

Evaluation of Climate Change Awareness among Geography Students in Government Universities, Jordan

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Abstract

The study evaluated climate change awareness among geography students in government universities by following a combination of descriptive analytical approach and quantitative method. Randomly selected geography students (307) from various public universities (Jordan University, Mut'ah University, Al Hussein University, Al-Albait University, and Yarmouk University) participated in this study. The questionnaire-based data was collected featuring validity and reliability. The results revealed a medium level of climate change awareness among geography students in terms of concept, awareness, addressing climate change, and factors affecting climate change. The level of awareness significantly differentiated among students based on gender, age, and the university. The study strongly recommends the establishment of climate change study programs to enlighten the students with an in-depth understanding of this issue, nurture their critical thinking skills, and provide practical remedies.

Keywords: Climate Change Awareness, Environmental Education, Geography Students, Knowledge Gap, Public Universities

1. Introduction

The Sixth Report of the Intergovernmental Panel on Climate Change emphasizes it as a critical global challenge of the 21st century [1]. The situation necessitates proper education and enhanced awareness of climate change in educational institutes [2]. Integration of climate change with instructional strategies and informed decision-making are crucial for addressing global warming in Social Sciences [2]. Higher education institutions (HEIs) and universities play a pivotal role in individuals' learning about climate change [3]. The enhanced interest in climate change depicts the need for addressing the impacts of human behavior and industrial progress on the earth's climate, which are manifested in rising hurricane frequencies [1]. A sustainable future can be ensured by educating the youth for informed decisions regarding climate change. University students could devise policies and technologies to assert social changes. Therefore, they must be well-informed and skilled regarding climate change [2]. The universities can further promote the exploration of renewable energy sources along with providing climate change knowledge. Educational activities-based increased understanding and awareness of climate change

among youth could shape their perspectives for better solutions [4]. Academic staff of universities should design novel teaching methods to promote students' participation in climate change alleviation [5].

Environmental issues are often associated with human behavior and environmental protection organizations emphasize human involvement in environmental protection and preservation [6]. Therefore, curriculum reforms are important to engage students in enhancing their decision-making skills for countering climate change issues [7]. The assessment of the degree of awareness among students and other segments regarding climate change could generate valuable insights for fruitful educational programs and possible solutions for mitigating climate change impacts [8]. The young population is a valuable asset of the nation, which effectively contributes towards communities' progress. The behavioral dimensions-associated environmental issues necessitate environmental awareness among youth. Environmental organizations advocate that youth must be well-informed for sustainable environmental preservation and protection.

Therefore, environmental awareness is a fundamental need for safeguarding the environment. Environmental education has been prioritized in developed nations, which have integrated it into their curriculum (primary and higher education). This was based on the recognition of environmental significance, which led to the desired behavioral patterns, and enhanced environmental awareness among individuals [9].

This study aims to assess the environmental (climate change) awareness level among geography students at different Jordanian universities. The study provides crucial insights regarding their understanding of climate change and unfolds potential approaches for enhancing environmental education. The following points further elaborate on the importance of studying environmental awareness level among geography students:

1. Identifying knowledge gaps: The study aims to assess environmental awareness levels among geography students from various public universities and identify any discrepancies in their understanding of climate change. This information could help in dealing with a lack of knowledge and misconceptions. It could further facilitate the development of targeted courses and curricula to address the knowledge gaps and enhance students' understanding and awareness of climate change.
2. Future leaders and decision-makers: Geography students are future leaders and will actively participate in the decision-making of environmental resource management and urban planning. They should have the necessary information and skills to effectively counter climate change-associated challenges. The assessment of awareness degree will ensure their preparation to address these challenges in the future.
3. Mitigating climate change consequences: Long-term efforts are needed to mitigate greenhouse gas emissions and related consequences. The impacts of climate change can be directly minimized by adapting to its expected outcomes. The assessment of environmental awareness levels among geography students could facilitate the development of necessary tools for their better awareness, which can effectively contribute to climate change alleviation measures [10].

Thus, this study can provide insights to fill knowledge gaps, modernize curriculum, and produce future leaders for effective mitigation of climate change and adaptation.

The understanding of climate change and its impacts is associated with the rapid industrialization that was initiated by the European industrial revolution. The development of steam engines and coal usage followed by the oil discovery in the early 20th century significantly increased the surface temperatures and atmospheric greenhouse gas emissions. This phenomenon was termed “global warming”, which resulted in serious environmental and climatic changes such as the rise in surface temperatures, melting of ice in Antarctica causing higher sea levels, and atmospheric release of methane, carbon dioxide, and other gases. Climate change refers to long-term modifications in the climate system over several decades or millions of years. Primarily, climate change is associated with human activities such as the aggravated concentration of atmospheric greenhouse gases trapping more heat. The atmosphere plays a crucial role in life on Earth by protecting it from harmful cosmic radiations, regulating light distribution, and allowing optimum penetration of the sun's light and thermal radiations.

Multiple factors can influence climate change including natural internal factors (volcanic eruptions), and external factors (sunspots and solar circulation processes). According to Quito Agreement, human activities directly or indirectly cause climate changes leading to modified atmospheric composition [5] and [11]. Therefore, understanding of theoretical climate change framework is important for comprehending its environmental impact. Previous studies have investigated various aspects of climate change such as the effects, causes, and potential remedies. These studies have recommended immediate actions to alleviate climate change impacts for current and future generations.

1.1 Geography Teachers and Climate Change: Views on Consequences, Counter Strategies, and Mitigation

The literature review provides details about the relationship between climate change and geography teachers, professional intervention programs' impact on students' awareness, climate change scenarios in various countries, students' awareness regarding environmental issues, the efficacy of climate change education, and climate change perception among university students. Panamaldeniya [12] has demonstrated the direct and indirect atmospheric effects of climate change (atmosphere, water, biosphere, and lithograph). The fluctuations in weather factors (humidity, temperature, wind, and precipitation) affect climate over a few months to millions of years.

The current studies are mainly focused on the climate changes that occurred during the last three decades. The radiation balance is also important in determining global climate changes and related factors have been identified. Yli-Panula et al., [13] have studied Finnish University Students' views on climate change education and their ability as climate educators. Climate change education mainly aims to enhance structural knowledge, thinking skills, and applicability in current and future scenarios. During the study, the participants mainly expressed preconceived opinions from the media. The social discussion turned out to be the most complicated factor in climate change education. The inability of teaching climate change was considered a general weakness whereas students were quite excited to learn about climate change. Prasad and Mkumbachi [14] identified the perception of university students regarding climate change. The case study of the University of the South Pacific-Fiji Islands elaborated on the understanding of the main ideas related to climate change. The study analyzed individual opinions and information about climate change causes from the students' perspective of two organizations for environmental protection. The study followed the qualitative approach to reveal students' views regarding climate change at two different institutions of the same university. The results of both institutions significantly varied, and students related all the environmental issues with the gas emissions leading to climate change. The students of the economic community presented a better understanding of climate change. The differences in the students' perceptions could be attributed to their demographic variables.

Morote Sequido and Hernández-Hernández [1] analyzed the schoolchildren's (preschool, primary education, secondary education) views of climate change. The students were within an age group of 10 to 18 years and were from the Valencia region, Spain. They identified the main information sources from where children received the climate change information in addition to assessing the consequences of climate change identified by the students. The study also clarified the main atmospheric greenhouse gases, which were believed to be present in the atmosphere by the students. The study was conducted during 2020-2021 and the sample consisted of 575 students. The results revealed that students obtained the climate change information mainly from three sources including television (82.8%), internet (56.2%), and social communication (49.4%). The students believed that climate change is caused by pollution (70.1%),

temperature alterations (61.7%), and greenhouse gases (63.5%). The study also highlighted the role of schools in training the future society about climate change, and risks related to misleading information from the internet and private websites. Abdul Hafez [15] investigated the views of Finnish secondary geography teachers about climate change, counter strategies, and mitigation. The results depicted that teachers followed different strategies against unfavorable emotions and carried out simple modifications to reduce their environmental impact. Some teachers were well aware of their role to make a difference through student engagement.

Al-Jabri [11] studied the relationship between emotional climate change awareness among students and professional intervention programs. The study tracked the climate changes in Iraq and their impacts on rainfall and temperature fluctuations. The study involved secondary school students in Kuwait and assessed their climate change-related awareness and sense of social responsibility. The grade variable significantly impacted the students' responses. Jeong et al., [2] analyzed the climate change education effects on the awareness levels and knowledge of students from Atatürk University, Turkey. The study emphasized youth-targeted educational activities for raising their awareness regarding proper lifestyles and attitudes to counter climate change. The students from different faculties (law, tourism, agriculture, architecture, and city planning) participated in the study. McCowan [16] studied the climate change-related impact of universities. The participation of universities is crucial in investigating climate change issues but the multifaceted nature of climate change presents complex challenges, which require a complete understanding of universities role in the society and environment. The results provided a thorough understanding of climate change and remedial measures through universities (public participation, education, operations, knowledge, and services), direct participation, and societal practices. The university can enhance the students' concepts of climate and environmental changes via path specification for impact identification. These could include climate change and adaptability to climate change. The study also presented the regulatory role of higher education institutions in tackling climate change.

Al-Rabaani and Al-Shuili [17] investigated the climate change-related awareness level among teachers and students of social studies and sciences at Sultan Qaboos University. The study revealed differential levels of awareness according to specialization and gender.

Table 1: Participants from different public universities

University	Number of participants	0.21×participants
Jordan	356	75
Mutah	255	53
Al-Hussein	300	63
Al-Albait	250	53
Yarmouk	300	63
Total	1,461	307

The females exhibited higher cognitive awareness whereas social studies students demonstrated greater emotional awareness. The study recommended enhancing climate change awareness in social, political, and economic aspects. Al Manasiyah and Shehadeh [10] studied the climate change perceptions among first-year students of the University of Jordan. Most of the students believed in climate change reality and its negative outcomes for Jordan. A significant percentage of students also acknowledged the possibility of heightened climate change hazards in the future. These studies have significantly contributed to the existing knowledge on climate change awareness among the general public, teachers, and students. They highlighted that climate change should be addressed through education, the development of emotional coping strategies, and the promotion of responsible behavior and effective engagement.

2. Methods

2.1 Study Methodology

A descriptive analytical approach was adopted to assess the degree of climate change awareness among geography students in public universities. The methodology involved the data collection, analysis, and interpretation of the awareness level in the target population.

2.2 Participants

Geography students from various public universities (Jordan University, Mutah University, Al Hussein University, Al-Albait University, and Yarmouk University) participated in the study. Table 1 presents the participants' distribution across each university. The study sample comprised 307 randomly selected students from the above-mentioned five public universities. The selection of participants was based on the recommended sample size table according to Krejcie and Morgan [18]. The online questionnaire was distributed among participants using the following link: https://docs.google.com/forms/d/e/1FAlpQLSUT26_husmulqLC10zUEj02wZfl-t7XFv1PK-xgRYhjveSeg/viewform?vc=0&c=0&w=1&flr=0.

The researcher successfully received the completed questionnaire from all 307 participants, thus having a response rate of 100%. Table 2 presents the demographic data of the participants [18].

2.3 Information Source

2.3.1 Primary source

A specifically designed questionnaire was the primary source of participant data collection. Participants' responses to the questionnaire were analyzed to derive the results.

2.3.2 Secondary sources

Different secondary sources were used during the study for literature review and development of the theoretical framework, which mainly included geography-related journals, abstracts, and articles. These secondary sources provided theories, background information, and previous findings related to the study. They helped in establishing the context and theoretical basis for the current research.

2.4 Study Tool

The questionnaire was divided into two sections. Section I was comprised of participants' demographic variables and included questions regarding gender, age, academic year, region, and university. This section provided characteristics and background information of participants. Section II was designed to assess the degree of climate change awareness among geography students of public universities. This section contained four dimensions and each contained a set of statements.

1. The first dimension "concept of climate change" included statements 1 to 10. Participants indicated their agreement or disagreement level with these statements, which helped in measuring their understanding of climate change.
2. The second dimension "factors affecting climate change" included statements 11 to 18. Participants expressed their opinions on various climate change-associated factors to indicate agreement or disagreement level.

3. The third dimension “addressing climate change” included statements 19 to 22. Participants assessed their attitudes towards actions and measures taken for addressing climate change to indicate agreement or disagreement level.
4. The fourth dimension “climate change awareness” included statements 23 to 27. Participants indicated their awareness level regarding different aspects of climate change and expressed their agreement or disagreement with the statements.

The questionnaire facilitated a comprehensive assessment of climate change awareness levels among geography students in public universities.

2.5 Validity

Two types of validity tests (content validity and internal construction validity) were performed to ensure the reliability and accuracy of assessment results. The extent of questionnaire content representing the target construct is known as content

validity. A carefully designing of the theoretical framework and literature-based questionnaire and its dimensions during this study ensured the content validity. The statements of each dimension were reviewed by climate change and geography experts, which established their relevance during the assessment of students' awareness. Internal construction validity or construct validity demonstrates the extent of accuracy with which the questionnaire measures the target construct. During this study, the internal construction validity was established by pre-testing the questionnaire with a pilot sample of students similar to the target population. This practice helped in the identification of ambiguities or potential issues in the questionnaire's items or response options. Adjustments were carried out according to the feedback from the pilot phase, which improved the effectiveness and clarity of the questionnaire. The content validity and internal construction validity ensured an accurate and relevant assessment of the intended construct.

Table 2: Demographic data of the participants

Variable	Frequency	
	Number	Percentage (%)
Gender		
Male	108	35.2
Female	199	64.8
Total	307	100.0
Age		
17 - 20 years	148	48.2
21 years and above	159	51.8
Total	307	100.0
Academic Year		
First year	82	26.7
Second year	91	29.6
Third year	68	22.1
Fourth year	66	21.5
Total	307	100.0
Region		
North	138	45.0
Middle	103	33.6
South	66	21.5
Total	307	100.0
University		
Al-Albait	53	17.3
Jordan	75	24.4
Mutah	53	17.3
Yarmouk	63	20.5
Al Hussien	63	20.5
Total	307	100.0

Table 1: Internal Construction Validity representing the correlation coefficient of each statement with its dimension

Assessing the degree of climate change awareness among geography students in public universities							
Concept of climate change		Factors affecting climate change		Addressing climate change		Awareness of climate change	
#	r	#	r	#	r	#	r
1	.871**	11	.861**	19	.758**	23	.930**
2	.940**	12	.891**	20	.924**	24	.934**
3	.904**	13	.894**	21	.932**	25	.886**
4	.845**	14	.861**	22	.907**	26	.941**
5	.916**	15	.917**			27	.943**
6	.930**	16	.898**				
7	.935**	17	.920**				
8	.936**	18	.898**				
9	.921**						
10	.910**						

** : significant at the level of (0.01)

2.5.1 Content validity

Multiple reviewers provided their input to establish the content validity. The questionnaire was submitted to (****) different expert reviewers, which ensured the relevance and accuracy of the questionnaire's paragraphs to retrieve reviewers' opinions regarding necessary modifications. Reviewers and experts reviewed each dimension and provided their input for required changes. The researcher carefully examined and considered all the comments of the reviewers. Finally, the researcher accepted the phrases, which were approved by 80% or more of the reviewers. The researcher modified the questionnaire according to the reviewers' suggestions. The phrases were amended, excluded, or enhanced to improve the overall quality and clarity of the questionnaire. The number of questionnaire phrases was finally reduced to 27. The incorporation of reviewers' suggestions ensured the content validity of the questionnaire. The modifications helped in the accurate assessment of the intended construct (degree of climate change awareness among geography students in public universities).

2.5.2 Internal construction validity

The internal construction validity of the scale was established by performing Pearson's correlation test, which examined the correlation coefficient of each dimension within the questionnaire. The analysis assessed the association degree between items of each dimension and the overall construct for the assessment of climate change awareness among geography students in public universities. Table 3 presents the results of Pearson's correlation test and demonstrates correlation coefficients for each dimension. The analysis determined the coherence

and internal consistency of items within each dimension. A stronger relationship between items is represented by a higher correlation coefficient, which suggests the measurement of the same underlying construct. Pearson's correlation test ensured internal coherence and consistency between items of each dimension, which contributes to the questionnaire's overall construct validity. The results provided valuable insights into the internal structure of the scale and reliability and established its suitability for measuring the degree of climate change awareness among geography students in public universities.

Pearson correlation test indicated a significant relationship between all the statements within each dimension of the questionnaire. The correlation coefficients for all statements exceeded the threshold of 0.30, which is considered acceptable in determining the internal consistency and coherence of the scale (Rest, 1979). The relationships were found to be statistically significant at a significance level of 0.01.

2.6 Reliability

Cronbach's Alpha test was performed to assess the study's reliability, which expresses internal consistency. The test results indicated the high reliability of the questionnaire. The Cronbach's Alpha values ranged from 0.904 to 0.977, which is very close to the maximum value of 1.00. These values exceeded the recommended threshold of 0.60 for acceptable reliability [19]. Higher Cronbach's Alpha values indicated high correlation and consistency between the items of each dimension. It presents the questionnaire as a reliable tool for measuring students' awareness levels.

Table 2: Cronbach's alpha coefficient test

Variables	Statements	Cronbach Alpha
Concept of climate change	1-10	0.977
Factors affecting climate change	11-18	0.964
Addressing climate change	19-22	0.904
Awareness of climate change	23-27	0.959
All Questions	27	0.987

Table 4 provides an overview of Cronbach's Alpha values for each dimension, and demonstrates their high internal consistency. These results further support the reliability, accuracy, and precision of the questionnaire in obtaining students' awareness of climate change. Overall, high Cronbach's Alpha values indicated the questionnaire's reliability and consistency in assessing the degree of climate change awareness among geography students. Statistical Package for Social Sciences (SPSS) was used to statistically analyze the questionnaire data. Multiple statistical tests were employed for data analysis as follows:

1. Frequencies and percentages were used for demographic variables such as gender, age, academic year, region, and university.
2. Pearson Correlation test examined the construct validity of the scale used in the study. It measured the correlation coefficient between each dimension and corresponding statements to indicate the direction and strength of the relationship.
3. Cronbach's Alpha coefficient assessed the study tool's reliability. The coefficient values revealed the reliability and internal consistency of the questionnaire items in measuring the degree of climate change awareness among geography students.
4. Descriptive Statistical Techniques (means and standard deviations) presented a summary of the responses to the questionnaire. These statistics also demonstrated dispersion and central tendency of the participants' attitudes and perceptions toward climate change.
5. Multiple Analysis of Variance (MANOVA) and Scheffe test analyzed the variables-based differences between groups. MANOVA examined the overall differences among multiple groups whereas the Scheffe test provided the post hoc multiple comparisons to identify specific group differences.

The research utilized a 5-point Likert scale where response options ranged from "Strongly Disagree" to "Strongly Agree" (coded as 1.00 to 5.00). The responses were categorized into three levels: low level (1.00-2.33), medium level (2.34-3.67), and high level (3.68-5.00), which facilitated participants' awareness level assessment based on their responses. These data analysis techniques provided a comprehensive understanding of the degree of climate change awareness among geography students in public universities and revealed potential relationships and variations within the collected data.

3. Results

3.1 Degree of Climate Change Awareness among Geography Students in Public Universities

Question number (1) aimed to assess the degree of climate change awareness among geography students in public universities. The analysis involved the calculation of means, standard deviations, ranks, and importance levels to reveal students' level of awareness. The following tables present the related results (Table 5, Table 6, Table 7, Table 8, and Table 9). Table 5 presents the mean values of climate change awareness among geography students in public universities. The means ranged from 3.37 to 3.60 with a total mean of (3.49), which indicates a medium level of awareness. Climate change awareness exhibited the highest mean value (3.60) and standard deviation (1.34) among various dimensions. It was followed by the concept of climate change with a mean of 3.51 and a standard deviation of 1.35. The dimension of climate change affecting factors ranked third with a mean of 3.47 and a standard deviation of 1.27 followed by the dimension of addressing climate change, which had the lowest mean value of 3.37 and a standard deviation of 1.24. All of the dimensions demonstrated a medium level of awareness. The subsequent tables provide detailed information about the level of each statement within its respective dimension about climate change awareness among geography students in public universities.

Table 3: Degree of climate change awareness among geography students in public universities

No	Dimensions	Mean	Std. Deviation	Rank	Importance Level
1	Concept	3.51	1.35	2	Medium
2	Factor	3.47	1.27	3	Medium
3	Addressing	3.37	1.24	4	Medium
4	Awareness	3.60	1.34	1	Medium
Total		3.49	1.25		Medium

Table 4: Degree of climate change concept among geography students in public universities

No	Concept of climate change	Mean	Std. Deviation	Rank	Importance Level
2	I know that there are causes of climate change.	3.77	1.54	1	High
1	I believe there is a climate change.	3.64	1.66	2	Medium
7	I believe that climate change affects living organisms in general.	3.57	1.49	3	Medium
8	I am aware of the effects of climate change on the environment.	3.57	1.47	4	Medium
10	I am aware of the public health impacts of climate change.	3.57	1.44	5	Medium
6	I see that climate change affects human life.	3.53	1.47	6	Medium
3	I believe that human activity contributes to climate change.	3.50	1.50	7	Medium
9	I am aware of the effects of climate change on the economy.	3.45	1.45	8	Medium
5	I believe that climate change is a long-term threat.	3.44	1.47	9	Medium
4	I believe that climate change is a threat in the short term.	3.05	1.36	10	Medium
Total		3.51	1.35		Medium

Table 5: Knowledge about factors affecting climate change among geography students in public universities

No	Factors affecting climate change	Mean	Std. Deviation	Rank	Importance Level
12	I believe that the effects of climate change differ from one region to another, depending on the topography of the place.	3.58	1.44	1	Medium
17	Transportation and off-gases from different modes of transport are major contributors to climate change.	3.56	1.45	2	Medium
13	I support relying on renewable resources such as solar and wind energy to adapt to the effects of climate change.	3.55	1.43	3	Medium
15	I believe that the manufacturing industries and their emissions are a major cause of climate change.	3.52	1.45	4	Medium
16	I believe that cutting down forests to create farms or pastures, or for other reasons is one of the most important causes of climate change.	3.44	1.46	5	Medium
18	I believe that urban sprawl has a negative role in climate change.	3.42	1.41	6	Medium
14	I believe that one of the causes of climate change is the generation of electricity and heat by burning fossil fuels.	3.36	1.43	7	Medium
11	I support the idea that climate change depends on a region's proximity or distance to bodies of water.	3.35	1.36	8	Medium
Total		3.47	1.27		Medium

3.1.1 The level of climate change concept

Table 6 presents the means, standard deviations, ranks, and importance levels to demonstrate the degree of climate change concept among geography students in public universities. The mean values ranged between 3.05-3.77 with a total mean of 3.51, which reflected a medium level of understanding. The highest mean value (3.77) and standard deviation (1.54) was noted for Statement (2) "I know that there are causes of climate change", which indicated a high level of understanding. It was followed by Statement (1) "I believe there is climate change", which had a mean value of 3.64 and a standard deviation of 1.66 indicating a medium level of understanding. Contrarily, the lowest mean value (3.05) and standard deviation (1.36) were noted for statement (4) "I believe that climate change is a threat in the short term" ranked last, which represented a medium level of understanding.

3.1.2 The level of factors affecting climate change

Table 7 presents the means and standard deviations for the statements related to the dimension "factors affecting climate change" among geography students in public universities. The mean values ranged between 3.55-3.58 with an overall mean of 3.47, which indicated a medium level of awareness among the participants regarding this dimension. The highest mean value (3.58) and standard deviation (1.44) were observed for Statement (12), which suggested a moderate level of agreement among participants. Contrarily, statement (11) obtained the lowest mean value (3.35) and standard deviation (1.36), which also represented a medium level of awareness. The complete data in the table could be considered for further interpretation and analysis.

3.1.3 The level of addressing climate change

Table 8 demonstrates the mean values for the statements related to the dimension of addressing

climate change. The mean values ranged between 2.84 to 3.69 having a total mean of 3.47, which referred to a medium level of awareness. Statement (20) "I believe that governments should adopt preventive measures to combat climate change" presented the highest mean value (3.69) and standard deviation (1.44), and reflected a medium-level understanding. Statement (21) "I believe that renewable energy is beneficial and effective in mitigating climate change" also presented a medium level of awareness with a mean value of 3.53 and a standard deviation of 1.41. Contrarily, statement (19) "I believe that the current measures taken to adapt to climate change are sufficient" had the lowest mean value of 2.84 and a standard deviation of 1.36, which also indicated a medium level of awareness.

3.1.4 The level of climate change awareness:

The mean values and standard deviations of this dimension demonstrated the level of awareness regarding climate change (Table 9). The values ranged from 3.34 to 3.79 having an overall dimension mean of 3.60, which indicated a medium level of awareness. Statement (27) "I believe that social media can have a positive role in spreading awareness of the dangers of this phenomenon" presented the highest mean value of 3.79 and a standard deviation of 1.46, which depicted a high level of awareness. Statement (26) "I believe that governments and institutions should make an extra effort to raise awareness of the dangers of this phenomenon" ranked second with a mean value of 3.69 and a standard deviation of 1.44, which also exhibited a high level of awareness. The lowest mean value (3.34) and standard deviation (1.45) was noted in the case of statement (25) "I think the media plays a big role in spreading awareness about climate change", which indicated a medium level of awareness.

Table 6: Awareness level regarding addressing climate change

No	Addressing climate change	Mean	Std. Deviation	Rank	Importance Level
20	I believe that governments should adopt preventive measures to combat climate change.	3.69	1.44	1	High
21	I believe that renewable energy is beneficial and effective in mitigating climate change.	3.53	1.41	2	Medium
22	I think people have a role to play in mitigating climate change.	3.41	1.41	3	Medium
19	I believe that the current measures taken to adapt to climate change are sufficient.	2.84	1.36	4	Medium
Total		3.37	1.24		Medium

Table 7: Level of climate change awareness

No	Climate change awareness	Mean	Std. Deviation	Rank	Importance Level
27	I believe that social media can have a positive role in spreading awareness of the dangers of this phenomenon.	3.79	1.46	1	High
26	I believe that governments and institutions should make an extra effort to raise awareness of the dangers of this phenomenon.	3.69	1.44	2	High
23	I think adequate awareness of climate change is important to address this problem.	3.58	1.43	3	Medium
24	I believe society can reduce carbon emissions and fight climate change through awareness and education.	3.58	1.43	3	Medium
25	I think the media plays a big role in spreading awareness about climate change.	3.34	1.45	5	Medium
Total		3.60	1.34		Medium

Table 10: Descriptive statistics related to climate change awareness level among geography students in public universities

Source	Dependent Variable	Alternatives	N	Mean	Std. Deviation
Gender	Concept	Male	108	4.16	0.58
		Female	199	3.16	1.51
	Factor	Male	108	4.06	0.67
		Female	199	3.16	1.41
	Addressing	Male	108	3.96	0.72
		Female	199	3.05	1.34
	Awareness	Male	108	4.21	0.70
		Female	199	3.26	1.47
Age	Total	Male	108	4.11	0.58
		Female	199	3.16	1.38
	Concept	17 - 20 years	148	3.27	1.37
		21 years and above	159	3.73	1.31
	Factor	17 - 20 years	148	3.37	1.26
		21 years and above	159	3.57	1.28
	Addressing	17 - 20 years	148	3.29	1.24
		21 years and above	159	3.44	1.24
Academic Year	Awareness	17 - 20 years	148	3.51	1.35
		21 years and above	159	3.68	1.32
	Total	17 - 20 years	148	3.35	1.23
		21 years and above	159	3.63	1.26
	Concept	First year	82	3.71	1.03
		Second year	91	3.29	1.51
		Third year	68	3.18	1.53
		Fourth year	66	3.89	1.16
		Total	307	3.51	1.35
	Factor	First year	82	3.67	0.97
		Second year	91	3.35	1.41
		Third year	68	3.10	1.43
		Fourth year	66	3.78	1.13
		Total	307	3.47	1.27
	Addressing	First year	82	3.59	0.93
		Second year	91	3.18	1.37
		Third year	68	3.02	1.38
		Fourth year	66	3.70	1.12
		Total	307	3.37	1.24

Table 10: Descriptive statistics related to climate change awareness level among geography students in public universities (con't)

Source	Dependent Variable	Alternatives	N	Mean	Std. Deviation
Academic Year	Awareness	First year	82	3.89	1.03
		Second year	91	3.40	1.48
		Third year	68	3.25	1.49
		Fourth year	66	3.86	1.18
		Total	307	3.60	1.34
	Total	First year	82	3.71	0.89
		Second year	91	3.31	1.39
		Third year	68	3.15	1.42
		Fourth year	66	3.83	1.12
		Total	307	3.49	1.25
Region	Concept	North region	138	3.25	1.49
		Middle region	103	3.46	1.44
		South region	66	4.13	0.40
		Total	307	3.51	1.35
	factor	North region	138	3.33	1.35
		Middle region	103	3.32	1.42
		South region	66	4.01	0.55
		Total	307	3.47	1.27
	addressing	North region	138	3.24	1.31
		Middle region	103	3.25	1.37
		South region	66	3.81	0.66
		Total	307	3.37	1.24
	Awareness	North region	138	3.42	1.40
		Middle region	103	3.50	1.48
		South region	66	4.12	0.68
		Total	307	3.60	1.34
	total	North region	138	3.30	1.33
		Middle region	103	3.39	1.39
		South region	66	4.04	0.42
		Total	307	3.49	1.25
University	Concept	Al-Albait	53	2.31	1.68
		Jordan University	75	3.21	1.56
		Mutah University	53	4.22	0.40
		Yarmouk University	63	3.72	1.16
		Al Hussien University	63	4.07	0.43
		Total	307	3.51	1.35
	Factor	Al-Albait	53	2.32	1.68
		Jordan University	75	3.21	1.54
		Mutah University	53	3.86	0.65
		Yarmouk University	63	3.98	0.49
		Al Hussien University	63	3.93	0.61
		Total	307	3.47	1.27
	Addressing	Al-Albait	53	2.25	1.62
		Jordan University	75	3.13	1.50
		Mutah University	53	3.73	0.73
		Yarmouk University	63	3.85	0.54
		Al Hussien University	63	3.80	0.54
		Total	307	3.37	1.24
	Awareness	Al-Albait	53	2.31	1.68
		Jordan University	75	3.28	1.58
		Mutah University	53	4.17	0.74
		Yarmouk University	63	3.97	0.57
		Al Hussien University	63	4.18	0.59
		Total	307	3.60	1.34

Table 10: Descriptive statistics related to climate change awareness level among geography students in public universities (con't)

Source	Dependent Variable	Alternatives	N	Mean	Std. Deviation
University	Total	Al-Albait	53	2.30	1.66
		Jordan University	75	3.21	1.53
		Mutah University	53	4.03	0.44
		Yarmouk University	63	3.86	0.56
		Al Hussien University	63	4.01	0.43
		Total	307	3.49	1.25

Table 11: MANOVA test differentiating climate change awareness level of geography students in public universities

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	Concept	42.488	1	42.488	35.968	.000*
	Factor	40.981	1	40.981	36.573	.000*
	Addressing	41.710	1	41.710	39.128	.000*
	Awareness	37.991	1	37.991	31.795	.000*
	Total	41.078	1	41.078	40.714	.000*
Age	Concept	17.915	1	17.915	15.166	.000*
	Factor	4.446	1	4.446	3.967	.047*
	Addressing	1.955	1	1.955	1.834	.177
	Awareness	4.262	1	4.262	3.567	.060
	Total	7.739	1	7.739	7.670	.006*
Academic year	Concept	3.756	3	1.252	1.060	.366
	Factor	2.028	3	.676	.603	.613
	Addressing	3.002	3	1.001	.939	.422
	Awareness	1.954	3	.651	.545	.652
	Total	2.601	3	.867	.859	.462
Region	Concept	1.618	2	.809	.685	.505
	Factor	3.238	2	1.619	1.445	.237
	Addressing	1.089	2	.545	.511	.600
	Awareness	.068	2	.034	.028	.972
	Total	1.278	2	.639	.633	.531
University	Concept	71.102	4	17.776	15.048	.000*
	Factor	69.893	4	17.473	15.594	.000*
	Addressing	64.709	4	16.177	15.176	.000*
	Awareness	89.991	4	22.498	18.828	.000*
	Total	70.965	4	17.741	17.584	.000*
Error	Concept	348.476	295	1.181		
	Factor	330.560	295	1.121		
	Addressing	314.461	295	1.066		
	Awareness	352.492	295	1.195		
	Total	297.631	295	1.009		
Total	Concept	4,340.340	307			
	Factor	4,198.344	307			
	Addressing	3,951.188	307			
	Awareness	4,514.040	307			
	Total	4,224.560	307			
Corrected Total	Concept	560.666	306			
	Factor	496.858	306			
	Addressing	470.279	306			
	Awareness	545.394	306			
	Total	478.702	306			

The study also examined statistically significant differences between climate change awareness levels of geography students from different public universities. The studied parameters included gender, age, academic year, region, and university. Statistical differences were established by performing the Multiple Analysis of Variance (MANOVA) test and the results are presented in Table 10. Table 11 presents the MANOVA test results revealing statistical differences in climate change awareness levels of geography students in public universities based on gender, age, academic year, region, and university. Gender-based F values were noted as 35.968, 36.573, 39.128, 31.795, and 40.714 for the dimensions of climate change concept, factors affecting climate change, addressing climate change, climate change awareness, and total degree of awareness, respectively.

F values were statistically significant at a level of 0.05. The Scheffe test indicated that the variances were in favor of male participants. Age-based F values for climate change concept, factors affecting climate change, and total degree of awareness remained at 15.166, 3.967, and 7.670 respectively, which differentiated at a significance level of 0.05. The variances were in favor of participants aged 21 years and above according to the Scheffe test. The F-values of the dimension addressing climate change (1.834) and climate change awareness (3.567) remained non-significant at a significance level of 0.05. Academic year and region-based F-values of the dimensions climate change concept (1.060 and 0.685), factors affecting climate change (0.603 and 1.445), addressing climate change (0.939 and 0.511), climate change awareness (0.545 and 0.028), and total degree of awareness (0.859 and 0.633) also remained non-significant at a significance level of 0.05. The university-based F values of the dimensions climate change concept (15.048), factors affecting climate change (15.594), addressing climate change (15.176), climate change awareness (18.828), and total degree of awareness (17.584) were observed to significantly differentiate from each other at a significance level of 0.05 whereas variances favored the male participants. The Scheffe test revealed that the variance was in favor of Mutha University regarding the climate change concept and the total degree of awareness. However, the variance was in favor of Yarmouk University in the case of dimensions factors affecting climate change and addressing climate change whereas the variance favored Al Hussein University in the case of climate change awareness.

4. Discussion

Participants' responses to question 1 revealed the mean values of climate change awareness among geography students in public universities. The dimension "climate change awareness" had the highest mean value followed by the dimension "climate change concept". The dimension "factors affecting climate change" demonstrated the 3rd highest mean value whereas the dimension "addressing climate change" had the lowest mean value. The students' responses revealed a medium level of awareness regarding the "climate change concept". However, the students had a high level of knowledge related to the causes of climate change. These findings could be attributed to students' major in geography. The students used to discuss climate change in addition to the daily events, which depict a generalized picture of climate change. The respondents were also found to believe in a moderate level of climate change, which could be attributed to their limited awareness of climate change. They might also not be completely convinced about climate change or consider climate change as a normal phenomenon. Therefore, they should enhance their knowledge about climate change concept. Higher standard deviation values than 1.00 indicate differentiated views of the participants regarding the climate change concept. These findings are in line with Prasad and Mkumbachi [14] who observed significantly different perceptions of climate change in students. McCowan [16] has also stated that the university could contribute to improving students' concepts of environmental and climate change.

The knowledge of geography students regarding factors affecting climate change was of a medium level whereas students had a high level of knowledge about varying climate change effects in different regions depending on the topography. This could be attributed to different terrains in Jordan and student experiences might have varied according to the terrain of their living areas. For example, the students from high altitude areas could experience extremely cold and rainy weather at certain times of the year whereas the weather remains warm in the plain areas. Therefore, the features of an area also contribute to students' perception in addition to their mental image of the topography-associated climatic changes. Transportation and associated gases emission are also major contributors to climate change. Students thought that transportation systems could raise the temperature levels whereas gas and fume emissions could raise global warming. The situation ultimately increases the atmospheric toxin level, which particularly changes the climate during the dry season. Climate change could lead to intense, sudden, and disastrous rain and dramatic rise in temperatures

affecting the plants and humidity levels. Panamaldeniya [12] has also speculated that weather fluctuations (precipitation, temperature, humidity, and wind) affect climate change.

Regarding the “addressing climate change” dimension, students were noted to believe that governments should adopt preventive measures for addressing climate change. The students might have believed that governments could reduce the transportation, and emission of toxic fumes from the factories to mitigate global warming. The government could also direct the population to adopt renewable energy sources, which can help in addressing climate change issues. The students also believed that people can contribute to addressing climate change by modifying their behaviors towards the environment. The accidental fire occurrence in forests due to irresponsible human behavior should be reduced. People could also contribute to alleviating the emissions and temperature levels by reducing the usage of their private cars. The knowledge about addressing climate change should also be enhanced for better outcomes. McCowan [16] has also reported similar findings for addressing climate change through universities (public participation, education, operations, knowledge production, and service), influence, and direct participation.

A medium level of knowledge was observed among the participants regarding the dimension “climate change awareness”. They believed that social media can positively spread awareness about climate change hazards. This could be due to the frequent use of social media among geography students in Jordanian universities where they watch videos related to climate change and associated risks. The participants exhibited a desire to adapt according to climate change. Therefore, awareness levels should be significantly enhanced along with promoting students’ interest in climate change affairs. It could facilitate in identifying climate change-affecting factors leading to the development of appropriate solutions for a stable climate. Jeong et al., [2] have also emphasized educational activities for enhancing awareness, adopting proper attitudes and lifestyles, and finding solutions.

Participants’ responses to question 2 revealed significant differences in climate change awareness levels among geography students from various public universities. The variance was noted to be in favor of males regarding the gender category, which could be due to more interest of males in climate change issues. Generally, males deal more with climatic factors during their more complicated work (driver or construction-related workshops). Males are directly exposed to weather factors because of outdoor work

activities and thus are more exposed to health-risk factors such as high temperatures and rain. Therefore, a high level of climate change awareness enables them to appropriately accomplish their work. Contrarily, females are not exposed to such conditions, which leads to their comparatively less interest in climate change than males. These results contradict the findings of Al Manasiyah & Shehadeh (2013), [10] who observed higher cognitive awareness in females as compared to males. The results demonstrated significant age-based differences in climate change concepts, factors affecting climate change, and total degree of awareness. The variances favored the age category of 21 years and above.

This might be due to the impulsive nature of young individuals, and their desire to go outside for external matters (work, studying, traveling, and adventure) for a successful future. The activities of young individuals require better climate change awareness, which can otherwise be an obstacle leading to reduced activities. The results also depicted university-based significant differences in climate change awareness levels. The participating geography students were from different regions with varying terrains. Therefore, their climate change anticipation is necessary for safe traveling to the universities and return to their homes.

5. Recommendations

1. Climate change-related specialized courses, majors, and minors should be developed. These programs can provide critical thinking skills, in-depth knowledge, and practical solutions for addressing climate issues. Students should be encouraged to critically think about climate change information, potential biases, and sources. They should also be taught to evaluate data and distinguish between misinformation and credible scientific research.

2. Internships, practical projects, and field trips can introduce the students to real-world climate-related challenges. Hands-on experiences can enhance their understanding to take appropriate actions.

3. Climate change-related talks should be organized involving activists, experts, and policymakers. They can provide insights from various perspectives and inspire student involvement.

4. Students should be encouraged to initiate and lead on-campus climate-related projects, clubs, and events. They should be empowered to take ownership of raising climate change awareness within the university community.

5. Sustainable practices should be performed on campus to lead by example. Energy-efficient buildings, renewable energy sources, sustainable transportation options, and waste reduction can lower the carbon footprint in universities.

6. Climate change should be considered a global issue. Students should be encouraged to attend international conferences, collaborative projects, and seminars to acquire diverse perspectives and solutions.

7. Partnerships should be established with the local communities to address regional climate challenges. Such engagements in local projects can provide practical learning experiences and substantial impacts.

8. The effectiveness of climate awareness initiatives should be regularly assessed by collecting students' feedback and tracking their engagement in climate-related activities. Success stories and lessons learned must be shared to inspire other institutions.

In conclusion, climate change stands as a critical and urgent global issue, exerting profound impacts on our lives, activities, and environments. Its far-reaching consequences have manifested in disastrous outcomes worldwide. Recognizing the urgency and severity of the situation, it becomes imperative for the global population to be well-informed and prepared to confront the realities of climate change. Universities play a pivotal role in this endeavor by serving as hubs for knowledge dissemination and awareness-building.

The study has shed light on the awareness levels of geography students in public universities regarding climate change. While the findings indicate a moderate level of awareness, there are specific areas where knowledge can be strengthened. Notably, the study underscores the importance of universities in fostering a deep understanding of climate change concepts, causative factors, and remedial measures among students. Climate change poses a multifaceted threat, ranging from rising temperatures to increased occurrences of floods and seasonal turbulence. In response, universities can play a proactive role by collaborating with government and civil society institutions to initiate participatory efforts aimed at raising awareness about climate change and its associated factors. By activating individuals and fostering collective action, universities contribute to limiting the adverse impacts of climate change. In conclusion, it is imperative to develop strategic plans through collaborative efforts at both individual and institutional levels. These plans should encompass comprehensive initiatives to mitigate the impacts of

climate change. By fostering a culture of awareness, understanding, and collective responsibility, universities can act as catalysts for positive change in the face of this global challenge. The study highlights the need for ongoing efforts to enhance climate change education, empower individuals, and drive impactful actions to address the pressing issues posed by climate change.

6. Conclusion

In conclusion, climate change stands as a critical and urgent global issue, exerting profound impacts on our lives, activities, and environments. Its far-reaching consequences have manifested in disastrous outcomes worldwide. Recognizing the urgency and severity of the situation, it becomes imperative for the global population to be well-informed and prepared to confront the realities of climate change. Universities play a pivotal role in this endeavor by serving as hubs for knowledge dissemination and awareness-building.

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7. Further Recommendations

To enhance the efficacy of climate change awareness programs, we propose a robust framework for trans-boundary collaboration in research. This approach aims to harness the collective expertise of researchers, institutions, and policymakers across international borders. Initiating and fostering collaborations between diverse countries will contribute invaluable perspectives, data, and experiences, enriching the outcomes of climate change awareness initiatives.

The establishment of international research networks dedicated to climate change studies can serve as pivotal platforms for knowledge exchange, fostering a global community committed to addressing climate challenges collaboratively.

A key focus of future research endeavors should include cross-cultural climate change studies to unravel the nuanced variations in awareness across diverse regions and societies. Investigating cultural influences on perceptions and responses to climate change will enable the tailoring of awareness strategies to align with the values and norms of specific communities. Furthermore, trans-boundary regions vulnerable to climate change impacts should be the focal point of research efforts. Understanding the interconnectedness of environmental changes in these regions and their implications can inform collaborative adaptation and mitigation strategies, emphasizing the necessity of coordinated efforts on a global scale. Integrating technology, fostering public-private partnerships, and promoting policy frameworks for trans-boundary cooperation will amplify the impact of climate change awareness programs, facilitating a more informed and empowered global community. These recommendations seek to fortify the foundation of climate change awareness initiatives through collaborative, cross-border efforts.

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