Bridging the Climate Education Gap: Assessing Teachers' Knowledge, Attitude, and Practice in Preparatory Schools

Lamiaa Saad Abdallah[1], Basma Mohamed Osman[2], Ebtesam Ali Mohamed[3]
[1, 2] Community Health Nursing, Faculty of Nursing, Cairo University, Egypt
[3] Community Health Nursing, Faculty of Nursing, Banisuef University, Egypt
[1] Community Health Nursing, Faculty of Nursing, British university, Egypt

Abstract

Background: Climate Change and Sustainability Education (CCSE) has gained prominence due to the imminent climate emergency humanity is facing. **The aim:** The study aims to evaluate teachers' knowledge, attitudes, and practices regarding climate change. **Methods:** The study utilized descriptive (Cross-sectional) research design to achieve its aim. **Sample:** Convenient samples of 100 teachers were recruited. **Setting:** The study was conducted at four preparatory schools in Bani-Suef City, Egypt. **Tools:** The data collection tools included structured interview questionnaire for the teachers' knowledge about climate change, teacher attitude scale towards climate change, and teachers' climate change-related reported practices. **Results:** The current study finding depicts that around half of teachers had a moderate level of knowledge, and the minority had a high level of total knowledge scores. More than half of teachers had a fair attitude, and more than one third had a poor attitude toward change mitigation. Around half of teachers had poor practice, two fifth had fair practice, and the minority had a high total practice score. **Conclusion:** While teachers have a moderate level of knowledge about climate change, their attitudes and practices toward climate change mitigation require significant improvement. **Recommendations:** The findings of this study emphasized the importance of offering additional climate change education programs for teachers, particularly focusing on enhancing their knowledge, attitudes, and practices in this regard.

***Keywords**: Climate Change, Knowledge, Attitude, Practice, Teachers.*

Introduction

Climate change is a humanistic crisis affecting millions of people worldwide **(Ferrari & Mart, 2022)**. The impacts of climate change on health can be due to the direct effects of exposure to weather events, such as heat stress, floods, droughts, and storms, with subsequent increases in respiratory and cardiovascular morbidity and mortality (**Mohiuddin, 2023**).

Egypt faces significant climate change risks, which are increasingly recognized. These climatic risks pose a substantial threat to today's younger generations in the country (**UNICEF/Egypt, 2022**). As part of its 2030 Vision and sustainable development strategy, Egypt has pledged to incorporate climate change considerations into national development policies and progressively adopt environmentally friendly budgeting across various sectors **(Egyptian Ministry of Environment, 2022)**.

Studies have shown that one of the main barriers to climate action is a lack of knowledge about the causes, consequences, and potential solutions of climate change; a distrust of information sources; and expectations that governments and industry must take the initiative to make changes in the first instance **(Chowdhury et al., 2021).**

Recent research in diverse settings has uncovered a significant proportion of students who are not receiving sufficient and accurate education on climate change **(Corrochano et al., 2022).** Teachers play a pivotal role in the discourse on environmental education. They are tasked with shaping the minds of future leaders over an extended period of time. It is important to note that if teachers themselves harbor misconceptions, they are more likely to transmit

these inaccuracies to their students **(Winter et al., 2022).**

It has been reported that students basically trust their teachers' knowledge and authority on the topics they teach. Therefore, the systematic instruction provided by teachers in schools about climate change is important for the construction of young people's knowledge and beliefs in this field **(Pierce, 2019).**

Many studies have revealed that teachers are currently not able to teach climate change-related content because they lack confidence or content knowledge, believe it is too controversial, or do not possess a strong understanding of how to address socio-scientific issues by teaching students the nature of science (**Tserej et al, 2024**). Furthermore, the studies conducted to assess trainee teachers' knowledge of climate change demonstrated that future classroom teachers themselves hold the same erroneous understandings as secondary school students **(Pierce, 2019).** Research shows that teachers' perceptions about climate change vary based on their educational institution type (private or public) and their exposure to extreme weather events **(Nadimul, Ahmed & Ahmed, 2022).**

Several studies indicate that teachers are influenced by their beliefs in both the content they teach and the pedagogy they adopt **(Gal, 2022; Igu et al., 2023)**. When teachers see environmental destruction as a simple phenomenon, their approach to teaching about it becomes less reliant on scientific ideas. Over time, this shapes students' perceptions because they see the topic as a matter of memorizing concepts and not as a contextual problem that may threaten their future lives **(Filho et al., 2023).**

Significance of the study

Understanding teachers' knowledge and practices is essential for implementing effective educational policies. Most teachers in Egypt have heard about climate change and understand its basic concepts, particularly regarding temperature rises and rainfall fluctuations. This awareness helps in developing targeted training programs and curriculum modifications **(Abdelfattah et al., 2023).**

Egypt's National Climate Change Strategy 2050 emphasizes the importance of integrating climate issues into the educational process. Understanding teachers' current knowledge levels helps identify gaps and design appropriate capacity-building programs **(Ministry of Environment & Arab Republic of Egypt, 2022).**

Teachers who understand the impact of climate change are better positioned to promote environmental stewardship among students. Their knowledge and practices influence how future generations will approach climate challenges. Therefore, this study aimed to evaluate teachers' knowledge, attitudes, and practices concerning climate change to determine the extent to which they regard it as a critical matter and propose a guideline based on their knowledge, attitude, and practice. Furthermore, the findings of this study could facilitate modifications in existing educational policies and the climate change curriculum.

Aim of the study

Evaluate teachers' knowledge, attitudes, and practices regarding climate change.

Research questions

Q1. What is the knowledge that teachers possess regarding climate change?

Q2. What is the practice of teachers regarding climate change?

Q2. What are teachers' personal attitudes toward climate change?

Subject and methods.

Study design:

The descriptive (Cross-sectional) research design was utilized to achieve the aim of the study.

Study Setting and Sample:

The study was conducted at four preparatory schools located in Beni Suef City. These included two girls' schools, and two boys' schools. A multistage stratified random sampling technique was employed to select these schools. Initially, Beni-Suef city was identified as having a total of 15 preparatory schools, comprising seven girls' schools and eight boys' schools. Subsequently, two schools were randomly selected from each category. The final selection consisted of the following four schools: Om El-Momineen girls' school, El-Salam girls' school, Mohamed Anwar Al-Sadat boys' school, and El-Shab boys' school.

- **The study included** a convenient sample of all teachers (100) at the previously selected schools.

Tools for data collection:

The tools of data collection were developed by the researchers after reviewing relevant national and international literature (UNICEF 2022; Seroussi et al. 2019; Karami et al. 2017).

1- **Structured interview questionnaire for teachers' knowledge regarding climate change.**

It consisted of two sections: The first section; Demographic characteristics of teachers, contains seven questions related to age, education, years of teaching experience, and extra teaching courses. The second section; Teachers' knowledge regarding climate change, includes 10 questions about meaning, risky groups, causes, aggravating factors, solutions to climate change problems, and the last question about the source of information. The first 4 questions were designed to be answered by "yes, no," or "don't know, and Questions 5, 6, 7, and 10 were designed in multiple choice question form. Lastly, questions number 8-9 was ranking form.

The scoring system is: The score of the first four questions ranged from two to zero (yes = 2, no = 1, don't know = 0). Total knowledge scores ranged from 0 to 40. Total knowledge scores equal 40. Divided into 3 levels, low knowledge ranged from 0 to less than 20 (50%), fair knowledge ranged from 20 to less than 30 (50% <75%), and high knowledge ranged from 30 to 40 (≥75%).

2- **The teachers' attitude toward climate change**: This tool consisted of 20 statements on a 5-point Likert scale ranging from strongly agree to strongly disagree. It was divided into two parts, as follows: The first part includes the first 10 statements regarding the personal concern of the origin, nature, and future concerning climate change and readiness to make real changes in their way of life to slow climate change in their school and community. The second part includes the remaining 10 questions measuring the importance of climate change education as perceived by teachers, readiness to make specific efforts to teach about climate change and readiness to influence students.

Scoring system: The responses were distributed on a five-point Likert scale, ranging from strongly agree to strongly disagree. The scoring system was as follows: Strongly agree = 5, agree = 4, neutral = 3, disagree = 2, and strongly disagree = 1. Total attitude scores equal 100. Divided into 3 levels, poor attitude ranged from 0 to less than 50 (<50%), fair attitude ranged from 50 to less than 75 (50% <75%) and high attitude (from 75 to 100) (≥75%).

3- **Teachers' climate change-related reported practices:** This tool consists of 20 climate change action statements divided into two parts, as follows: The first set of statements includes 16 statements related to the activities done by the teachers themselves to protect the environment and decrease the potential effects of climate change. The next set of questions contains four statements referring to their activities regarding climate change

education at school and the activities that are undertaken to raise the students' awareness regarding climate change.

Scoring system: Responses were designed to be on a Likert scale to measure the frequency of action. Regularly (almost every day) = 5, Often (a few times a week) = 4, Sometimes (two to three times a month) = 3, Rarely (once a month, a few times a year) = 2, and I don't practice it at all = 1. The total self-reported practice scores equal 100. Divided into 3 levels, poor practice ranged from 0 to less than 50 (<50%), fair practice ranged from 50 to less than 75 (50% <75%), and high attitude ranged from 75 to 100 (≥75%).

Tools validity and reliability

Tools of data collection had been developed in English and translated into Arabic; Three professors of community health nursing made up the panel of experts who established the content and face validity. We asked each expert on the panel to evaluate the item's relevance to objectives and determine whether the tool's items accurately represented the domain of interest. Also, examine the tool for content, clarity, wording, and format. The necessary modifications were carried out.

Tool's reliability: Cronbach's Alpha was used to determine internal consistency of the developed tools which was (0.784 for Teachers' Knowledge regarding Climate Change questionnaire, 0.970 for the teachers' attitude toward climate change and 0.79 for Teachers' climate change-related practices).

Ethical Consideration

Ethical approval was granted from the Ethical Research Committee at the Faculty of Nursing at Cairo University to undergo the current study of primary schools in the Cairo governorate. We obtained official permission from the central agency responsible for public mobilization and statistics. Written permission was obtained first from the district education officer and then from individual school principals. We obtained informed consent from participating teachers. The ethical considerations included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, and ensuring the and ensuring the confidentiality of the information through data coding, where it will not be accessed by any other party without the permission of the participants.

Pilot study: The pilot study was conducted to assess the feasibility, clarity, and objectivity of the tools and to determine how long it would take to answer questions using the tools. The pilot study determined the feasibility of the tools and estimated the time required to answer questions to be 15 to 20 minutes. This sample was included in the total study sample.

Procedure: The final tools were self-administered, which gave the teachers a chance to complete the survey in their own free time during the day. The school deputy held multiple meetings and handed the survey directly to the teachers. Before beginning the survey, the school deputy asked the teachers to read and sign the consent form. The researcher's point of contact in the school assisted in collecting the data from the teachers. Depending on the necessary explanation, teachers spent between 15 and 20 minutes filling out the tools. We collected the data from October to December 2023. The researchers met with the teachers in the selected schools for two days per week, from 9 a.m. to 1 p.m. during the school day, until they completed the sheets.

Statistical analysis

The study collected data, scored it, tabulated it, and analyzed using SPSS. Descriptive analysis was performed, calculating categorical factors like teacher age, educational attainment, and climate change knowledge. Continuous factors like age and years of experience were calculated. The outcome variable was understanding climate change. The Pearson Chi-square test was used to compare data with a 95% confidence interval.

Results:

Regarding the teachers' demographic characteristics, **Table (1)** shows that, regarding the teacher age, 45% of the teachers aged between 36 and 45 and 4% aged between 46 and 55 years. With a mean age of 30.5 and SD of 8.9. As regards teachers' education, 87% of teachers have a bachelor's degree, and 6% have a teaching diploma. Regarding the number of teaching years, 40% of teachers have worked for two to less than five years, while 4% have worked for 20 years or more.

Regarding the human causes of climate change, **Figure (1)** shows that, the majority of teachers identified industrial activities as the primary cause (73%), followed by transportation (64%), improper waste management (59%), and deforestation (54%). Conversely, building activities and energy production were the least frequently mentioned causes, with only 9% of teachers mentioning them.

Figure (2) shows that, digit transformation and use of technology were ranked as having the greatest impact on climate change mitigation with a mean (SD) of 4.51 (2.58), followed by limiting air flights with a mean (SD) of 4.73 (2.49) while rationale consumption of natural resources was ranked as having the lowest impact on climate change mitigation with a mean (SD) of 2.83 (2.13).

Figure (3) reveals that, a low percentage of teachers (6%, 11%, and 17%) strongly agree that there is no need to address climate change in educational curriculum, that schools are the best place to raise children's environmental awareness, and that it is normal for the climate to change. Forty percent of teachers strongly agree with climate change.

Regarding the practices related to human activity that contribute to and have either positive or negative impacts on the environment in general, **Table (2)** reflects that, 37 percent of teachers wake regularly, while 6% sleepily. 41% of teachers never ride a bicycle to work, and 10% regularly do that. The same table also conveyed that 38% of teachers answered that they mostly use public transport at all, and 6% answered that they rarely use it. The most commonly practiced activities are using energy-saving light bulbs, as practiced regularly by 47% of teachers and 8 % of students. 41% of teachers pay attention to water consumption, whereas only 8% do. Forty-four percent of teachers never grow vegetables or fruits for their own needs, and 10% sometimes practice it.

As regards total knowledge, attitude, and practice, the results of the current study in **Figure (4)** show that 46% of teachers had a moderate level of knowledge, 22% of teachers had low knowledge, and 12% had a high level of total knowledge scores. The same figure also shows that 54% of teachers had a fair attitude, 38% of teachers had a poor attitude, and 8% had a high attitude toward climate change mitigation. Regarding total practice scores, 48% of teachers had a poor level of practice, 43% of teachers had a fair level of practice knowledge, and 9% had a high level of total practice scores.

Table (3) revealed that, there's a highly significant statistical relationship between the teacher's total knowledge scores and total attitude scores. A significant relationship was detected between the total attitude scores and the total practice scores. There is no significant correlation between total knowledge and total practice scores.

Table (1): Distribution of teachers regarding their personal characteristics (N=100)

Personal character	No.	%
Age		
16-≤ 25	14	14.0
26-35	36	36.0
36-45	45	45.0
46-55	4	4.0
Mean (SD)	30 (8.9)	
Education		
Teacher diploma	6	6.0
Bachelor's degree	87	87.0
Postgraduate	7	7.0
Previous Job before teaching		
Employee	5	5.0
None	95	95.0
Number of teaching years		
1<2 year	22	22
2<5 years	40	40
6<10 years	22	22
10<20 years	8	8
≤20 years	4	4

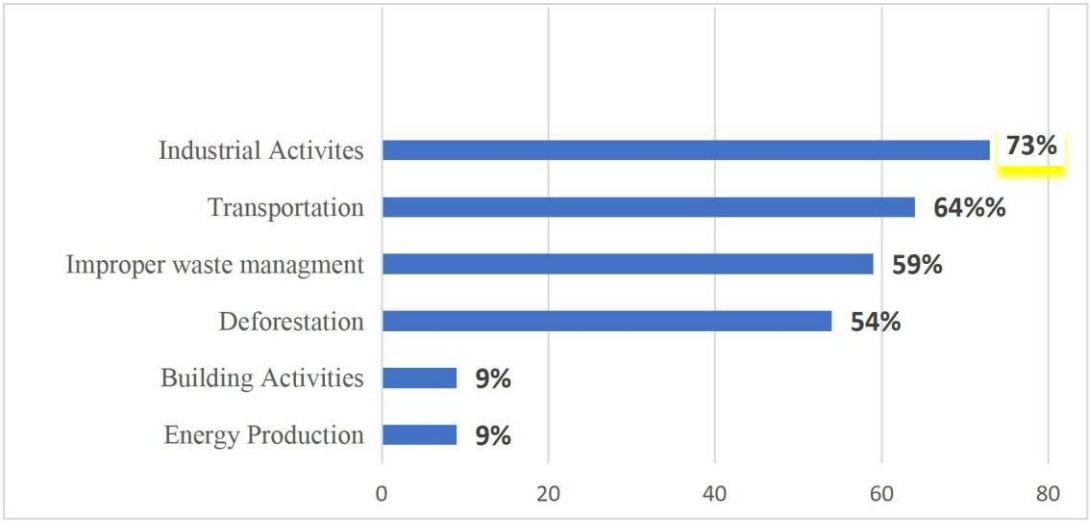

Figure (1): distribution of teachers regarding their knowledge on the human causes of climate change (N=100).

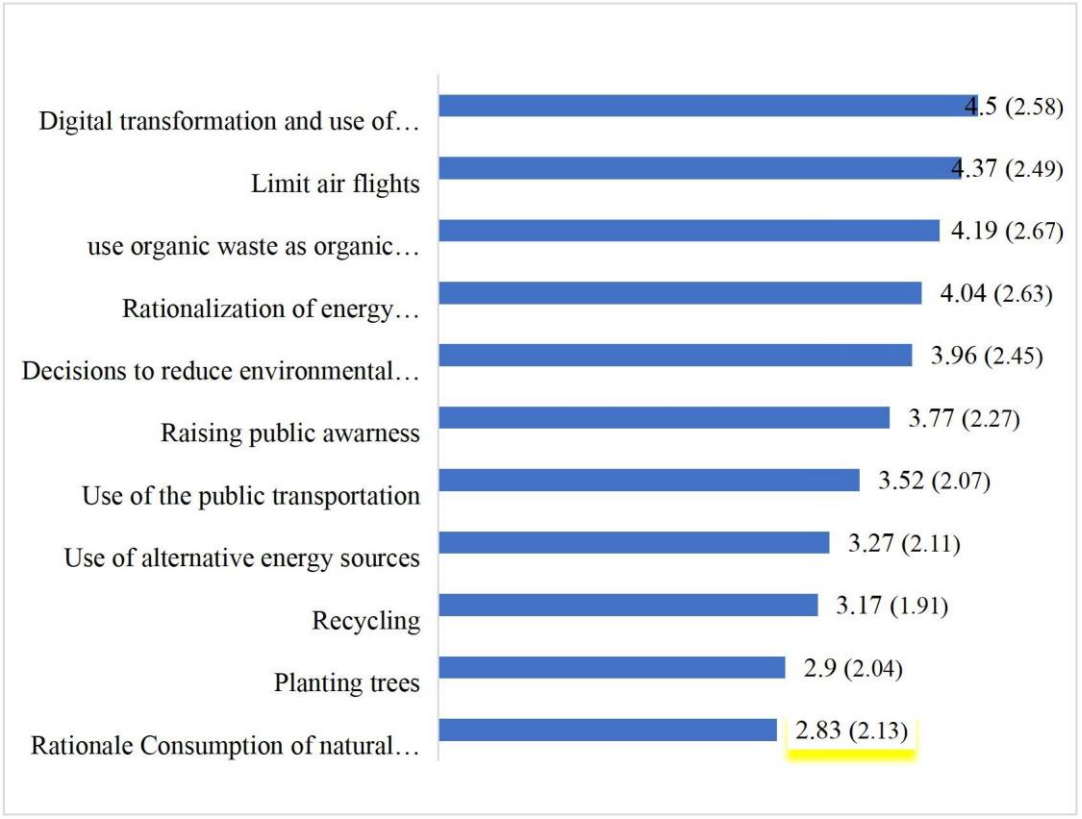

Figure (2): The means and standard deviations of teachers' ranking of the effect of climate change mitigation activities. *(N=100).*

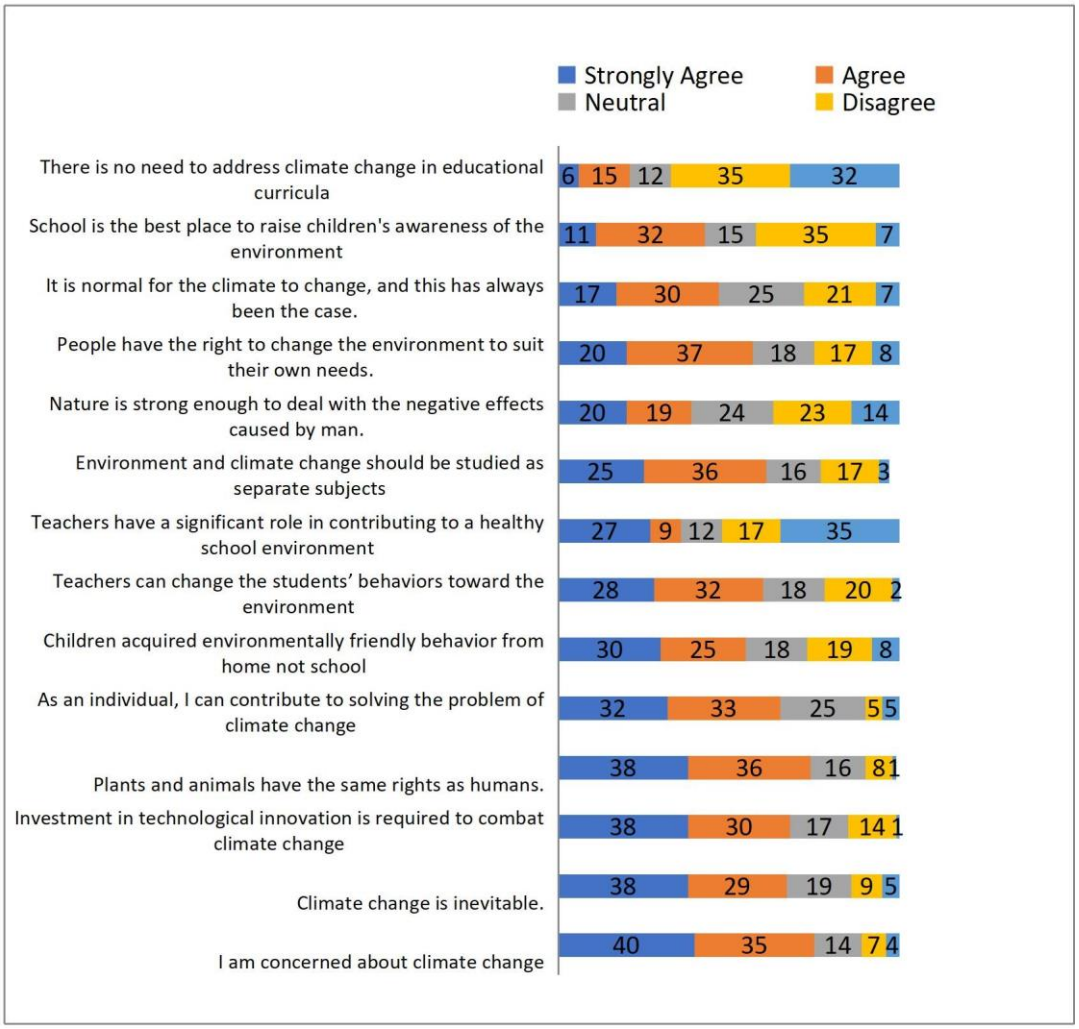

Figure (3): Distribution of teachers regarding their attitude regarding climate change (N=100).)

Table (2): Distribution of teachers regarding their practices of climate change mitigation and education (N=100)

Items	Regularly	Mostly	Some-times	Rarely	Never
	No. %	No. %	No. %	No. %	No. %
Practices of climate change mitigation					
Waking	37	35	15	6	7
Riding a bicycle to go to work	10	11	13	19	47
Using public transportation	34	38	12	6	10
Take care of energy efficiency and electricity consumption.	35	20	22	9	14
Use energy-saving saving light bulbs	47	17	13	8	15
Sorting out the waste	26	18	14	6	36
Collect garbage from public areas	12	12	10	15	51
paying attention to water consumption	41	24	17	8	10
Growing fruits/vegetables for my own needs	14	13	10	19	44
Recycle wastes	12	20	27	29	12
Eat organic food	9	20	17	31	23
Use perfumes and cosmetics	30	33	16	9	11
Remove rubbish from public places	20	15	21	19	25
Avoiding the use of plastic for life purposes	13	18	19	24	26
Talk about the environment with my family and friends	19	27	14	18	22
Practices regarding climate change education					
Encourage students to participate in environmental activities	28	20	27	9	15
Voluntarily looking for information new about climate change	18	29	28	4	20
I discuss information about the environment in class whenever possible	15	22	29	17	16
Participate in the preparation of competitions and activities related to the environment	14	22	19	20	24

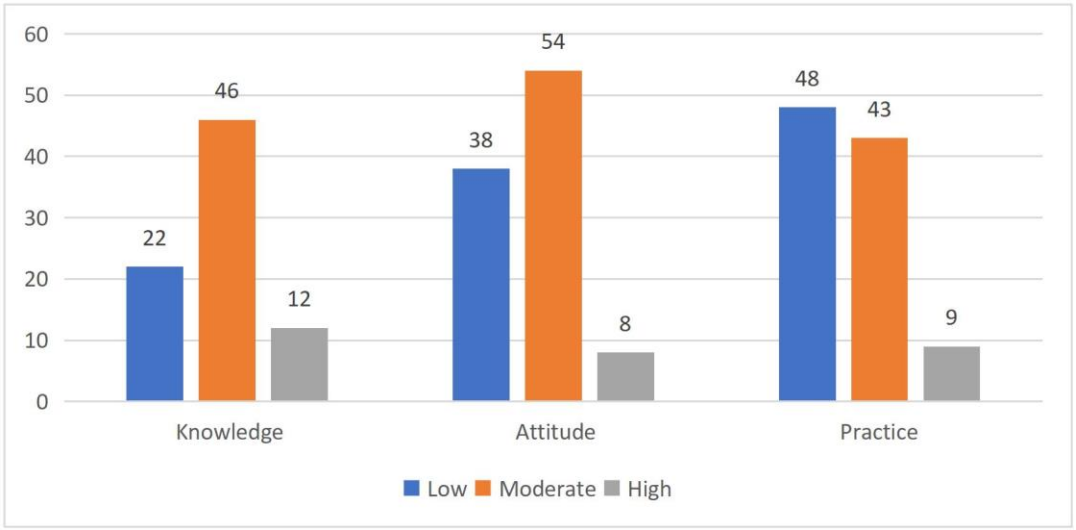

Figure (4): Distribution of teachers regarding their total knowledge, attitude & practice scores related to climate change mitigation. (N=100).

Table (3): Correlation between teachers' total scores of knowledge, practice, and attitude

Variables	**knowledge**		**Practice**		**Attitude**	
	r	**p**	**r**	**p**	**R**	**p**
Knowledge	1		0.05	0.6	0.46	0.0001*
Practice	0.05	0.6	1		0.37	0.0001*
Attitude	0.46	0.0001*	0.37	0.0001*	1	

*Significant at p-value<0.05

Discussion:

Regarding teachers' demographic characteristics, the current study revealed that more than one fifth of teachers have from two to less than five years of teaching experience. This finding was in accordance with **Natalia et al., (2023)** who investigated teachers' perception of climate health awareness regarding low carbon ecofriendly practices and found that one fifth of the participants have experience from 3-6 years.

In terms of teachers' understanding of the human-induced causes of climate change, the present study reveals that the majority of teachers identified industrial activities as a primary contributor. The fact that manufacturing and industrial processes often involve the combustion of fossil fuels, leading to emissions that contribute to climate change, could explain this perception. These processes are integral to the production of various goods, including cement, iron, steel, electronics, plastics, and clothing.

This finding aligns with the research conducted by **Igu et al., (2023)** who examined the influence of teachers' beliefs about climate change on their classroom management practices for fostering students' awareness of climate change in Nigeria. Their study found that a significant majority of teachers from both public and private institutions acknowledged the role of human industrial activities in driving climate change. Similarly, the study by **Seroussi et al., (2019)** reported that a substantial majority of teachers (70%) concurred that climate change is primarily caused by human industrial activities. Collectively, these studies underscore the consensus among educators regarding the anthropogenic origins of climate change.

Regarding the effect of climate change mitigation activities, the current study illustrated that digit transformation and use of technology were ranked as having the greatest impact on climate change mitigation, with a mean (SD) of 44.51 (2.58). This may be due to the fact that digital transformation can improve energy consumption and reduce carbon emissions.

This result is in agreement with an Australian study of pre-service teachers' knowledge of climate change and attitude toward environmental education done by **Boon (2016),** who reported that the development of greener technologies is considered a crucial activity to mitigate the effects of climate change. Similarly, in a study that assessed the knowledge, attitudes, and practices of lower secondary teachers towards climate change education in **Tehran, Karami, Shobeiri, Jafari, Hendi &Nabibid, (2017)** emphasized that technological transfer is a key element in responding to climate change. These studies collectively highlight the importance of technology in addressing the challenges posed by climate change.

In terms of teachers' attitudes towards climate change, the present study reveals that two-fifths of teachers strongly agree with the concern about climate change. This finding is consistent with the study that explored teachers' attitudes towards climate science in the USA conducted by **White et al., (2022)** who investigated the teachers attitudes relating to climate science' in the USA and showed that less than half (48%) of the participants were concerned about climate change and its severity.

As regards climate change education practices, the current study showed that less than one third of the teachers sometimes discussed information about the environment in class whenever possible, and less than half of them were using energy-saving light bulbs as practiced regularly. From the researcher's point of view, this may be due to their awareness of

the importance of environmental and energy conservation.

These results were supported by **Drosos et al., (2021)** who studied the perception of the school managers towards energy efficiency and found that the participants always turned off classroom lights and, at the same time, had stronger support for the idea of providing more environmental education discussion in the school environment.

With respect to the overall knowledge, attitudes, and practices of teachers related to climate change mitigation, the current study shows that around half of teachers had a moderate level of knowledge, a moderate attitude, and a low level of practice. The researchers speculate that the lack of a comprehensive climate change education program for the participants could potentially explain these findings.

These findings were in the same line as those of **Dixit & Sehrawat (2022),** who investigated education for sustainability: curriculum provisions and teaching-learning in India and reported that teachers' knowledge and attitude about climate and sustainability were limited and non-scientific at times, and **Worlu & Glory (2016),** who conducted 'teachers awareness of climate change: implications for innovative teaching' in Nigeria and found the awareness of teachers on climate change and the sources of information are significantly low.

Also, **Boon, (2016)** reported that knowledge and understanding of climate change were unacceptably low among preservice teachers in Australia; similarly, **Karami et al., (2017)** reported that the respondents' scores were approximately 3.0, suggesting a moderate level of attitude towards climate change. However, they also noted that teachers demonstrated inadequate practices (as indicated by lower mean scores in practice) regarding climate change topics.

Contrarily, a study by **Karami et al., (2018)** on teachers' attitudes towards environmental education and its relevance to their readiness to educate students reported different findings. They found that most teachers were well-informed about climate change. The implementation of climate change courses may be the cause of this discrepancy. These contrasting findings highlight the variability in climate change education and awareness among teachers.

Regarding the correlation between teachers' total knowledge, practice, and attitude scores. The current study results show that there's a highly statistically significant relationship between the teacher's total knowledge scores and total attitude scores. The study also revealed a significant relationship between total attitude scores and total practice scores. While no significant correlation was found between total knowledge and total practice scores.

Also, in a comparative study of teachers' perceptions of climate change in Bangladesh ,**Chowdhury et al., (2021)** identified a statistically significant relationship between teachers' total knowledge scores about climate change and their total attitude scores towards climate change. These results collectively underscore the interconnectedness of knowledge, attitudes, and practices in the context of climate change education.

Conclusion:

The research results indicate that teachers have a moderate level of knowledge and attitude toward climate change, but a lower level of practice. The study reveals that teachers attribute climate change primarily to industrial activities, transportation, and improper waste management. Teachers perceive digital transformation and technology use as having the greatest impact on mitigating climate change. However, a significant proportion of teachers do not see the need to address climate change in the educational curriculum. A significant correlation was found between teachers' knowledge and attitude scores and between attitude and practice scores, but not between knowledge and practice scores. These findings underscore the need for enhanced climate change education and practices among teachers.

Recommendations

Based on the research findings, there are some recommendations for teachers to approach climate change education with a positive attitude and a willingness to learn:

- Participate in professional development programs focused on climate change to stay up to date with the latest information and effective teaching strategies.

- Interdisciplinary approach: integrate climate change education into different subjects such as science, geography, and social studies to provide a comprehensive understanding.

- Work with scientists or environmental organizations to gain access to additional resources and real-world experiences.

- Engage students in active learning activities, such as projects, experiments, and field trips, to make learning about climate change more interactive and meaningful.

- Promote critical thinking: Encourage students to think critically about climate change issues, including understanding science, considering different perspectives, and evaluating potential solutions.

- Creativity: unleash the creativity of teachers and students to combat climate change and provide opportunities for global leadership.

- Address the knowledge gaps in climate change among students by integrating climate change science into the education curricula at all levels.This can inspire students to take an interest in the subject and become informed citizens who can contribute to climate change solutions.

References

Abdelfattah, S., Asmaa, E., Elsheikh, A., Abdel, L., & Refaat, R. (2023). Knowledge , perception , and practices regarding climate change among students of Al - Azhar University for Girls in Cairo , Egypt. *Journal of Public Health*, *0123456789*. https://doi.org/10.1007/s10389-023-01901-9

Boon, H. J. (2016a). *Pre-Service Teachers and Climate Change : A Stalemate ? 41*(4).

Boon, H. J. (2016b). Pre-service teachers and climate change: A stalemate? *Australian Journal of Teacher Education*, *41*(4), 39–63. https://doi.org/10.14221/ajte.2016v41n4.3

Chowdhury, M. T. A., Ahmed, K. J., Ahmed, M. N. Q., & Haq, S. M. A. (2021). How do teachers' perceptions of climate change vary in terms of importance, causes, impacts and mitigation? A comparative study in Bangladesh. In *SN Social Sciences* (Vol. 1, Issue 7). *Springer International Publishing.* https://doi.org/10.1007/s43545-021-00194-7

Corrochano, D., Ferrari, E., & Ortega-quevedo, V. (2022). *education sciences Educational Gardens and Climate Change Education : An Analysis of Spanish Preservice Teachers ' Perceptions*.

Dixit, S., & Sehrawat, G. (2022). Education for sustainability : curriculum provisions and teaching – learning in India. *CURRENT SCIENCE, . 122*,(1), 87–92.

Drosos, D., Kyriakopoulos, G. L., Ntanos, S., & Parissi, A. (2021). *School Managers Perceptions towards Energy Efficiency and Renewable Energy Sources*. *10*(3), 573–584. https://doi.org/10.14710/ijred.2021.36704.

Ferrari, E., & Mart, F. (2022). *Examining the Relationship between the Dimensions of the Climate-Change Competence (C3): Testing for Mediation and Moderation*.

Filho, W. L., Yayeh Ayal, D., Wall, T., Shiel, C., Paco, A., Pace, P., Mifsud, M., Lange Salvia, A., Skouloudis, A., Moggi, S., LeVasseur, T., Vinuesa Antonio, G., Azeiteiro, U. M., Ioannis, N., & Kovaleva, M. (2023). An assessment of attitudes and perceptions of international university students on climate change. *Climate Risk Management*, *39*. https://doi.org/10.1016/j.crm.2023.100486.

Gal, A. (2022). *From recycling to sustainability principles : the perceptions of undergraduate students studying early childhood education of an education for sustainability course*. https://doi.org/10.1108/IJSHE-05-2022-0165.

Igu, N., Anochiwa, R., Ogba, F. N., & Nwinyinya, E. (2023). *How Teacher ' s Climate Change Belief Influences Classroom Management Practices for Students ' Climate Change Awareness In Nigerian Schools*. *March*. https://doi.org/10.15244/pjoes/159429.

Karami, S., Bidhendi, M. E., & Naderi, M. (2018). *Assessment of Teachers ' Attitude Toward Environmental Education and its Relevance to their Readiness to Educ*. *6*(4), 9–18.

Karami, S., Shobeiri, S. M., Jafari, H., & Hendi, G. N. (2017). Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. *International Journal of Climate Change Strategies and Management*, *9*(3), 402–415. https://doi.org/10.1108/IJCCSM-04-2016-0043

Le, K. T.-V. (2019). Keeping it cool: Approaching global climate change as a socioscientific issue to support science teachers looking to address the NGSS. *Dissertation Abstracts International Section A: Humanities and Social Sciences*, *80*(11-A(E)), No-Specified. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc16&NEWS=N&AN=2019-46352-263

Ministry of Environment, & Arab Republic of Egypt. (2022). *Egypt National Climate Change Strategy 2050*. 57.

Mohiuddin, A. K. (2023). *GLOBAL HEALTH ISSUES WITH CONFLICT ESCALATION AMONG PANDEMIC , CLIMATE , AND ECONOMIC CRISES*. *11*.

Nadimul, M., Ahmed, Q., & Ahmed, K. J. (2022). *Teachers ' Perceptions About Climate Change : A Comparative Study of Public and Private Schools and Colleges in Bangladesh*. *4*(May), 1–13. https://doi.org/10.3389/fclim.2022.784875

Natalia, M., Ullah, W., Khan, A. R., Wahid, A., Mehmood, M. S., & Naz, M. (2023). Investigation among students' and teachers' perception of climate health awareness regarding low carbon ecofriendly practices. *Frontiers in Environmental Science*, *11*(June), 1–15. https://doi.org/10.3389/fenvs.2023.1177952

Pierce, C. (2019). Realities of Teaching Climate Change in a Pacific Island Nation. In *Climate Change Management*. https://doi.org/10.1007/978-3-030-32898-6_18

Seroussi, D. E., Rothschild, N., Kurzbaum, E., Yaffe, Y., & Hemo, T. (2019). Teachers' Knowledge, Beliefs, and Attitudes about Climate Change. *International Education Studies*, *12*(8), 33. https://doi.org/10.5539/ies.v12n8p33.

Text, F. (2022). *Jacobs Launches Education Program for Young Climate Change-Makers : Embeds progressive mindset towards climate change*. 2022–2023.

UNICEF. (2022). *Knowledge , attitudes and practices study on climate change and the environment*.

Tserej, O, Sidoti, B, Assael, S, Padolf, A, Bistrain, M, Shen, J & Feeley, K.J. (2024). How Do Teachers Learn and Engage with Climate Change? An Examination of the Shade Our Schools—Leaves Are Cool! Citizen Science Program. Citizen Science: Theory and Practice, 9(1): 2, pp. 1–14. DOI: https://doi.org/10.5334/cstp.619

Winter, V., Kranz, J., & Möller, A. (2022). Climate Change Education Challenges from Two Different Perspectives of Change Agents: Perceptions of School Students and Pre-Service Teachers. *Sustainability (Switzerland)*, *14*(10). https://doi.org/10.3390/su14106081

Worlu, J., & Glory, N. (2016). *Teachers Awareness of Climate Change : Implications for innovative Teaching*. *2*(6), 24–31.