Transportation, 'pollution of the seas and oceans', 'soil pollution' and 'Environmental effects resulting from natural disasters' were 4.16, 4.12, 4.10, 3.88, 3.57, 3.55 and 3.42, respectively these values fall within level 4, classified as 'moderate awareness' indicating that students are aware of the problem and its causes but they not aware of its effects. Meanwhile, the mean score values for the issues 'extinction of species of plants and animals', 'climate change, 'flooding', 'ozone layer depletion', 'excessive depletion of resources', 'global warming', noise pollution', 'genetically modified foods', 'electromagnetism' and 'food contamination by growth hormones' were 3.13, 3.11, 3.10, 3.03, 2.90, 2.90, 2.90, 2.69, 2.68 and 2.67, respectively these values fall within level 3 "limited awareness" indicating that respondents recognize the problem but may not be aware of its causes or effects. As for the mean score values of the issues 'polar ice melting' and 'environmental effects resulting from biological changes' were 2.51 and 2.46 which fall within level 2, classified as 'poor awareness' indicating that respondents may not be aware of the problem. The variation in students awareness level toward global

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environmental issues is influenced by socioeconomic background, academic discipline, regional priorities, access to information and other factors .This finding is in accordance with [27], [28], and [29].

Overall, the students' mean awareness level of national and global environmental issues falls within level 3, classified as "limited awareness". The results of the study confirm the previous findings by [13], [14] and [20], which revealed weaknesses in the academic role of universities in fostering environmental awareness in developing countries.

Table 6: Rank order of Students awareness level toward global environmental issues

Environmental Issue	Mean	95% Confidence interval of Mean	Std. Deviation	Awareness Level
Air pollution	4.16	4.04 - 4.27	1.16	Level 4
Pollution from factories	4.12	4.00 - 4.24	1.20	Level 4
Drinking water Contamination	4.10	3.98 - 4.22	1.22	Level 4
Pollution from Transportation	3.88	3.75 - 4.01	1.35	Level 4
Pollution of the seas and oceans	3.57	3.44 - 3.71	1.40	Level 4
Soil pollution	3.55	3.41 - 3.68	1.39	Level 4
Environmental effects resulting from natural disasters	3.42	3.28 - 3.56	1.43	Level 4
Extinction of species of plants and animals	3.13	2.99 - 3.27	1.40	Level 3
Climate change	3.11	2.97 - 3.25	1.39	Level 3
Flooding	3.10	2.97 - 3.22	1.30	Level 3
Ozone layer Depletion	3.03	2.89 - 3.18	1.47	Level 3
Excessive depletion of resources	2.90	2.75 - 3.05	1.54	Level 3
Global warming	2.90	2.77 - 3.04	1.37	Level 3
Noise pollution	2.90	2.74 - 3.05	1.55	Level 3
Genetically modified foods	2.69	2.55 - 2.84	1.49	Level 3
Electromagnetism (power lines, mobiles, etc.)	2.68	2.54 - 2.82	1.43	Level 3

Table 6: Continued

Environmental Issue	Mean	95% Confidence interval of Mean	Std. Deviation	Awareness Level
Food contamination by growth hormones	2.67	2.51 - 2.83	1.59	Level 3
Polar ice melting	2.51	2.36 - 2.66	1.50	Level 2
Environmental effects resulting from biological changes	2.46	2.32 - 2.59	1.40	Level 2
Mean	**3.20**			**Level 3**

The students' level of awareness of each environmental issue per faculty was measured based on their mean score values as shown in Table 7 and Figure 1. The students' mean score values per faculties "Engineering, Pharmacy, Dentistry, Administrative Science, Computing & information technology and Social & humanitarian science were 3.38, 3.33, 3.29, 3.27, 2.98 and 2.62, respectively which falls within level 3 "limited awareness" while for "Medicine & medical science" was 3.58 which falls within level 4 "moderate awareness" according to [30] and [30], medical students tend to have strong analytical skills and a curiosity about cause-effect relationships, which influences them to be more interested to scientific discussions on environmental issues.

Table 7: Mean scores of student's answers for environmental issues per faculty

No.	Environmental Issue	Admin	Computing	Dentistry	Engineering	Medicine	Pharmacy	Social	Avg.
1	Climate change	3.03	2.87	3.32	3.11	3.24	3.21	2.13	3.11
2	Ozone layer depletion	2.86	2.57	3.07	3.17	3.41	2.93	2.27	3.03
3	Air pollution	4.32	3.61	4.37	4.10	4.36	4.10	3.80	4.16
4	Drinking water contamination	4.12	3.78	4.05	3.99	4.53	4.17	3.53	4.10
5	Soil pollution	3.75	3.04	3.66	3.50	3.97	3.49	2.27	3.55
6	Excessive depletion of resources	2.97	2.48	2.76	3.02	3.14	2.85	2.13	2.90
7	Global warming	2.69	2.43	2.95	3.12	3.25	2.74	2.00	2.90
8	Polar ice melting	2.17	2.04	2.54	2.81	2.64	2.46	1.67	2.51
9	Pollution from transportation	3.81	3.26	3.83	3.87	4.25	3.92	3.67	3.88

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Table 7: Continued

No.	Environmental Issue	Admin	Computing	Dentistry	Engineering	Medicine	Pharmacy	Social	Avg.
10	Pollution from factories	4.32	3.74	4.17	3.97	4.27	4.23	3.87	4.12
11	Contamination of food by pesticides	4.14	3.83	4.20	3.87	4.25	4.07	3.07	4.00
12	Food contamination by growth hormones	2.73	2.35	2.73	2.52	3.12	2.76	1.73	2.67
13	Genetically modified foods	2.15	2.52	2.51	2.73	3.44	2.82	1.60	2.69
14	Electromagnetism	2.46	2.52	2.44	2.91	2.68	2.77	1.87	2.68
15	Pollution of the seas and oceans	3.44	3.35	3.78	3.62	3.76	3.54	3.00	3.57
16	Pollution caused by raw sewage discharge	3.61	2.87	2.85	3.22	3.83	3.14	2.60	3.27
17	Pollution caused by the improper disposal of solid waste in non-designated areas	4.08	3.52	4.07	3.90	4.17	4.13	4.00	4.01
18	Pollution resulting from non-treatment of wastewater	3.51	3.22	3.05	3.52	3.76	3.51	2.80	3.46
19	Flooding	2.76	2.87	3.10	3.33	3.25	3.04	2.53	3.10
20	Extinction of species of plants and animals	2.83	2.96	3.20	3.25	3.08	3.31	2.60	3.13
21	Noise pollution	2.56	2.78	2.80	3.10	3.17	2.85	2.20	2.90
22	pollution resulting from Random urbanization	3.80	3.30	3.12	3.99	3.41	3.45	2.53	3.59
23	Environmental effects resulting from wars	3.88	3.48	3.88	3.92	4.02	3.93	3.07	3.87
24	Environmental effects resulting from natural disasters	3.44	2.96	3.56	3.38	3.75	3.37	2.93	3.42

Table 7: Continued

No.	Environmental Issue	Admin	Computing	Dentistry	Engineering	Medicine	Pharmacy	Social	Avg.
25	Environmental effects resulting from biological changes	2.29	2.04	2.29	2.51	2.86	2.57	1.53	2.46
Mean		**3.27**	**2.98**	**3.29**	**3.38**	**3.58**	**3.33**	**2.62**	**3.32**
Awareness Level		**Level 3**	**Level 3**	**Level 3**	**Level 3**	**Level 4**	**Level 3**	**Level 3**	**Level 3**

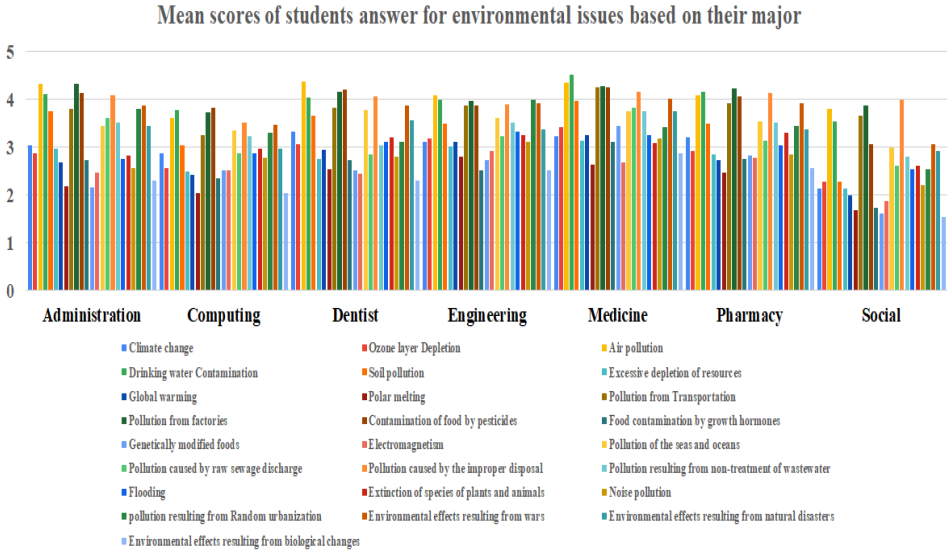

Figure 1: The mean scores values of the students answer on the environmental issues per faculty

The students' level of awareness of each environmental issue per gender was measured based on their mean score values as shown in Table 8. The students mean score values per gender can be categorized into three groups, the first group consist of females being more aware than males in 13 environmental issues. The second group consist of males being more aware than females in 5 environmental issues while the third group consist of both males and females having almost have the same awareness in 4 environmental issues. This result confirms the previous findings by [31], which revealed that emotional empathy mediates the relationship between gender and environmental concern. Women reported greater levels of environmental concern due to their higher emotional empathy.

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Table 8: Mean scores of student's answers for environmental issues per gender

	Environmental Issue	Gender	Mean	Std. Deviation
1	Climate change	Female	3.14	1.40
		Male	3.07	1.37
2	Ozone layer Depletion	Female	3.06	1.49
		Male	3.00	1.45
3	Air pollution	Female	4.26	1.14
		Male	3.99	1.19
4	Drinking water Contamination	Female	4.19	1.20
		Male	3.96	1.25
5	Soil pollution	Female	3.68	1.38
		Male	3.33	1.38
6	Excessive depletion of resources	Female	2.78	1.56
		Male	3.10	1.48
7	Global warming	Female	2.85	1.34
		Male	2.99	1.41
8	Polar ice melting	Female	2.48	1.51
		Male	2.55	1.49
9	Pollution from Transportation	Female	3.92	1.36
		Male	3.81	1.33
10	Pollution from factories	Female	4.23	1.14
		Male	3.94	1.27
11	Contamination of food by pesticides	Female	4.11	1.22
		Male	3.83	1.32
12	Food contamination by growth hormones	Female	2.85	1.64
		Male	2.38	1.47
13	Genetically modified foods	Female	2.76	1.54
		Male	2.58	1.41
14	Electromagnetism	Female	2.64	1.45
		Male	2.73	1.40
15	Pollution of the seas and oceans	Female	3.72	1.39
		Male	3.34	1.39

Table 8: Continued

	Environmental Issue	Gender	Mean	Std. Deviation
16	Pollution caused by raw sewage discharge	Female	3.21	1.57
		Male	3.37	1.52
17	Pollution caused by the improper disposal of solid waste in non-designated areas	Female	4.13	1.25
		Male	3.83	1.28
18	Pollution resulting from non-treatment of wastewater	Female	3.47	1.48
		Male	3.44	1.36
19	Flooding	Female	3.14	1.30
		Male	3.03	1.31
20	Extinction of species of plants and animals	Female	3.18	1.41
		Male	3.04	1.4
21	Noise pollution	Female	2.89	1.55
		Male	2.90	1.57
22	pollution resulting from Random urbanization	Female	3.59	1.47
		Male	3.58	1.35
23	Environmental effects resulting from wars	Female	3.95	1.31
		Male	3.74	1.36
24	Environmental effects resulting from natural disasters	Female	3.53	1.41
		Male	3.23	1.45
25	Environmental effects resulting from biological changes	Female	2.48	1.44
		Male	2.42	1.34

The students' level of awareness of each environmental issue per grade (Table 9) was measured based on their mean score values per grade excluding the 5th and the 6th grades since they each representing only one facility each with limited number of participants that definitely affects the results. The 3rd grade students' score values have higher mean values for 18 environmental issues while the 2nd grade has higher mean values for 7 environmental issues. The findings show that 3rd year university students tend to have greater environmental awareness than 2nd year students due to several factors including increased academic exposure, greater research engagement, maturity and critical thinking. This result confirms the previous findings by [32], [33] and [34].

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Table 9: Mean scores of student's answers for environmental issues per grade

No.	Environmental issue	Academic Level	Mean	Std. Deviation
1	Climate change	1st	2.64	1.52
		2nd	3.23	1.37
		3rd	3.17	1.41
		4th	3.05	1.34
2	Ozone layer Depletion	1st	2.67	1.68
		2nd	2.86	1.45
		3rd	3.03	1.52
		4th	3.04	1.39
3	Air pollution	1st	3.81	1.42
		2nd	4.39	1.02
		3rd	4.21	1.18
		4th	4.22	1.08
4	Drinking water Contamination	1st	3.73	1.49
		2nd	4.11	1.33
		3rd	4.39	0.96
		4th	4.06	1.20
5	Soil pollution	1st	3.21	1.52
		2nd	3.56	1.47
		3rd	3.69	1.33
		4th	3.46	1.41
6	Excessive depletion of resources	1st	2.64	1.52
		2nd	2.73	1.57
		3rd	2.92	1.53
		4th	2.92	1.58
7	Global warming	1st	2.64	1.40
		2nd	2.59	1.41
		3rd	2.97	1.40
		4th	2.87	1.31

Table 9: Continued

No.	Environmental issue	Academic Level	Mean	Std. Deviation
8	Polar ice melting	1st	2.52	1.58
		2nd	2.22	1.45
		3rd	2.51	1.49
		4th	2.49	1.49
9	Pollution from Transportation	1st	3.57	1.62
		2nd	3.75	1.46
		3rd	4.11	1.15
		4th	3.88	1.31
10	Pollution from factories	1st	3.76	1.58
		2nd	4.23	1.07
		3rd	4.28	1.10
		4th	4.22	1.03
11	Contamination of food by pesticides	1st	3.76	1.37
		2nd	4.14	1.26
		3rd	4.07	1.23
		4th	4.01	1.28
12	Food contamination by growth hormones	1st	2.51	1.59
		2nd	2.69	1.72
		3rd	2.65	1.61
		4th	2.64	1.51
13	Genetically modified foods	1st	2.70	1.62
		2nd	2.44	1.47
		3rd	2.74	1.53
		4th	2.54	1.40
14	Electromagnetism	1st	2.46	1.46
		2nd	2.73	1.49
		3rd	2.76	1.42
		4th	2.61	1.38
15	Pollution of the seas and oceans	1st	3.45	1.56
		2nd	3.75	1.26
		3rd	3.60	1.39
		4th	3.66	1.35

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Table 9: Continued

No.	Environmental issue	Academic Level	Mean	Std. Deviation
16	Pollution caused by raw sewage discharge	1st	3.10	1.67
		2nd	3.22	1.52
		3rd	3.35	1.57
		4th	3.16	1.51
17	Pollution caused by the improper disposal of solid waste in non-designated areas	1st	3.73	1.50
		2nd	4.09	1.24
		3rd	4.10	1.21
		4th	4.06	1.17
18	Pollution resulting from non-treatment of wastewater	1st	3.51	1.64
		2nd	3.47	1.38
		3rd	3.66	1.30
		4th	3.28	1.45
19	Flooding	1st	3.15	1.47
		2nd	2.94	1.28
		3rd	3.25	1.32
		4th	3.03	1.30
20	Extinction of species of plants and animals	1st	3.21	1.53
		2nd	3.09	1.39
		3rd	3.26	1.45
		4th	3.07	1.34
21	Noise pollution	1st	2.88	1.69
		2nd	2.64	1.56
		3rd	3.00	1.53
		4th	2.80	1.50
22	pollution resulting from Random urbanization	1st	3.43	1.57
		2nd	3.84	1.26
		3rd	3.59	1.48
		4th	3.51	1.45
23	Environmental effects resulting from wars	1st	3.63	1.57
		2nd	4.03	1.28
		3rd	3.93	1.30
		4th	3.84	1.25

Table 9: Continued

24	Environmental effects resulting from natural disasters	1st	3.22	1.58
		2nd	3.38	1.36
		3rd	3.57	1.36
		4th	3.24	1.46
25	Environmental effects resulting from biological changes	1st	2.45	1.52
		2nd	2.30	1.33
		3rd	2.51	1.34
		4th	2.22	1.39

The students' level of awareness of each environmental issue per degree level was measured based on their mean score values as shown in Table 10. The students mean scores values per academic level exposed that, postgraduate students are more aware than undergraduate students. This result confirm the previous results by [35] it revealed that postgraduate student does has higher level of awareness in comparison with undergraduate students.

Table 10: Mean scores of student's answers for environmental issues per degree level

No.	Environmental Issue	Degree level	Mean	Std. Deviation
1	Climate change	Undergraduate	3.07	1.4
		Postgraduate	3.39	1.29
2	Ozone layer depletion	Undergraduate	2.99	1.49
		Postgraduate	3.41	1.29
3	Air pollution	Undergraduate	4.17	1.17
		Postgraduate	4.09	1.13
4	Drinking water contamination	Undergraduate	4.11	1.23
		Postgraduate	4.07	1.16
5	Soil pollution	Undergraduate	3.52	1.41
		Postgraduate	3.74	1.24
6	Excessive depletion of resources	Undergraduate	2.86	1.54
		Postgraduate	3.20	1.51
7	Global warming	Undergraduate	2.84	1.38
		Postgraduate	3.35	1.22

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Table 10: Continued

No.	Environmental Issue	Degree level	Mean	Std. Deviation
8	Polar ice melting	Undergraduate	2.48	1.5
		Postgraduate	2.70	1.52
9	Pollution from transportation	Undergraduate	3.85	1.37
		Postgraduate	4.13	1.13
10	Pollution from factories	Undergraduate	4.11	1.21
		Postgraduate	4.22	1.07
11	Contamination of food by pesticides	Undergraduate	3.99	1.28
		Postgraduate	4.13	1.19
12	Food contamination by growth hormones	Undergraduate	2.65	1.59
		Postgraduate	2.80	1.63
13	Genetically modified foods	Undergraduate	2.66	1.49
		Postgraduate	2.93	1.5
14	Electromagnetism	Undergraduate	2.65	1.42
		Postgraduate	2.89	1.49
15	Pollution of the seas and oceans	Undergraduate	3.35	1.39
		Postgraduate	3.60	1.48
16	Pollution caused by raw sewage discharge	Undergraduate	3.22	1.56
		Postgraduate	3.65	1.4
17	Pollution caused by the improper disposal of solid waste in non-designated areas	Undergraduate	4.00	1.28
		Postgraduate	4.13	1.19
18	Pollution resulting from non-treatment of wastewater	Undergraduate	3.43	1.45
		Postgraduate	3.67	1.33
19	Flooding	Undergraduate	3.07	1.32
		Postgraduate	3.28	1.17
20	Extinction of species of plants and animals	Undergraduate	3.13	1.42
		Postgraduate	3.11	1.3
21	Noise pollution	Undergraduate	2.90	1.56
		Postgraduate	2.87	1.51
22	pollution resulting from Random urbanization	Undergraduate	3.56	1.44
		Postgraduate	3.78	1.23

Table 10: Continued

No.	Environmental Issue	Degree level	Mean	Std. Deviation
23	Environmental effects resulting from wars	Undergraduate	3.86	1.34
		Postgraduate	3.98	1.24
24	Environmental effects resulting from natural disasters	Undergraduate	3.37	1.44
		Postgraduate	3.78	1.33
25	Environmental effects resulting from biological changes	Undergraduate	2.39	1.4
		Postgraduate	2.98	1.36

4. Conclusion

The study aimed to assess the students' awareness level toward national environmental issues including "environmental impacts of war in Yemen" and global environmental issues. For the national environmental issues, the study reveals that 42.71% of the students "know everything about the problems, Its causes and its effects" while 29.70% for the global environmental issues. In addition, the survey findings showed that the students' awareness level toward national environmental issues is higher than their awareness of global environmental issues. The students' awareness level for most of the national environmental issue including "wars environmental effects" were fall within level 4 "Moderated awareness" indicating that students may be aware of the problem and its causes but not aware of its effects while, varies results for global environmental issue with average of level 3 "Limited awareness". The study finding exposes that the students'mean awareness level regarding both national and global environmental issues falls within Level 3 "Limited Awareness"indicating that students may be aware of the problems but not aware of its causes or effects. Besides, the survey result demonstrates that, female shows higher awareness than male and the students from faculty of medicine shows higher awareness followed by engineering. Furthermore, the academic level, students of the third grade show higher awareness followed by the second grade.

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Moreover, the study demonstrates that postgraduate students show higher awareness than undergraduate students. The results of the study are consistent with related researches on environmental awareness in Yemen and other developing countries. These findings highlight the necessity of improving environmental education and awareness programs in developing countries' universities where environmental understanding empowers students to address global issues and play an active part in building a sustainable future.

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