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Original Article

Effect of Educational Program Regarding Climate Change on Nursing Students' Awareness, Attitude and Practices in Suez Canal University

Ebtehal Galal Fathy Mohammed¹, Lamees Mahmoud Fahmy¹ and Fatma Ibrahim Abdel-Latif Megahed¹

¹ lecturer of Family and Community Health Nursing, Faculty of Nursing, Suez Canal University, Ismailia, Egypt.

Corresponding author: fatma.megahed2013@gmail.com

ABSTRACT

Background: Nurses have an incredible opportunity, role, and chance to coach and inspire the public to play a role against climate change. They are trustworthy healthcare professionals. **The aim of this study:** was to evaluate the effect of educational program regarding climate change on nursing students' awareness, attitude, and practices. **Design:** a quasi-experiment with a pre-/post-test experimental model was applied. **Setting:** this study was carried out at the faculty of nursing at Suez Canal University in Ismailia City. **Sample:** 200 nursing students were included in this study. **Tools:** nursing students' socio-demographic characteristics and knowledge assessment; perception; and daily life practices Likert scale questionnaire was used for data collection pre-and post-program implementation. **Results:** showed that the majority of the students had little to no background information about climate change and their main sources of information were their school and social media. The study also revealed that there was a significant difference in the students' knowledge and perceptions of climate change before and after implementing an educational program. Additionally, the study found that there were significant differences in the students' attitudes and environmental practices before and after the program. The results also showed a positive correlation between awareness, attitude, and practice scores. **Recommendations:** taking information from sources documented in references and scientific books.

Keywords: Climate change, educational program, knowledge assessment, perception, daily life practices.

Introduction

Climate change (CC) is a phenomenon that refers to changes in climate caused by variations in solar radiation, the earth's orbit, ocean circulation, increased emission of greenhouse gases from the burning of fossil fuels, and human injudicious/reckless activities. Climate change's consequences are drought, deforestation, heat waves, rain-related floods, storms & hurricanes, which might affect human lives and threaten populations' health in direct and indirect ways, and increase physical and mental harm, which could lead to illnesses and even deaths (Xiao et al., 2016).

Examples of the direct health effects of climate change include extreme weather events such as storms, wildfires, floods or drought, increased exposure to pollen, and heat waves. Examples of indirect effects include air pollution. (Respiratory and heart disease) water pollution (gastroenteritis) changes in ecosystems and the geographic distribution of vector-borne diseases, food insecurity, population displacement, conflicts, and disturbs mental health. In addition to having direct and indirect consequences on mental and physical health, climate change results in a loss of biodiversity (Woodhall et al., 2021).

Climate change affects nature and the national economy as well. Nurses & healthcare systems have made a sensational contribution by creating sustainable, climate-smart hospitals and health systems to protect patients from the impacts of climate change (Anåker et al., 2021). Nurses can play an administrative role in the

health sector by increasing awareness of climate change as an important health threat issue or by organizing actions and patronage of the challenges that arise from climate change. In their daily work, nurses also have an advocacy role toward their patients suffering from the effects of climate change, especially those who are the most vulnerable (Schenk et al., 2021; Diallo et al., 2022).

Climate change has been called the number one public health threat of the twenty-first century (Ryan et al., 2020). The World Health Organization (WHO) estimates that climate change could cause approximately 250,000 additional deaths per year between 2030 and 2050 due to malnutrition, malaria, diarrhea, and hot-weather stress (WHO, 2021). Investigations revealed that nurses in developed countries are more knowledgeable regarding climate change than nurses in developing countries; hence, the former could contribute to solving climate change-related health issues by helping patients acclimatize to these changing environments (Xiao et al., 2016).

Climate change experts declared that increasing awareness, especially in educational institutions can influence youth awareness & perception regarding the causes and effects of CC and its related miscellaneous solutions. Improving youth awareness and own perception related to CC could be reflected in many positive daily life practices for minimizing the great environmental and health consequences. In Egypt, collaboration of efforts between ministries of environmental affairs, health &

education, and other nongovernmental agencies become obviously observable among different populations to improve their awareness, attitude, and practices regarding CC (**Al-Ahram Center for Political & Strategic Studies, 2021**).

The community health nurse's role becomes crucial to enhancing patients' quality of life and averting illness. In order to ensure a healthy environment, nurses must ensure that their actions align with the following five fundamental conditions: pure air; pure water; effective drainage; cleanliness; and light. For Nightingale, being healthy meant being able to utilize all of one's abilities to the fullest extent possible (**Portela Dos Santos et al., 2023**). Nurses and other public health specialists & officers ought to be equipped with high experience and take essential responsibilities in protecting populations from the damage of CC since they are presupposed to play an important role in mitigating the health risks of CC (**WHO, 2021**).

Significance of the study

Egypt has had environmental problems for a very long time. Climate change will cause Egypt's temperatures to rise and its rainfall patterns to become more unpredictable. By 2050, Egypt's population is predicted to surpass 160 million, which implies that in addition to the country's limited resources, there will be a greater demand for food and clean water because of the country's limited natural resources as a result of climate change. Regarding Egypt's food production, water scarcity, and human security, the anticipated trend of "more hot weather and

less cold weather" is quite alarming (**Al-Mailam et al., 2023**).

There is an opportunity to significantly reduce the environmental impact of healthcare practice because nursing makes up a significant portion of the healthcare business. This can be achieved, in particular, by actively participating in public health efforts to slow down climate change. By educating future professionals whose knowledge, values, and attitudes will either directly or indirectly affect their environment, universities have the chance to be change agents for sustainability. They can also support ecologically friendly methods of providing treatment and highlight the advantages of carbon footprint reduction initiatives for public health (**Alvarez-Nieto et al., 2022; Tuna et al., 2022**).

Eugene et al., (2020) investigated a sample of college students in terms of their existing knowledge and perception of CC and recommended the subject to be incorporated in the university curriculums. However, there is still very little known about nursing students' awareness, attitude, and perception of climate change and their anticipated role in it. A few recent studies have examined nurses' insights on climate change and health. In this respect, this study aimed to evaluate the pre-/post-effects of an educational program on the awareness, attitude, and practices of nursing students toward climate change.

Aim of the study

This study aimed to evaluate the influence of educational programs on nursing students'

awareness, attitudes, and practice regarding climate change through:

1. Assessing the level of the student's awareness, attitude, and environmentally friendly practices towards climate change.
2. Developing educational programs regarding climate change on the students' awareness, attitudes, and environmentally friendly practices.
3. Implementing educational programs regarding climate change on the students' awareness, attitudes, and environmentally friendly practices.
4. Evaluating the influence of educational programs on the students' awareness, attitudes, and environmentally friendly practices regarding climate change.

Null hypothesis

Implementing the educational program won't alter awareness levels, attitudes, and friendly environmental practices regarding climate change among nursing students.

Alternative hypothesis

Implementing the educational program will improve awareness levels, attitudes, and friendly environmental practices regarding climate change among nursing students.

Subjects and Method

Study design

A quasi-experiment with a pre-/post-intervention test experimental model was applied for the comebacks of the respondents (Adolescents Nursing B.Sc. Students; N=200).

Study setting

The study was carried out at the Faculty of Nursing; Suez Canal University; in Ismailia City.

Target population

Nursing B.Sc. students from all grades (first, second, third, and fourth); at the Faculty of Nursing; Suez Canal University at Ismailia City.

Study sample

G-power version 3.1 was used to assess/calculate the anticipated total sample size for the studied population assuming the difference between four groups; using two measurements pre and post; with effect size index.28; with α error .05 and using 93%, was d, and it was (the anticipated total sample-size) approximately 196 individuals, which means nearly 50 registered students from every grade (not less than 20% of registered students, ranged between 20-26%, with the first year has the greater number of individuals and lowest family size).

Sampling technique

The sampling method was a purposive sample that was conducted on those B.Sc. Nursing students listed in the Faculty of Nursing; Suez Canal University; at Ismailia City. Among the criteria for cluster equal inclusion in the study are being enrolled in the first, second, third, and fourth grades; Faculty of Nursing, being sufficiently informed about the objectives/goals of the study and accepting signing the enlightening consent form.

Study tools and data collection

A formal questionnaire was developed by the researchers based on a literature review to assess the knowledge, attitude, and daily life practices of B.Sc. Nursing students (participants). The questionnaire was comprised of three fractions/divisions, with involvement items derived from the existing literature.

Part I: Student knowledge regarding climate change:

The B.Sc. Nursing students' socio-demographic data such as age, gender, educational level, residence, and academic-year level/grade. The B.Sc. Nursing students' awareness regarding climate change. Knowledge, sources of information on climate change, and perception were the dependent variables selected to evaluate the level of student awareness of climate change.

a- Knowledge regarding climate change: Consisted of 10 multiple-choice questions to assess The B.Sc. Nursing students (participants) have knowledge regarding the nature and causes of global climate change (**Tuna et al., 2022 & Reddy et al., 2022**).

b- Perceptions of health-related impacts of climate change: a list of 12 health-related issues, the respondents were asked, whether each issue had already increased or would increase within the next 20 years due to climate change. The respondents were also asked to assess their perceptions of the health-related impacts of global climate change (**Felicilda-Reynaldo et al., 2018**).

Scoring system

Students answered "yes" or "no" to perception questions, and "yes", "no" or "I don't know" to knowledge questions. Responses to each question are represented as "correct," or "incorrect." A total score was calculated by the sum of correct answers and converted into a percentage to be categorized into Poor knowledge <50%; Average knowledge 50-70%; and Good knowledge >70% (**Abdallah & Farag., 2022**).

Part II: Attitudes scale regarding climate change:

A scale was developed (**Netravathia & Chauhan, 2014**) and used herein to measure the attitude of students toward climate change based on Likert's technique. It included 12 selected statements, three statements were the indicators of an unfavorable attitude (3,7,12) and nine statements were the indicators of a favorable attitude (1,2,4,5, 6,8,9,10,11).

Scoring system

Responses to each statement were (agree, uncertain, and disagree) by score (2, 1, 0) for favorable attitude and reverse scores for unfavorable attitude. The total attitudes score was summed up and converted into a percentage to be considered: Positive attitude $\geq 60\%$; Negative attitude <60% (**Abdallah & Farag, 2022**).

Part III: Friendly-environmental reported practices: This part was to assess The B.Sc. Nursing students' (participants') Friendly-environmental reported practices to reduce the effect of climate change and global warming. It consisted of eleven statements evaluating these students' friendly-environmental practices (**Reddy et al., 2022**).

Scoring system

Responses to each statement were "done," or "not done". A total score was calculated by the sum of done practices and then converted into a percentage resulting in adequate practices >60%; and inadequate practices <60% (**Abdallah & Farag, 2022**).

Content validity

After developing tools and before data collection, the content was tested by five expert

consultants in the field of the study (professors and lecturers from the family and community health nursing department; Faculty of Nursing, Suez Canal University, and from the family medicine and community medicine departments, Faculty of Medicine, Suez Canal University) for adjustments ensuring clarity, relevance, comprehensiveness, and understanding.

Pilot study

Carried out on 10% of the sample (n=20). It was conducted before data collection using Cronbach's alpha coefficient to evaluate the content and clarity of the questionnaire and to test the applicability of the tools as well as techniques. According to the results of the pilot study, no modifications were made to the suggested tool.

Content Reliability

Cronbach's alpha coefficient before (Pilot study)/after data collection was used to assess the reliability (internal consistency) of the established tool. It was 0.709 for the awareness questionnaire; 0.748 for practices and 0.546 for attitudes.

Field of work (procedure)

From Mars to June 2023, actual data collecting took place over a period of 4 months. The study was conducted in three phases: the pre-intervention (pre-test), the intervention phase with an educational program/curriculum, and then ended with the post-intervention (post-test) phases.

1. Pre-intervention (Pre-test) phase

Before starting up program design and planning, a review of the literature regarding current and past available literature was done to cover the "climate change and global warming"

aspects. It also guided/directed the development of data collection tools and likewise the contents of the introduced educational program. It involved analysis of the collected data to identify the needs and demands of the participants and to identify the most important topics to be addressed in the educational materials.

2. Intervention phase:

The intervention program was carried out at the Faculty of Nursing, Suez Canal University, in Ismailia city. The program was conducted during 4 sessions of 30 minutes classes over four weeks. The data was googled docs on the internet and was collected online through the questionnaires. In addition to being discussed and given out to students inside the faculty, the questionnaires were also disseminated via faculty WhatsApp groups, and their consent was obtained by informing them online. The education content was included/attached. The B.Sc. Nursing students' (participants') knowledge regarding basic facts about climate change and its occurrence, factors contributing to climate change, effects of global climate change on the environment and humans, and solutions for reducing climate change & sources of alternative energy, student's perception regarding climate change and friendly-environmental practices to climate change. The instructional strategies were presented as a slide show example, using instructive images for nursing students supplied by researchers to grab their interest and maintain focus on the subjects they knew less about. Active techniques like group discussions and question-and-answer sessions were also employed.

3-Post-intervention (Post-test) phase

Evaluation of the program outcomes was tested firstly through the pre-test before the program conduction, then finally after the implementation phase to evaluate the impact of the educational program on the nursing student's awareness, attitudes, and friendly- environmental practices regarding climate change and global warming.

Administrative approval:

An official letter was issued to the Faculty of Nursing, Suez Canal University, and its ethical committee to obtain permission to conduct the study.

Ethical considerations

The study proposal was permitted by the Research Ethics Committee at the Faculty of Nursing, Suez Canal University (Code number 193/ (2\2023)). All ethical considerations were considered. Informed verbal and written consent were taken after clarifying the aim of the study before the first part of applying the questionnaire. The participants were assured about the confidentiality of the information obtained and about their rights to withdraw at any time they want throughout the study.

Statistical design& analysis

Many statistical operations were performed on the data in order to achieve/accomplish the objectives and verify / evidence the hypotheses of the study. These statistical operations included the following: Degree of reliability& stability: The use of Cronbach alpha magnitude (coefficient/extent) to test the reliability of the survey list and determine its internal consistency between the

items of the survey or the questionnaire questions (known as internal consistency, or reliability tests).

They use descriptive/qualitative statistics methods to determine the characteristics of the sample expressions/terms through obtaining/attaining frequencies and percentages, then Median, and IQR. Using statistical analysis methods to test the hypotheses of the study, which are:

Frequencies (Number& %) and “Z” parametric or “X²” “McNemar's Bowker”, “Monte Carlo for Chi-square”, and “Fisher Exact” non-parametric tests (According to data type and the number of sub-classes); regarding the knowledge about climate change of B.Sc. Nursing student' according to their correct answers (Before & After intervention; N=200)

Correlation between study variables through calculation of the correlation coefficient (Pearson) for the relationship between pairs of quantitative variables (total awareness, total attitudes, and total practice scores).

Calculation of the correlation coefficient (Spearman) for the relationship between pairs of variables (between each dimension on the one hand with the rest of the dimensions of the study axes on the other hand).

Results of the research

Table (1) results revealed that the average age of the studied sample was 20.50 with SD 1.12, and 51% of them were females; 51.5% were from rural areas. Likewise, 23.5% reported that the school was their source of information, followed by social media with 18 %, while 25.5% didn't know what

their sources of information about climate change are.

Figure (1) illustrate that most Ismailia Nursing Students & from all B.Sc. Grades (81.3% of the studied sample) don't have any background information, whatsoever, about climate change.

Table (2) revealed that there was a significant ($P \leq 0.001^*$) difference between students' knowledge pre-, and post-intervention with the educational program regarding "climate change and global warming" definition, causes, daily life, human health, and the development of diseases, government measures, ways to reduce climate change, and ways to protect themselves from the consequences of climate change.

Table (3) showed that Frequencies (Number & %) of correct answers increased After applying the "Educational Program regarding the health effects of "climate change and global warming". However; these binomial differences (Pre- & Post-intervention using McNemar's test) as regard to any of the two responses separately "Already increased (P_1) / Increased over the next twenty years (P_2)" were highly significant ($P \leq 0.001$; Agresti 2007 and McNemar 1947). Climate change is a universal phenomenon, climate change situation has created a shortage of food, a climate change phenomenon has affected human health., study on climate change situation is the necessary for the growth of agriculture, the occurrence of climate change has increased soil evaporation rate, need to waste resources on climate change issue, climate change phenomena have increased natural calamities, change in rainfall pattern is mainly due to climate change, lack of sensitivity towards

climate change creates vulnerability/weakness in agriculture, and because of climate change there is need to adopt innovative methods in farming.

Table (4) showed that there was a significant ($P \leq 0.05$ or $P \leq 0.001$) difference between student attitudes pre-, and post-intervention with the educational program regarding the health effects of "climate change and global warming".

Table (5) uncover that there was a significant ($P \leq 0.05$ or $P \leq 0.001$) difference between student' friendly environmental practices pre-, and post-intervention with the educational program regarding turning off lights/devices when not in use, using energy-saving appliances, using public transportation to save fuel, quitting non-vegetarian diet, carpool (share)/travel with friends, using a solar water heater/cooker, defrosting refrigerator/freezer often, reducing use of plastic and recycle whenever possible, buying environmentally friendly products, participation in tree plantation drives, and reduction in consumption of packaged food.

Table (6) clarify that 47% of the studied sample had significant ($P \leq 0.001$) good awareness post-intervention in comparison with 25.5% pre-intervention, non-significant positive attitudes increase from 53% pre- to 59.5% post-intervention. Furthermore, adequate levels of practice significantly ($P \leq 0.001$) increased from 17% pre- to 34% post-intervention.

Table (7) showed that there were statistically high bivariate significant ($P \leq 0.001$) positive correlation coefficients (r) between awareness levels with total attitudes-score, and total practice score with r equivalents 0.637 and 0.739;

respectively. Also, there was a statistically significant ($P \leq 0.001$) positive correlation between the total attitudes score and total practice score with r equivalents of 0.755.

Figure (2) illustrates that there was a positive correlation between the total practice score and awareness levels with r equivalents of 0.739 ($P \leq 0.001^*$).

Table (8) revealed that there were generally statistically significant ($P \leq 0.05$) differences between awareness levels and classes of demographic characteristics (age, gender, academic year, But Not for the Residence classes).

Table (9) represent the distribution of pre-intervention attitude levels (Negative; Positive) in relation to demographic characteristics (Age\years; Gender; Academic year and Residence) for the respondents (Nursing B.Sc. students; N=200).

Table (10) revealed that there were generally statistically significant ($P \leq 0.05$) differences between total performed practice levels (Adequate, Inadequate) and classes of demographic characteristics (Age\years, academic year, but not for the gender, Residence classes) using Monte Carlo for Chi-squared or fisher exact tests.

Table 1 Demographic characteristics of adolescents (Nursing Students; N=200).

Items	No.	%
Age (Years)		
19	50	25.0
20	50	25.0
21	50	25.0
22	50	25.0
Mean \pm SD	20.50 \pm 1.12	
Gender		
Male	98	49.0
Female	102	51.0
Academic year		
First	50	25.0
Second	50	25.0
Third	50	25.0
Fourth	50	25.0
Residence		
Urban	97	48.5
Rural	103	51.5
Sources of information about climate change		
School	47	23.5
Television/radio	33	16.5
Internet / social media	36	18.0
family members, friends, and neighbors	14	7.0
Medical and academic journals	9	4.5
Formal Institutions (Government etc.)	6	3.0
Non-governmental organizations	4	2.0
h) Don't know	51	25.5

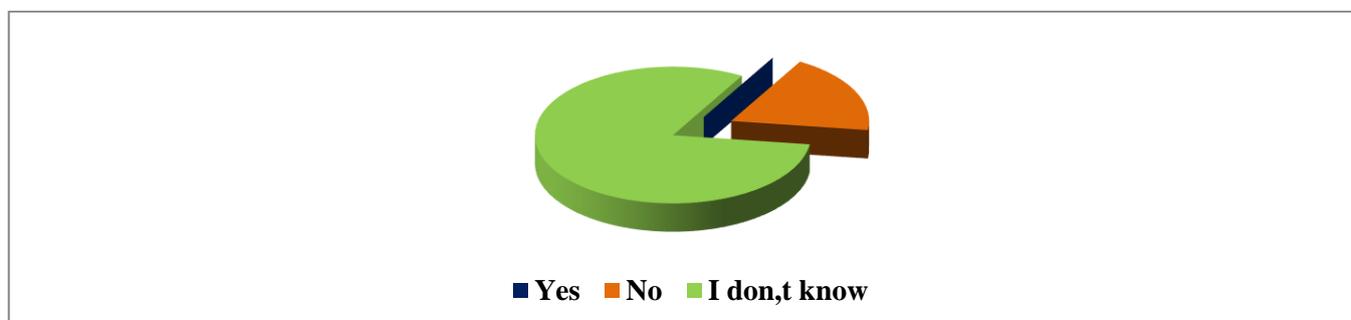


Figure 1: Percentage Frequencies) of faculty students' background knowledge regarding climate change.

Table 2 Frequencies (Number& %) and McNemar's test of Nursing B.Sc. students' knowledge about climate change according to their correct answers (Before& After intervention with the Educational Program; N=200).

Items	Pre		Post		McNemar's P value
	N	%	N	%	
1. What are "climate change and global warming"?	109	54.5	159	79.5	≤ 0.001*
2. Causes of climate change and global warming.	113	56.5	162	81	≤ 0.001*
3. Will "climate change and global warming" affect our daily lives?	112	56	156	78	≤ 0.001*
4. Will "climate change and global warming" affect human health and the development of diseases?	87	43.5	127	63.5	≤ 0.001*
5. Is the government taking measures that would reduce global warming?	96	48	130	65	0.002*
6. Ways to reduce climate change?	97	48.5	146	73	≤ 0.001*
7. Ways to protect ourselves from climate change?	76	38	124	62	≤ 0.001*

McNemar's Bowker test was used to compare pre-& post-intervention with an Alpha significance level of $P < 0.05$.

Table 3 Frequencies (Number& %) and McNemar's test of Nursing B.Sc. students' according to their correct answers about their perceptions of health-related impacts of climate change (Before& After the intervention with the Educational Program; N=200).

Items	Pre N (%)		Post N (%)		McNemar's P value	
	Already increased	Increased over the next twenty years	Already increased	Increased over the next twenty years	P1	P2
1. Health diseases.	71(35.5)	75(37.5)	132(66)	115(57.5)	≤ 0.001*	≤ 0.001*
2. Population displacement due to floods	71(35.5)	75(37.5)	129(64.5)	115(57.5)	≤ 0.001*	≤ 0.001*
3. Infectious diseases transmitted by disease vectors	71(35.5)	75(37.5)	129(64.5)	115(57.5)	≤ 0.001*	≤ 0.001*
4. Diseases transmitted through water	71(35.5)	75(37.5)	130(65)	115(57.5)	≤ 0.001*	≤ 0.001*
5. Diseases transmitted through food	81(40.5)	81(40.5)	131(65.5)	115(57.5)	≤ 0.001*	≤ 0.001*
6. Diseases transmitted through the air	81(40.5)	81(40.5)	130(65)	115(57.5)	≤ 0.001*	≤ 0.001*
7. Malnutrition	81(40.5)	81(40.5)	130(65)	115(57.5)	≤ 0.001*	≤ 0.001*
8. Disruption of health care services during severe weather events	81(40.5)	81(40.5)	122(61)	115(57.5)	≤ 0.001*	≤ 0.001*
9. Anxiety, depression, or other mental health conditions	81(40.5)	81(40.5)	122(61)	121(60.5)	≤ 0.001*	≤ 0.001*
10. Cold related diseases	81(40.5)	81(40.5)	130(65)	115(57.5)	≤ 0.001*	≤ 0.001*
11. Other health impacts related to climate change in your community	81(40.5)	81(40.5)	141(70.5)	115(57.5)	≤ 0.001*	≤ 0.001*

McNemar's Bowker test was used to test the difference between pre-, and post-intervention; significance at $P \leq 0.05$.

Table 4 Qualitative statistics (Median& IQR) and Z-test of Nursing B.Sc. student' according to their correct answers about their attitudes about the health effects of “climate change and global warming” (Before& After the intervention with the Educational Program; N=200).

Items	Pre		Post		Z test P value
	Median	IQR	Median	IQR	
1.I believe that climate change is a universal phenomenon (+).	1	1	2	1	7.61($\leq 0.001^*$)
2.I assume that the climate change situation has created a shortage of food .	1	1	2	1	7.54($\leq 0.001^*$)
3.I feel that a climate change phenomenon is only propaganda.	0	1	0	2	1.40(.161)
4.I feel that a climate change phenomenon has affected human health(+).	1	1	1	1	6.11($\leq 0.001^*$)
5.I feel study on the climate change situation is necessary for the growth of agriculture	1	1	1	2	5.33($\leq 0.001^*$)
6.I think that the occurrence of climate change has increased the soil evaporation rate	1	1	1	2	5.12($\leq 0.001^*$)
7.I think no need to waste resources on climate change issue	1	1	0	1	4.44($\leq 0.001^*$)
8.I think the climate change phenomenon has increased natural calamities	1	1	1	2	4.41($\leq 0.001^*$)
9.I feel that the change in rainfall pattern is mainly due to climate change	1	1	1	1	5.05($\leq 0.001^*$)
10. I think a lack of sensitivity towards climate change creates vulnerability in agriculture.	1	1	1	2	2.13($\leq .033^*$)
11. I feel that because of climate change, there is a need to adopt innovative methods of farming	1	1	1	2	5.51($\leq 0.001^*$)
12. I feel climate change is a natural phenomenon, so man has nothing to do with it	0	1	0	1	1.03(.302)

Z-value stands for Wilcoxon sign ranked test; significance at $P \leq 0.05$.

Table 5 Frequencies (Number& %) and McNemar's test for the responses of Nursing B.Sc. students according to their correct answers about their friendly environmental practices (Before& after the intervention with the Educational Program; N=200).

Items	Pre		Post		McNemar's P value
	N	%	N	%	
1. Turn off lights/devices when not in use .	78	39.0	129	64.5	$\leq 0.001^*$
2. Use energy-saving appliances .	73	36.5	120	60	$\leq 0.001^*$
3. Use public transportation to save fuel	70	35.0	113	56.5	$\leq 0.001^*$
4. Quit non- vegetarian diet .	46	23.0	91	45.5	$\leq 0.001^*$
5. Carpool (share)/travel with friends .	76	38.0	127	63.5	0.002*
6. Use a solar water heater/cooker	34	17.0	104	52	$\leq 0.001^*$
7. Defrost refrigerator/freezer often .	52	26.0	95	47.5	$\leq 0.001^*$
8. Reducing the use of plastic and recycling whenever possible	53	26.5	116	58	$\leq 0.001^*$
9. Buy environmentally friendly products	77	38.5	107	53.5	$\leq 0.001^*$
10. Participation in tree plantation drives.	73	36.5	85	42.5	0.037*
11. Reduction in consumption of packaged foods.	70	35.0	114	57	$\leq 0.001^*$

McNemar's Bowker test was used to test the difference between pre, and post intervention; significance at $P \leq 0.05$.

Table 6 Frequencies (Number & %) McNemar's and Chi-squared tests for the responses of Nursing B.Sc. students according to their levels of awareness, attitudes, and friendly environmental practices (Before & After the intervention with the Educational Program; N=200).

Items	Pre		Post		Test P value
	N	%	N	%	
1. Awareness					
Poor	120	60.0	68	34.0	≤ 0.001*#
Average	29	14.5	38	19.0	
Good	51	25.5	94	47.0	
2. Attitudes					
Positive	106	53.0	119	59.5	.171\$
Negative	94	47.0	81	40.5	
3. Practice					
Adequate	34	17.0	68	34.0	≤ 0.001* ^{\$}
Inadequate	166	83.0	132	66.0	

= Chi-squared test, \$ McNemar's Bowker test was used to test the difference between pre-, and post-intervention; significance at $P \leq 0.05$.

Table 7 Pearson Correlation coefficients (r) between total awareness score, total attitudes score, and total practice score for the responses of Nursing B.Sc. students (N=200).

Items	1	2	3
1. Total awareness score	---		
2. Total attitudes-score	.637 (≤ 0.001*)		
3. Total practice score	.739 (≤ 0.001*)	.755 (≤ 0.001*)	

Significant on two-tailed ($P \leq 0.05$).

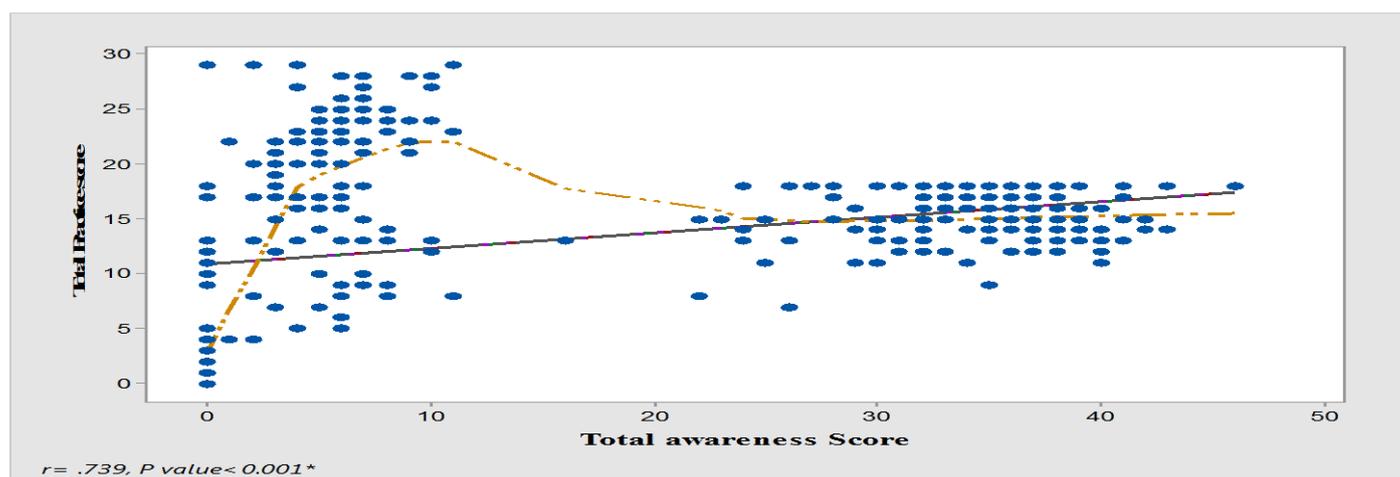


Figure 2 Scatter plot shows the correlation between awareness levels and total practice score (N=200).

Table 8 Relation between students' socio-demographic characteristics and their levels of awareness regarding climate change (Nursing B.Sc. students; N=200).

Items	Awareness						χ^2 (P value)
	Poor		Average		Good		
	N	%	N	%	N	%	
Age (Years)							
19	25	50.0	10	20.0	15	30.0	129.50 ^{MC} ($\leq 0.001^*$)
20	0	0	18	36.0	32	64.0	
21	45	90.0	1	2.0	4	8.0	
22	50	100.0	0	0	0	0	
Gender							
Female	48	49.0	17	17.3	33	33.7	9.99(0.007*) ^{FET}
Male	72	70.6	12	11.8	18	17.6	
Academic year							
First	25	50.0	10	20.0	15	30.0	129.50 ^{MC} ($\leq 0.001^*$)
Second	0	0	18	36.0	32	64.0	
Third	45	90.0	1	2.0	4	8.0	
Fourth	50	100.0	0	0	0	0	
Residence							
Urban	55	56.7	13	13.4	29	29.9	1.92 (.382) ^{FET}
Rural	65	63.1	16	15.5	22	21.4	

χ^2 is the Chi-squared test, ^{MC} is the Monte Carlo for the Chi-squared test; ^{FET} is the Fisher Exact test; significance at $P \leq 0.05$.

Table (9): Distribution of pre-intervention attitudes level in relation to demographic characteristics for the respondents (Nursing B.Sc. students; N=200).

Items	Attitudes				χ^2 (P value)
	Negative		Positive		
	N	%	N	%	
Age (Years)					
19	26	52.0	24	48.0	9.07 ^{MC} (.028*)
20	34	68.0	16	32.0	
21	19	38.0	31	62.0	
22	27	54.0	23	46.0	
Gender					
Female	59	60.2	39	39.8	9.99(.049*) ^{FET}
Male	47	46.1	55	53.9	
Academic year					
First	26	52.0	24	48.0	9.07 ^{MC} (.028*)
Second	34	68.0	16	32.0	
Third	19	38.0	31	62.0	
Fourth	27	54.0	23	46.0	
Residence					
Urban	53	54.6	44	45.4	.203 (.673) ^{FET}
Rural	53	51.5	50	48.5	

χ^2 is the Chi-squared test, MC is the Monte Carlo for the Chi-squared test; FET is the Fisher Exact test; significance at $P < 0.05$.

Table 10 Distribution of pre-intervention levels performed practices in relation to demographic characteristics for the respondents (Nursing B.Sc. students; N=200).

Items	Practice				X ² (P value)
	Adequate		Inadequate		
	N	%	N	%	
Age (Years)					
19	13	26.0	37	74.0	22.82 ^{MC} ($\leq 0.001^*$)
20	16	32.0	34	68.0	
21	5	10.0	45	90.0	
22	0	0	50	100	
Gender					
Female	13	13.3	85	86.7	1.89(.191) ^{FET}
Male	21	20.6	81	79.4	
Academic year					
First	13	26.0	37	74.0	22.82 ^{MC} ($\leq 0.001^*$)
Second	16	32.0	34	68.0	
Third	5	10.0	45	90.0	
Fourth	0	0	50	100	
Residence					
Urban	18	18.6	79	81.4	.323 (.579) ^{FET}
Rural	16	15.5	87	84.5	

X² is the Chi-squared test, MC is the Monte Carlo for the Chi-squared test; FET is the Fisher Exact test; significance at P < 0.05.

Discussion

Nursing students need to be prepared to work in a world where climate change is a reality and contribute to sustainable healthcare and society. Student perspectives and experiences are critical to the continuous improvement of education. Understanding nursing students' perspectives on sustainability, climate change, and their personal role in advocating for a more sustainable healthcare system is critical. Using this data, the curriculum can be designed to match the student's level of understanding of the subject matter (Anâker et al., 2021). Thus, the aim of this study was to evaluate the effect of educational program

regarding climate change on nursing students' awareness, attitude, and practices in Suez Canal University.

The sample's average age in the current study was 20.50 (standard deviation; SD 1.12), 51% of the participants (nursing students), were females and 51.5% of them were rural. Similarly, 35.5% of respondents said that they got their information from school, while the other 64.5% said they had no idea where to find any information regarding climate change. According to a research paper by Deveci et al., (2019), the average age of the students is 21.37 ± 2.85 (minimum: 17; maximum: 44), with 53.5% of them being females

(46.5% being males). Students in the first, third, and sixth grades make up 32.7%, 32.2%, and 35.1% of the total. The percentages of respondents who said they had knowledge about Global Warming and Climate Change (GWCC) and its effects via the internet, television, school, family, friends, and non-governmental groups were 77.0%, 91.8%, 30.7%, 38.1%, and 22.3%, respectively.

In a similar approach study, **Nigatu et al., (2014)** uncovered that the participants' average age was 24.1 years ($\pm 2.3SD$). The majority of those study participants (63.1%) stated that they typically learned about climate change from electronic mass media (TV and radio). However, 47 (15.4%), 44 (14.4%), and 22 (7.1%) said they learned about it from newspapers, friends/neighbors, and schools, respectively. Students mentioned national newspapers as one of their sources of information about climate change, even though newspapers are not issued by schools.

Similarly, the study by **Tuna et al., (2022)** revealed that 83.3% of the students involved were females and that the average age of the participants was 20.58 ± 1.42 . It was also shown that fourth-grade pupils, who made up 8.1% of the sample, participated the least in their study, and defined their current health status as good. Relatedly, it was found that 64.2% of the students' information sources about climate change and global warming came from television, and 63.5% came from the internet. 19.6% of the students indicated that they obtained their information via university education. The students' response to the health effects of climate change was found to be a

97.3% increase in diseases connected to air quality, a 91.9% increase in diseases caused by food, and an 89.9% increase in diseases caused by water (waterborne diseases).

However, according to the current study, there was a positive attitude that grew, post-intervention, from 53% to 59.5% with a difference that wasn't statistically significant. 47% of the investigated sample exhibited good post-intervention awareness compared with 25.5% pre-intervention. Similarly, following the intervention, the proportion of practice with a sufficient level rose from 17% to 34%, with a significant difference $<0.001^*$. Based on similar findings, a study by **Mulugeta et al., (2023)** showed that respondents' levels of awareness of the health effects of climate change were inadequate for 21 (3.47%; with 95% Confidence Interval being between 2.1, 5.2), but medium for 260 (42.98%; 95% CI: 38.99, 47.02). Additionally, it was discovered that roughly 324, (53.55%, 95% CI: 49.4, 57.5), respondents have sufficient expertise. Male respondents make up a larger share of those with a medium or inadequate degree of expertise. Similarly, **Álvarez-Nieto et al.'s study (2022)** showed that more than 95% of nursing degree students in years two and three had excellent or extremely good attitudes after completing a training program that used scenario-based learning and augmented reality related to sustainability, climate change, and health.

Correspondingly, **Yang et al.'s (2018)** study found that compared to their counterparts in the medical and public health fields, nursing students know less about how climate change affects

health. On the other hand, **Liao et al.'s (2019)** study revealed that Chinese students are aware of climate change. This conclusion was consistent with research by **Nigatu et al., (2014)**, which found that most health-science students (77.5%) knew about climate change. This can be used as a trigger to get health science students talking about climate change and other environmental issues that may be more broadly related to public health. Similarly, **Deveci, et al.'s (2019)** study found that the average knowledge point for climate change and global warming is 26.15 ± 2.88 . Nevertheless, the average knowledge-score decreases as health-science students' grades increase ($p < 0.002$).

Consistent with that, **Ibrahim et al., (2018)** disclosed that most of the students they studied had completely favorable attitudes toward climate change and global warming. According to **Tiong et al., (2020)**, the majority of study participants exhibited very supportive pro-environmental attitudes, with over two-thirds strongly believing that the pollution problem would have a more detrimental influence on human health. This finding was supported by another study. Moreover, to a consensus on shifting values that could aid in resolving certain environmental issues.

According to the study by **Adio-Moses & Aladejana (2015)**, which evaluated the knowledge and awareness of global warming/CC among residents of an urban community residing in industrial zones of Nigeria, an African developing country, contradicted these findings. Only 25% of their study participants exhibited optimistic attitudes. However, the results of the

current study revealed that 81.3% of the under-investigation-sample had no prior knowledge about climate change. **Mulugeta et al., findings (2023)**, revealed related results: 123 respondents (20.33%; 95% CI: 17–24) did not consider climate change to be a worldwide issue. Moreover, 57 respondents (roughly 9.42%; 95% CI: 7–12.4) had never heard of climate change.

These results are somewhat higher than those of a similar survey conducted in Bangladesh by **Kabir et al., (2016)**, who exposed that 45.8% of their investigation respondents lacked knowledge of climate change. The majority of people (54.2), in their study area may be involved in environmental protection activities where they may learn about health issues associated with climate change, which could be a likely explanation for this. Comparably, the results of this survey are somewhat better than those of **Odonkor et al., (2020)**, who indicated that 29.6% of respondents in Ghana had never heard of climate change. According to **Akrofi et al., (2019)**, this better knowledge could be related to the public awareness campaigns in our study region compared to the lower public awareness accomplished in Ghana, the counter-study area.

The current study found a significant difference ($P < 0.001$), in students' perceptions, before and after the intervention, of the health-related effects of climate change, including population displacement from floods, infectious diseases spread by disease vectors, diseases transmitted through water, diseases transmitted through food, and diseases that would increase over the next 20 years, before and after

intervention in terms of health diseases, population displacement from floods, infectious diseases spread by disease vectors, diseases spread through water, diseases transmitted through food, diseases transmitted through the air, malnutrition, disruption of health care services during extreme weather events, anxiety, depression, or other mental health conditions, diseases related to colds, and other health impacts related to climate change in your community.

Likewise, a study by **Deveci, et al., (2019)** showed that among the students, 98.8%, 86.4%, 94.1%, 92.6%, 77.7%, and 50.0% think that the GWCC increases health problems such as respiratory problems, sunburn, heat stroke, cancer, infectious diseases, and physical injuries, respectively. 38.2% reported that they heard about the Kyoto Protocol, and 61.8% said they did not.

The current study uncovered that there was a significant difference between student' friendly environmental practices pre- and post-intervention with the educational program regarding turning off lights/devices when not in use, using energy-saving appliances, using public transportation to save fuel, quitting non-vegetarian diet, Carpool (share)/travel with friends, using a solar water heater/cooker, defrosting refrigerator/freezer often, reducing use of plastic and recycle whenever possible, buying environmentally friendly products, involvement/participation in tree planting campaigns and decrease in packaged food intake ($P < 0.001$).

According to **Reddy et al., (2022)**, the majority of study investigation participants were somehow engaging in eco-friendly behaviors,

such as turning off lights when not in use (94%), utilizing energy-saving equipment (60%), and purchasing environmentally friendly goods (57%). **Nalgundwar et al., (2014)** revealed similar results, indicating that a high percentage of environmentally friendly habits were seen among their survey participants.

The results of the current study demonstrated a significant difference ($P < 0.05$) in the levels of awareness due to academic year, gender, and/or age. Similarly, there were significant differences ($P < 0.05$) were distinguished according to age, gender, academic year, and attitude level. Likewise, significant differences ($P < 0.05$) were indicated due to age, gender, academic year, and level of practice.

Similarly, **Abdallah & Farag's study (2022)** showed no relationship during the pre-test phase but a significant strong positive association ($P < 0.001$), between the post-test total nursing students' knowledge score level and total daily life practices & perception ($r = .938$ & $r = .797$). In contrast, a positive correlation ($r = .304$) between the post-test total nursing students' knowledge and their faculty level. Additionally, at ($P < 0.05$), there is a positive correlation ($r = .298$ & $r = .302$) and ($r = .296$ & $r = .307$) between the post-test total nursing students' daily life practices & perception and their faculty level & gender. In a similar vein, it was discovered that individuals with sufficient knowledge of climate change engaged in more ecologically friendly behaviors than those without sufficient knowledge.

Research among Chinese rice farmers by **Li et al., (2021)** has shown an upward relationship

between their endorsement of low-carbon models and their sense of climate change.

Conclusion

After exploring the quality and extent of the nursing students' overall understanding of climate change subject, it seems that the accordingly instigated awareness program significantly improved these students' overall understanding, perceptions, and daily routines in relation to climate change. Additionally, there was a seemingly intermediate to high statistically significant association between the general knowledge of nursing students' score level, as well as their attitudes and behaviors in daily life about climate change.

Recommendations

Regular appropriate and relevant awareness campaigns should be held to increase university students' knowledge about climate change and other contemporary stifling subjects, as this may have a beneficial impact on how they perceive, deal and guide others with climate change in their circadian life. Increasing the inclusion of environmental issues such as climate change in the university curriculum is also required. Educational initiatives might be strengthened in order to raise students' understanding and sensitivity to climate change.

Taking information from sources documented in references and scientific books. Healthcare providers (e.g., Nurses) should help their community and patients adopt environmentally friendly behaviors and address the effects of climate change on their health. More study is

therefore required to enhance climate change education.

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Abbreviations

CC: Climate Change
GWCC: Global Warming and Climate Change
WHO: World Health Organization

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