ISSN 2786-0183
Helwan International Journal for Nursing Research and Practice
Vol. 4, Issue 11, Month: September 2025, Available at: https://hijnrp.journals.ekb.eg/

Preparatory School students'Awareness Regarding Climate Change Effects Mitigation and Adaptation

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Abstract

Background: Climate change represents a challenging difficulty that requires transforming societies' systemic practices to generate adaptation and mitigation solutions to address the climate crisis. **Aim**: This study aimed to assess preparatory school students' awareness regarding climate change effects mitigation and adaptation .**Research design:** A descriptive research design was used in this study. **Sample**: Multi stage random sample included 240 students. **Setting**: 4 preparatory schools in Massara district (Hudaa Sharawy Eltagribia, El-kholafaa El- Rashedeen , El-Shaheed Ahmed Hamdy ,khadiga bent khoild preparatory schools). **Tool for data collection:** One tool included four parts, **part 1 :** demographic characteristic **part 2:** students' knowledge regarding climate change and its effects mitigation and adaptation **part 3:** preparatory school students' attitude toward climate change **part 4:** preparatory school students' reported practices regarding climate change mitigation and adaptation. **Results**: 56.7 % of the studied preparatory school students had poor total knowledge regarding climate change effects mitigation and adaptation**,** 83.3 % of the studied preparatory school students had negative total attitude toward climate change effects mitigation and adaptation.40.0 % of the studied preparatory school students had a adequate total reported practices level regarding climate change effects mitigation and adaptation. **Conclusion**: There were highly statistically significant positive correlation between total knowledge, total attitude and total reported practices regarding preparatory school students' awareness regarding climate change effects mitigation and adaptation. **Recommendations**: Provide students'with knowledge, practice regarding climate change mitigation and adaptation through educational program.

Key words: *Adaptation***,** *Climate Change, Mitigation, Preparatory School* students' *Awareness.*

Introduction

Climate change means long-term changes in the Earth's weather patterns. These changes are mostly caused by human activities like burning coal, oil, and gas. This creates gases that trap heat in the atmosphere, making the Earth warmer over time. When we use cars, factories, or electricity from fossil fuels, we release gases like carbon dioxide. These gases stay in the air and trap heat, like a blanket around the Earth. This causes global warming. Over time, this leads to changes in weather, like stronger storms, hotter days, and longer droughts Climate change is not just about the weather it also affects our health. Hotter temperatures can cause heat stroke or worsen heart and breathing problems. Changes in rain and temperature can spread diseases like malaria and dengue fever **(Awan et al .,2025).**

Mitigation is the process of reducing or preventing the release of greenhouse gases into the atmosphere to slow down climate change this helps protect public health by reducing harmful air pollution that can cause respiratory diseases. It involves taking steps to lower carbon emissions from human activities such as transportation, industry, and agriculture. Lowering emissions can prevent extreme weather events that threaten community safety and health. Mitigation means adopting cleaner energy sources like solar, wind, or hydropower to replace fossil fuels. Clean energy reduces pollution, improving air quality and decreasing health problems like asthma and heart disease. Mitigation includes lifestyle changes such as using less electricity, recycling, and conserving water, these simple actions by individuals and communities help reduce environmental damage and promote healthier living conditions **(Nascimento et al., 2022).**

Adaptation to climate change involves the modifications that communities implement to reduce the adverse effects of climate-related events. This encompasses the development of infrastructure, readiness for emergencies, and changes in

ISSN 2786-0183
Helwan International Journal for Nursing Research and Practice
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behavior to address shifting weather conditions and health threats. It is crucial for students to understand adaptation methods, including water conservation, the implementation of early warning systems, and health measures during extreme heat, to foster preparedness at the community level. Educational institutions play a key role not only in imparting knowledge but also in encouraging practical adaptation activities, such as planting trees, conducting flood drills, and promoting sustainable water practices. Recognizing these initiatives can improve individual safety and enhance overall public health **(Darjee et al., 2023).**

Awareness of Preparatory school students about climate change is an important issue because if they understand climate change early, they can grow up to become responsible adults who care for the planet. Their actions now, like using less plastic or turning off lights when not in use, can help protect the environment and improve health in their communities. Many students have heard about climate change from the internet, school, or TV. But sometimes, they do not fully understand what it means. Some may think it's just about hot weather. Climate change can make people sick. For example, dirty air can cause asthma, and too much heat can lead to heat stroke. Floods can spread diseases. When students be aware about how climate change affects health, they understand why it's important to take care of the environment **(Hilal, 2023).**

Community health nurses play a pivotal role in enhancing adaptive capacity by educating preparatory school students about health risks associated with climate change and the corresponding protective measures. By incorporating climate adaptation into health promotion initiatives within schools, nurses can strengthen students' resilience and provide them with the necessary skills for making informed decisions. Additionally, fostering awareness of adaptation enables students to serve as conduits of information within their families and communities, disseminating essential health-protective behaviors ***(Mani et al., 2024).***

Significance of the study

Worldwide, between 2030 and 2050, climate change is expected to cause approximately 250.000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress alone. The direct damage costs to health are estimated to be 2-4 billion dollars per year by 2030 ***(Fadda, 2020).***

In Egypt, with its almost 100 million citizens, threats posed by extreme weather conditions are already a reality. In 2015, the Egyptian Ministry of Health and population registered more than 100 deaths due to extreme summer heat waves. In that same year, news reported that 11 citizens had lost their lives in the abnormal winter floods. Around 1.000 children are predicted to die annually from diarrhea related to infectious diseases from climate change by 2050. Between 2070 and 2100, floods are expected to affect 2.4 million Egyptian citizens ***(Sarhan, 2023).***

Climate change has adverse health effects on human health in Egypt, which will be aggravated by high population densities and presence of many factories especially in Helwan district. These may include increases severity of asthma, and infectious diseases, vector borne diseases, skin cancer, eye cataracts, and heat strokes, so infections and mortality rate are expected to be more frequent due to climate change ***(Omran et al.,2023).***So we need a study to asses students' awareness regarding climate change effects mitigation and adaptation .

Aim of the study:

This study aimed to asses preparatory school student awareness regarding climate change effects mitigation and adaptation it achieved through:

1-Assessing preparatory school students' knowledge regarding climate change effects mitigation and adaptation.
2- Determining preparatory school students' attitude toward climate change effects mitigation and adaptation.
3- Appraising preparatory school students' reported practices regarding climate change effects mitigation and adaptation.

Research questions:

1-What are preparatory school students' knowledge regarding climate change effects mitigation and adaptation?
2-What are preparatory school students' attitude toward climate change effects mitigation and adaptation?
3-What are preparatory school students' reported practices regarding climate change effects mitigation and adaptation?
4-Is there relation between preparatory school students' knowledge, attitude, reported practices and demographic characteristics regarding climate change effects mitigation and adaptation?

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Subjects and methods

The subject and methods used in carrying out the present study were presented under the following four main designs:

I. Technical item. II. Operational item.
III. Administrative item. IV. Statistical item.

I. Technical item:

The technical item for the study was included research design, setting of the study, sample and tools for data collection.

Research design:

A descriptive research design was utilized in this study.

Settings:

The study was conducted in 4 preparatory schools, El-Maasraa district Cairo Governorate, the first school was Huda-Sharawy EL-Tgribia it is Preparatory school in triangle shape with wide playground, consisted of 4 floors, involved 8 classes, 3 for grade one ,3 for grade two, 2 for grade three, each class of grade two contained about 60 students from boys and girls. The second school was EL-kholfa EL-Rasheeden preparatory school for boys only with square shape and wide playground ,consist of 4 floors ,7 classes for grade 1, 5 for grade two, 3 for grade three, each class of grade two contain about 60 students , The third school was EL-Shaheed Ahmed Hamdy preparatory school for female with triangle shape and wide playground and plenty of trees, consist of 4 floors contain 10 classes for grade one ,6 class for grade two , 3 class for grade three, each class of grade two contain about 60 students .and The fourth school was Khadiga bent khoild preparatory school for girls it consisted of 4 floors contained 8 classes .,3 for grade one,3 for grade two, 2 for grade three each classe of grade 2 contain about 60 students.

Sampling:

Type of the sample: Multi stage random sample was used to collect the sample of study .

First stage: Total number of preparatory schools in El-Maasara administration, Cairo Governorate was 16 school.

Second stage: Four school was selected randomly for the conduction of the study (Elkholfa EL-Rasheeden preparatory school, EL-Shaheed Ahmed Hamdy preparatory school, Huda Sharawy EL-Tagribia preparatory school, Khadiga Bent Khoild preparatory school for girls).

Third stage: One class was selected from grade 2 from each school randomly.

Forth stage: All students in the selected classes were taken. Total classes were 4 classes each class contain about 60 students .Total number were 240 students.

Tools for data collection:

The data was collected through using the following one tool:

An Interviewing questionnaire : Was used in this study, it was developed by the investigator after reviewing the national and international related literature to collect the required data. It wrote in simple Arabic language and refilled by students. It is divided into four parts.

Part I: Preparatory school students' demographic characteristics: Concerned with students' demographic characteristics it consisted of 6 questions related to age, sex, and place of residence, father and mother education, and ranking between sibling.

Part II: Studied preparatory school students' knowledge regarding climate change and its effects mitigation and adaptation as the following:

A) Assessing preparatory school students' general knowledge regarding climate change and its effects mitigation and adaptation It included 10 questions which include: Climate change meaning, human causes of climate change and natural causes of climate change, economic sector that cause climate change , risks related to climate change, most

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vulnerable groub to climate change ,impact of climate change on physical health ,impact of climate change on mental health, and environmental impact resulting from climate change.

B) Assessing preparatory school students' knowledge regarding climate change effects mitigation and adaptation it was 8 questions : included climate change mitigation goal ,barrier to protection from consequences of climate change , climate change mitigation strategies ,an individual need to do to mitigate climate change, climate change can be mitigated at the community level, climate change adaptation strategies, needs to adapt to climate change at the community level and actions that individuals can take to adapt to climate change .

Scoring system for knowledge items

Preparatory School Students' knowledge questions score where complete correct answer was scored 2 grades, incomplete correct was scored 1 grade and wrong or don't know was scored 0. Total score were ranged from 0-34 grades for 17 questions converted into percent score classified. **As the following:**

- Good knowledge (≥ 75%) = ≥ 25.5 grades.
- Average knowledge (50 - < 75%) = 17 - < 25.5 grades.
- Poor knowledge (< 50 %) = < 17 grades.

Part III: Studied preparatory school students' attitude toward climate change effects mitigation and adaptation which include:

Assessing preparatory school students' attitude toward climate change it was 7 questions included: think that should know about health care related to climate change, the media illustrates the problem of climate change, climate change can cause danger to human, climate change can affect physical health, climate change can cause mental problems, there are many solutions to climate change, climate change affect our daily life.

Assessing preparatory school students' attitude toward climate change effects mitigation and adaptation it was 12 questions included: climate change is reduced by increasing walking and cycling, climate change is reduced by using wind and solar energy, climate change is reduced by wasting food, climate change is reduced by using transportation and solar energy, climate change is reduced by reducing the use of fossil fuels, science and technology will help us adapt to climate change, must take climate change issues seriously and responsibly, behavior change can have a positive impact on climate change, providing adequate water and sanitation by collecting rainwater impact on climate change, planting more trees reduces climate change, saving electricity helps mitigate climate change and reducing the use of air conditioning in the summer helps reduce climate change.

Scoring system for attitude items:

Items of Preparatory School Students were 19 questions preparatory school students' attitude about climate change: scored as 2 points for agree, 1 point for neutral and zero point to disagree. The total score of preparatory school students ranged from 0-38 points for attitude about climate change effects mitigation and adaptation classified into:

- **Negative attitude < 60 % (< 22.8 points).**
- **Positive attitude ≥ 60 % (≥ 22.8 points).**

Part IV: Studied preparatory school students' reported practices regarding climate change effects mitigation and adaptation which include:

A) Assessing preparatory school students' reported practices regarding prevention of sun stroke , It include 5 questions included: Keep the body hydrated, drink water and fluids, make sure to wear light and loose clothing, avoid direct exposure to sunlight or extreme heat, and wear a hat and apply sunscreen.

B) Assessing preparatory school students' reported practices regarding protection from the risks of dust Storms it included 3 questions. as: Avoid leaving the house except in extreme cases, wear a mask and glasses to protect eyes when you need to go out, close all windows tightly when in the car and drive at a low speed

C) Assessing preparatory school students' reported practices regarding Protection from the risks of heavy rain it included 4 questions as: Use the emergency phone number in case of heavy rain, bring first aid and emergency supplies at home, avoid standing under tall trees and electricity poles and avoid riding horses and walking during heavy rain.

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Scoring system for reported practices items:

Each statement was assigned score according to preparatory school students' reported practices "Done" scored 1 and not done zero scored ". Total score were 12 grades for 12 items. The scores of items summed up and then converted into percentage score **as the following:**

- > 60 was considered adequate = > 7 grades.
- ≤ 60 was considered inadequate= ≤ 7 grades.

II. Operational item:

The operational item included preparation phases, content validity and reliability of the tools, pilot study and the field work.

A- The preparatory phase:

It included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals, and magazines to develop tools for data collection. In this phase the investigator statistically determined the number of the study sample and selected the suitable setting for this study.

B-Tool's Validity and Reliability.

Validity:

Content and face validity was conducted to determine whether the tool covers the aim. The tool was revised by a jury of 3 experts of Community Health Nursing, Faculty of Nursing, Helwan University who reviewed the tool for clarity, relevance, comprehensiveness and applicability. No modifications done but the expertise recommended rephrasing for some questions and items of the tool.

Reliability:

Reliability was tested statistically using the appropriate statistical tests to assure that the tools were reliable before data collection. Answers from the repeated testing were compared r- test Cronbach's Alpha reliability.as the following:

Tools	Alpha Cronbach
Knowledge items	0.82
Attitude items	0.858
Reported practices items	0.890

C-Pilot study:

After reviewing the tool by the experts, the investigator conducted a pilot study before administering the final questionnaire. The purpose of the pilot study was to ascertain the clarity, relevance, and applicability of the study tools and to determine obstacles that may be encountered during data collection. It also helped to estimate the time needed to fill out the questionnaire tools. The pilot study was carried out on 10% (24 students) of the sample size. Based on the result of the pilot study, rephrasing some questions was done to ensure clarity of the questions. So, pilot study were included in the main study sample.

D-Field work

- Data was collected within first semester of academic year 2024-2025 and the investigator was available two days per week (Tusday and Wednesday) from 9Am-2pm in the study setting till completion of the questionnaire, data was collected in 3 months from the beginning of October to the end of Decemper for data collection.

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- Before beginning of data collection from the study subjects the investigator met with the administrator of schools as a result acceptance of consent from AL- Maasra Educational Administration to determine the suitable time to collect the data and confirm the days and times.
- The study was carried out through an interviewing the students in the study settings. The time required for each student to fill the questionnaire was about 15-20 minutes, the investigator was filled 7-8 questionnaire within the day from student. The investigator checked completed of each filled sheet after the student completed it to ensure the absence of any missing data.

II. Administrative item:

Approval to carry out this study was obtained from the Dean of the Faculty of Nursing, Helwan University and directed to administrator of the selected schools at Elmaasara district.

Ethical Considerations:

An official permission to conduct the proposed study obtained from the Scientific Research Ethical Committee Faculty of Nursing, Helwan University. Participation in the study was voluntary and subjects were given complete full information about the study which included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of the information where it not be accessed by any other party without taking permission of the participants. Ethics, values, culture and beliefs were respected.

IV. Statistical item:

Upon completion of data collection, data was computed and analyzed using Statistical Package for the Social Science (SPSS), version 24 for analysis. The P value will be set at 0.05. Descriptive statistics tests as numbers, percentage, mean ± standard deviation (± SD), will be used to describe the results. Appropriate inferential statistics such as "F" test or "t" test will be used as well. Degrees of Significance of the results were:

- Non-Significant (NS) at $p > 0.05$.
- Statistically Significant (S) at $p < 0.05$.
- High statistically Significant (HS) at $p < 0.01$

Results:

Table (1): Shows that, the mean age of studied preparatory school students were 14.8± 0.27years. Also, 62.5 % of them were female and 62.1 % of fathers' educational level were university education or more. Moreover, 59.2 % of mothers' educational level were university education or more. Additionally, 75.8 % of them ranked third order between siblings.

Figure (1): Shows that, 56.7 % of the studied preparatory school students had poor total knowledge regarding climate change effects mitigation and adaptation. Also, 27.9 % of them had average total knowledge regarding climate change effects mitigation and adaptation. While, 15.4 % of them had good total knowledge regarding climate change effects mitigation and adaptation.

Figure (2): Illustrates that, 83.3 % of the studied preparatory school students had negative total attitude toward climate change effects mitigation and adaptation and 16.7 % of them had positive total attitude toward climate change effects mitigation and adaptation.

Figure (3): Illustrates that, 40.0 % of the studied preparatory school students had adequate level in total reported practices regarding climate change effects mitigation and adaptation. While 60.0 % of them had inadequate total reported practices regarding climate change effects mitigation and adaptation

Table (2): Cleared that, there were highly statistically significant relation between studied preparatory school students' total knowledge and all items of demographic characteristics, where (P = < .0001).

Table (3): Presented that, there were highly statistically significant relation between studied preparatory school students' total attitude and all items of demographic characteristics, where (P = < .0001).

Table (4): Shows that, there were highly statistically significant relation between studied preparatory school students' total reported practices and all items of demographic characteristics, where (P = < .0001)

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Table (5): Illustrates that, there were highly statistically significant positive correlation between total knowledge, total attitude and total reported practices.

Part (I): Demographic Characteristics of the Studied Preparatory School Students.

Table (1): Frequency Distribution of the Studied Preparatory School Students according to their Demographic Characteristics (n=240).

Demographic Characteristics	No.	%
Age (Years)		
13<14	40	16.7
14<15	188	**78.3**
≥ 15	12	5.0
Mean ± SD	**14.8 ± 0.27 years**	
Sex		
Male	90	37.5
Female	150	**62.5**
Father's educational level		
Read and write	8	3.3
Basic education	22	9.2
Secondary education	61	25.4
University education or more	149	**62.1**
Mother's educational level		
Read and write	14	5.8
Basic education	15	6.3
Secondary education	69	28.7
University education or more	142	**59.2**
Rank among siblings		
First	11	4.6
Second	47	19.6
Third	182	**75.8**

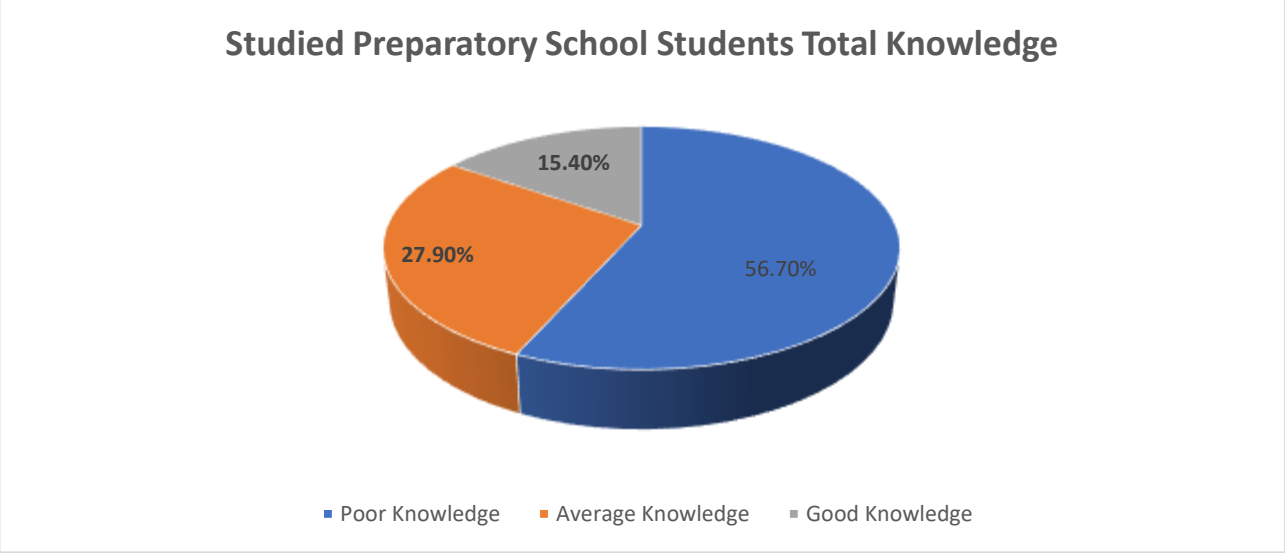

Figure (1): Percentage Distribution of the Studied Preparatory School Students' Total Knowledge regarding Climate Change Effects Mitigation and Adaptation (n= 240). Answered research question No.1

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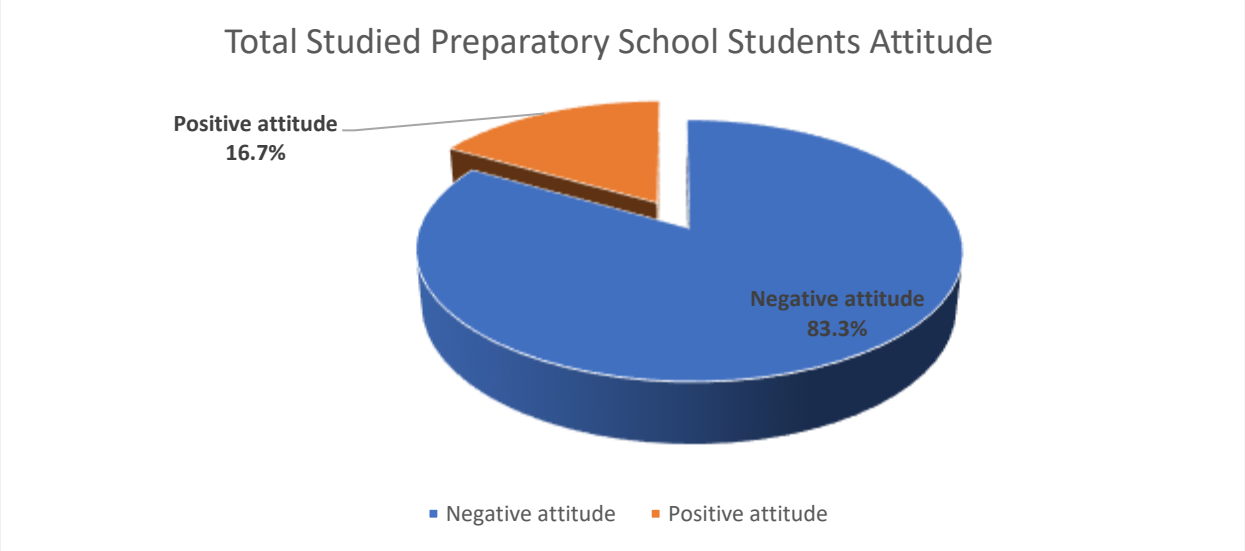

Figure (2): Percentage Distribution of Preparatory School Students' Total Attitude toward Climate Change Effects Mitigation and Adaptation (n=240). Answered Research Question No.2

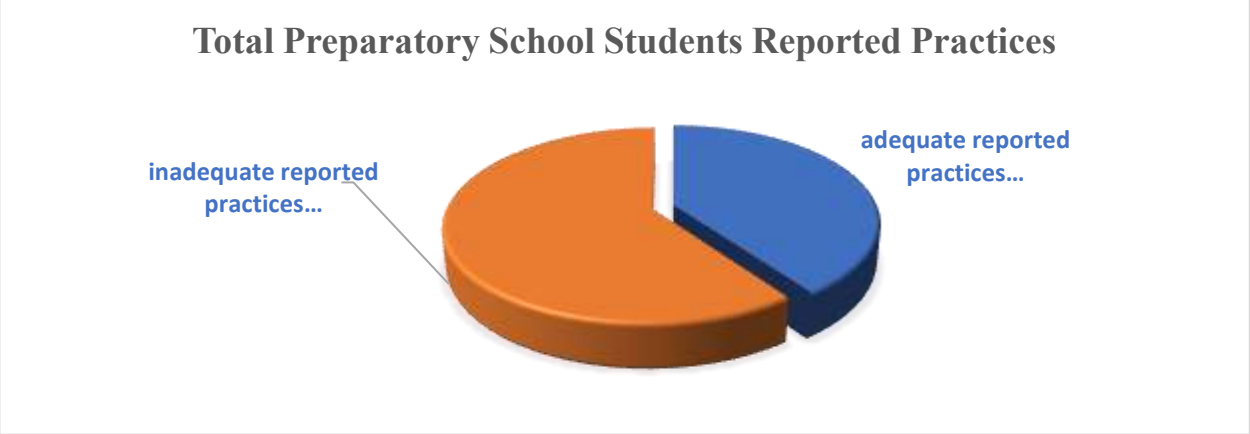

Figure (3): Percentage Distribution of the Studied Preparatory School Students' Total Reported Practices regarding Climate Change Effects Mitigation and Adaptation (n=240). Answered research question No.3

Table (2): Relation between Studied Preparatory School Students' Demographic Characteristics and their Total Knowledge (n=240).

Demographic characteristics	Total Knowledge						X^2	P – value
	Good n=(37)		Average n=(67)		Poor n=(136)			
	No.	%	No.	%	No.	%		
Age (year)								
13<14	20	54.1	13	19.4	7	5.1	9.258	0.000**
14<15	17	45.9	51	76.1	120	88.2		
≥ 15	0	0.0	3	4.5	9	6.7		
Sex								
Male	30	81.1	40	59.7	20	14.7	10.245	0.001**
Female	7	18.9	27	40.3	116	85.3		
Fathers' educational level								

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Read and write	1	2.7	1	1.5	6	4.4	11.241	0.005**
Basic education	6	16.2	12	17.9	4	1.7		
Secondary education	1	2.7	20	29.9	40	29.4		
University education or more	29	78.4	34	50.7	86	63.2		
Mothers' educational level								
Read and write	0	0.0	4	6.0	10	7.4	8.952	0.000**
Basic education	3	8.1	10	14.9	2	1.5		
Secondary education	25	67.6	30	44.8	9	6.6		
University education or more	9	24.3	23	34.3	115	84.5		
Rank among siblings								
First	0	0.0	6	9.0	5	3.7	12.241	0.001**
Second	20	54.1	27	40.3	0	0.0		
Third	17	45.9	34	50.7	131	96.3		
Place of residence								
Urban	27	73.0	37	55.2	112	82.4	10.254	0.005**
Rural	10	27.0	30	44.8	24	17.6		

****Highly statistically significant at p-value <0.001**

Table (3): Relation between Studied Preparatory School Students' Demographic Characteristics and their Total Attitude (n=240).

Demographic characteristics	Total Attitude				X^2	P – value
	Positive n= (40)		Negative n=(200)			
	No.	%	No.	%		
Age (years)						
13<14	20	50.0	20	10.0	9.872	0.000**
14<15	10	25.0	178	89.0		
≥ 15	10	25.0	2	1.0		
Sex						
Male	30	75.0	60	30.0	13.211	0.001**
Female	10	25.0	140	70.0		
Fathers' educational level						
Read and write	2	5.0	6	3.0	11.024	0.000**
Basic education	10	25.0	12	6.0		
Secondary education	18	45.0	43	21.5		
University education or more	10	25.0	139	69.5		
Mothers' educational level						
Read and write	4	10.0	10	5.0	12.654	0.005**
Basic education	8	20.0	7	3.5		
Secondary education	20	50.0	49	24.5		
University education or more	8	20.0	134	72.0		
Rank among siblings						
First	5	12.5	6	3.0	10.457	0.000**
Second	20	50.0	27	13.5		
Third	15	17.5	167	83.5		

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Place of residence						
Urban	18	45.0	158	79.0	15.241	0.000**
Rural	22	55.0	42	21.0		

****Highly statistically significant at p-value <0.001**

Table (4): Relation between Studied Preparatory School Students' Demographic Characteristics and their Total Reported Practices (n=240).

Demographic characteristics	Total reported practices				X^2	P – value
	Adequate n=(96)		In adequate n= (144)			
	No.	%	No.	%		
Age (year)						
13<14	10	10.4	30	20.8	12.002	0.000**
14<15	75	78.1	113	78.5		
≥ 15	11	11.5	1	0.7		
Sex						
Male	50	52.1	40	27.8	9.554	0.001**
Female	46	47.9	104	72.2		
Fathers' educational level						
Read and write	0	0.0	8	5.6	10.231	0.001**
Basic education	10	10.0	12	9.4		
Secondary education	40	40.0	21	15.6		
University education or more	49	50.0	100	69.4		
Mothers' educational level						
Read and write	4	4.2	10	6.9	10.336	0.005**
Basic education	5	5.2	10	6.9		
Secondary education	50	52.1	19	13.3		
University education or more	37	38.5	105	72.9		
Rank among siblings						
First	5	5.2	6	4.2	8.636	0.000**
Second	30	31.3	17	11.8		
Third	61	63.5	121	84.0		
Place of residence						
Urban	56	58.4	120	83.3	11.220	0.000**
Rural	40	41.6	24	16.7		

****Highly statistically significant at p-value <0.001**

Table (5): Correlation between Studied Preparatory School Students' Total Knowledge, Total Reported practices and Total Attitude (n= 240).

Variables	Total Knowledge		Total reported practices	
	r	p-value	r	p-value
Total Knowledge	------	----	0.154	0.861
Total Attitude	0.712	0.000**	0.661	0.001**

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Discussion:

Climate change poses significant threats to ecosystems, economies, and communities worldwide, prompting urgent action through both mitigation and adaptation strategies. Mitigation involves reduce or prevent the emission of greenhouse gases, such as transitioning to renewable energy sources, improving energy efficiency, and promoting sustainable land use practices. These actions aim to limit the extent of climate change by addressing its root causes. On the other hand, adaptation refers to adjusting systems, behaviors, and infrastructure to minimize the negative impacts of climate change. This includes building resilient infrastructure, developing early warning systems, and modifying agricultural practices to cope with changing weather patterns ***(Tiitta et al., 2024).***

Part I: Demographic characteristics of the studied nurse's:

Regarding to demographic characteristics of the studied preparatory school students. The present study findings related that mean age of the studied preparatory school students were 14.8 ± 0.27 years **(Table 1)**. This result is similar to a study conducted by **Abdallah et al., (2024)** who conducted a study in Egypt (n=100) about "Bridging the Climate Education Gap: Assessing Teachers' Knowledge, Attitude, and Practice in Preparatory Schools". They found that, the mean age of the sample were 14.4 ± 1.1 years

Concerning the studied preparatory school students' gender, the current study result revealed that, less than two thirds of the studied preparatory school students were female. This result disagrees with **Abdelwahed et al., (2024)** who carried out a study conducted in Egypt (n=100) about " The Effect of Using Simulation Strategy on Preparatory School Students' Earthquakes Preparedness ", they found that, 81.5 % of the studied preparatory school students were male.

Regarding the studied preparatory school student's father's education level, the current study revealed that, less than two thirds of studied preparatory school students' father's education level were university education or more. This finding was in accordance with **BinTaleb, (2024)** who conducted a study in Saudi Arabia (n=165) about "Climate Change Issues in Saudi Elementary Schools: An Analysis and Suggestions for Islamic Studies Textbooks" they clarified that, 63.6 % of studied sample their father's education level were university education or more.

Concerning the studied preparatory school student's mother's education level, the current study revealed that, more than half of studied preparatory school students' mother's education level were university education or more. This finding was disagreed with **Ali et al., (2024)** who conducted a study in Egypt (n=130) about "Effect of Awareness Program regarding Climate Changes and Sustainability Development on Nursing Internship Students' Knowledge" they clarified that, 43.1% of studied samples mother's education level were university education or more.

Part II: Studied preparatory school students' knowledge regarding climate change effects mitigation and adaptation.

Answered research question number Q1: What are preparatory school students' knowledge regarding climate change effects mitigation and adaptation?

Regarding studied preparatory school students' total knowledge, the current study revealed that, more than half of preparatory school students had poor knowledge, more than quarter had average knowledge and more than tenth of them had good knowledge **(Figure 1),** this result disagrees with **Nepraš et al., (2022)** who conducted a study in Malysia (n=200) about "Climate change education in primary and lower secondary education: Systematic review results", they found that, 60.0 % of the studied sample had good total knowledge. Also, 35.0 % had poor knowledge and 5.0 % of them had average knowledge. On the other hand, this result agrees with ***Gebeyehu et al., (2024)*** who conducted a study in Malaysia (n=200) about "Energy-, Environmental-, and Climate Change Literacy among Primary and Middle School Students", they clarified that,15.0 % of the studied sample had good total knowledge. Also, 59.0 % had poor knowledge and 26.0 % of them had average knowledge.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Practice
Vol. 4, Issue 11, Month: September 2025, Available at: https://hijnrp.journals.ekb.eg/

From the investigators point of view, many preparatory school curricula do not prioritize or comprehensively cover climate change topics, leading to superficial knowledge regarding climate changes.

Part III: Studied Preparatory School Students' Attitude toward Climate Change Effects Mitigation and Adaptation.

Answered Research Question number Q2: What are preparatory school students' attitude toward climate change effects mitigation and adaptation?

Regarding studied preparatory school students' total attitude toward climate change effects mitigation and adaptation, the current study revealed that, majority had negative total attitude, while nearly fifth of them had positive total attitude toward climate change effects mitigation and adaptation **(Figure 2)**, this result agrees with **Ccami-Bernal et al., (2024)** who conducted a study in Madrid (n=170) about "Health science students' preparedness for climate change: a scoping review on knowledge, attitudes, and practices", they found that, 81.9 % of the studied preparatory school students had negative total attitude toward climate change effects mitigation and adaptation and 18.1 % of them had positive total attitude toward climate change effects mitigation and adaptation .

From the investigator point of view, students with good knowledge of climate change are less likely to develop positive attitude toward mitigation and adaptation strategies, as they may not see their relevance or effectiveness. Climate change may seem like a distant or abstract issue to students, especially if they haven't personally experienced its effects, reducing their motivation to care or take it seriously.

Part IV: Studied Preparatory School Students' Reported Practices regarding Climate Change Effects Mitigation and Adaptation:

Answered research question number Q3: What are preparatory school students' reported practices regarding climate change effects mitigation and adaptation?

Regarding studied preparatory school students' total reported practices regarding climate change effects mitigation and adaptation, the current study revealed that, two fifths of them had adequate level in total reported practices, while three fifths of them had inadequate total reported practices**(Figure 3)**, this result agrees with **Mohamed & Ali, (2024)** who conducted a study in Egypt (n=180) about "Effectiveness of a Pop-Up Story-Based Program for Developing Environmental Awareness and Sustainability Concepts among First-Grade Elementary Students", they found that, 40.1 % of the studied sample had satisfactory level in total reported practices. Also, 59.9 % had unsatisfactory total reported practices.

From the investigator point of view, attitude is often learned through observation, and if environmental habits are not reinforced at home or in school, students may not practice them consistently

Part (V): Relation and Correlation between the Studied Variables:

Answered research question No (4): Is there relation between preparatory school students' knowledge, attitude, reported practices and demographic characteristics regarding climate change effects mitigation and adaptation?

Regarding to relation between studied preparatory school students' demographic characteristics and their total knowledge, the current study revealed highly statistically significant relation between studied preparatory school students' total knowledge and all items of demographic characteristics **(Table 2)**. This result agrees with the study done by **El-Aasar et --al., (2024)** who conducted a study in Egypt (n=210) about "Outdoor learning environment as a teaching tool for integrating education for sustainable development in kindergarten, Egypt", they found that, a statistically significant relation between studied samples' age, level of education and occupation, and their total knowledge scores.

Concerning to relation between studied preparatory school students' demographic characteristics and their total attitude, the current study revealed highly statistically significant relation between studied preparatory school students' total attitude and all items of demographic characteristics **(Table 3)**. This result agrees with the study done by **Al-Sayyari et al., (2025)** who

ISSN 2786-0183
Helwan International Journal for Nursing Research and Practice
Vol. 4, Issue 11, Month: September 2025, Available at: https://hijnrp.journals.ekb.eg/

conducted a study in Saudi Arabia (n=145) about "Assessing beliefs and preparedness for disasters among high school female students in Riyadh, Saudi Arabia", they found that, a statistically significant relation between studied samples' statistically significant relation between studied preparatory school students' total attitude and all items of demographic characteristics.

Regarding to relation between studied preparatory school students' demographic characteristics and their total reported practices, the current study revealed highly statistically significant relation between studied preparatory school students' total reported practices and all items of demographic characteristics **(Table 4)**. This result agrees with the study done by **Jabin et al., (2025)** who conducted a study in Pakistan (n=240) about "Analysis of environmental knowledge, attitude and behavior of school students in District Multan, Pakistan", they found that, a statistically significant relation between studied samples' statistically significant relation between studied preparatory school students' total reported practices and all items of demographic characteristics.

The current study revealed there were positive correlation between total knowledge, total attitude and total reported practices **(Table 5)**. This result agrees with the study done by **Sharrad et al., (2025)** who conducted a study in Iraq (n=160) about "Annual effective dose due to ingestion and inhalation of radon in tap-water from some preparatory schools, Samawa City, Iraq", they found that, there were positive correlation between total knowledge, total attitude and total reported practices.

Conclusion

Based on finding of the present study, it can be concluded that: More than half of the studied preparatory school students had poor total knowledge regarding climate change effects mitigation and adaptation, and majority of the studied preparatory school students had negative total attitude toward climate change effects mitigation and adaptation. While two fifths of the studied preparatory school students had adequate total reported practices regarding climate change effects mitigation and adaptation. There were highly statistically significant positive correlation between total knowledge, total attitude and total reported practices among preparatory school student's regarding climate change effects mitigation and adaptation.

Recommendations:

In the light of the results of this study, the following recommendations were suggested:

- Educational seminar, conference and work shop should be organized especially in preparatory school students' to increase their awareness level
- Dissemination of healthy educational guidelines about climate change mitigation and adaptation among preparatory school students.
- Provide health education and media at preparatory school to promote student knowledge, attitude, and practices regarding the effects of climate change and its mitigation and adaptation.

Further researches

- Ongoing researches were required for enhancing preparatory school students' awareness regarding climate change mitigation and adaptation on different sittings.

ISSN 2786-0183
Helwan International Journal for Nursing Research and Practice
Vol. 4, Issue 11, Month: September 2025, Available at: https://hijnrp.journals.ekb.eg/

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