HOW CAN CLIMATE CHANGE EDUCATION CONTRIBUTE TO AWARENESS AND ACTION IN EGYPT? CAIRO UNIVERSITY AS A CASE STUDY

Hamed Ead, Cairo University
Soheir Fahmy, Cairo University
Sahar Fadallah, Cairo University
Fathyea Elhalwany, King Abdul-Aziz University
Heba Fahmy, Cairo University
Tarek Kapiel, Cairo University

ABSTRACT

Climate change poses serious threats to human civilization, and the fact that Egypt is preparing to host the United Nations Climate Change Conference (COP 27) in 2022 appears to offer a good opportunity to create a better future for the Egyptian people if we seize the opportunity to educate students and the public more about this hot topic. Universities face, as do all institutions, clear and growing risks from climate disruption, and thus, university communities must be aware of these risks. Addressing these risks can provide the opportunity to renovate and equip universities for the 21st century to be safe, secure, and active in the face of climate change and to solve real-world problems. Universities have a critical role to play in combating climate change, but the issue's complexity and multifaceted nature pose challenges to the institution's traditional operations. Since guidelines for implementing climate change education (CCE) are not yet commonly applied, higher education institutions can support efforts related to that.

In continuation of work by the correspondent author that discussed the role that should be played by Egyptian universities in keeping the public's awareness of climate change and sustainable development, a questionnaire was prepared based on previous studies and administered to 305 staff, graduates, and students at Cairo University (305 votes), selected from different faculties in different stages analyzed. The survey covered demographic information and a range of matters related to climate change and environmental intentions. Data were analyzed using SPSS version 21.0. Demographic characteristics and the other qualitative measures were presented as counts and percentages (%).

There are currently no common guidelines for implementing CCE, and higher education institutions can support efforts related to that. This working paper aimed to explore the relationships between universities and their complex interactions with society as well as education's impact on climate change; the paper provides a conceptual mapping of the various functions of universities and the pathways through which they might influence climate change. Cairo University is taken as a case study of the normative implications for the role of universities.

Keywords: Climate Change Education, Higher Education, Cairo University, Case Study, COP 27.

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INTRODUCTION

Set as it is at the heart of one of the oldest civilizations on the planet, Egypt has entirely unsurprising concerns regarding global climate change and its consequences for sustainable development (Ead, 2014a; 2014b). Scientific evidence and climatic records have sharpened the focus on the relationship between the concentrations of greenhouse gases in the atmosphere and the increases in global temperature. In Egypt, with its diverse natural environments and social systems, these changes are affecting different areas in different ways, and this poses significant implications for developmental planning. CCE without brackets aims to address and develop effective responses to climate change by helping learners understand its causes and consequences, preparing them to live with its impacts, and empowering them to adopt more sustainable lifestyles. We aimed with the present investigation to better understand how Egypt can adapt to climate change and what solutions can overcome its risks and adverse effects.

Climate Change Risks in Egypt

According to the UN, Egypt had a population of 105,627,339 as of March 19, 2022, making it Africa's most populous country. Because of its primary dependence on the Nile River, which serves the needs for potable water, agriculture, industry, fish farming, power generation, inland river navigation, mining, oil and gas exploration, cooling of machinery, and power generation, the nation is considered highly vulnerable to climate change and its harmful consequences. Despite this, Egypt ranks 73rd in the world in climate change readiness (Climate Change Profile, 2018). Water supplies are under severe strain because of increasing populations and urbanization but also because of the effects of climate change (Egypt third national communication under the United Nations framework convention on climate change, 2016).

Indeed, climate change threatens food security, human health, and biodiversity, and with the expected climate effects, Egypt's rapidly expanding metropolitan areas will struggle to provide basic amenities such as housing, health care, education, sanitation, and energy. As the country experiences greater climate effects, productive lands will be pressured to raise yields, worsening water problems. Furthermore, 98% of Egypt's population and most of the country's infrastructure is concentrated along the Nile River, its delta, and its northern and eastern shores. Climate change will function as a risk multiplier in this area, amplifying the outcomes of the interactions between political, economic, and demographic variables.

Egypt is located in the northeastern corner of Africa: Its northern border is the Mediterranean Sea, with Sudan to the south; the Red Sea, Palestine, and Israel to the east; and Libya to the west. The topography ranges from 133 m below sea level in the Western Desert to 2,629 m above sea level in the Sinai Peninsula. Egypt has a total land area of 995,450 km2 and a coastline of 3,500 km along the Mediterranean Sea and the Red Sea, and the Mediterranean shoreline is more vulnerable to sea level increase because it sits at a lower elevation than the land around it. The Nile Delta and its north coast are hosts to several primary towns and cities such as Alexandria, Port-Said, Damietta, and Rosetta, all with populations of several million, and large investments in industrial, touristic, and agricultural activities as well as in the infrastructure serving these activities (Egyptian Environmental Affairs Agency, 2016).

Taking a closer look, the Nile River plays a critical role in Egypt's food and water security, so the impacts of climate change in Egypt cannot be ignored. The Nile provides 95% of Egypt's water needs, with 85% of that going to agriculture. The Nile Delta covers more than half of

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Egypt's agricultural land and provides for 80% of the country's fish farming needs. The Nile provides water for domestic use, industry, power generation, cooling of machinery and power plants, and transportation between Nile Valley communities (Green Climate Fund, 2017). In examinations of the impacts of climate change on Egypt's water quota and food security, the Nile is of enormous concern because of its linked involvement in so many industries.

Agriculture is Egypt's most water-intensive sector, requiring 80% of the country's water allowance, and is predicted to account for 14.5% of GDP and 28% of all jobs in Egypt's economy (Egypt-Country Profile, 2018). According to a UN Development Program (UNDP, 2013) assessment, agricultural productivity is expected to drop by 8% to 47% by 2060, with agricultural employment dropping by up to 39%. Climate change is expected to cause losses in agricultural welfare ranging from 40 to 234 billion EGP by 2060 (UNDP, 2013). All these factors bring great risk to the 50% of Egypt's economic operations in agriculture, fisheries, and other sectors that rely heavily on the water. Other climate-related impacts on the river include challenges with ferries sailing on the Nile, effects on coral reef growth and integrity, saltwater intrusion and submersion of monuments on the north coast, and socioeconomic losses as a result of all of the aforementioned impacts, all of which will harm tourism and biodiversity (EEAA, 2016).

Higher Education and Climate Change

Advanced human societies and the institutions that comprise them have emerged during a period of relatively stable climate over the past 12,000 years, making agriculture and settled civilizations possible. As we observe more widespread and drastic changes in climate across the globe, it is clear that this stability, and all it affords human civilization, is being threatened. This threat is serious, yet it offers exciting opportunities to make our communities more dynamic, resilient, and able to provide energy, water, food, shelter, and mobility with redesigned systems equipped to thrive in a changing climate.

Leading organizations are beginning to embrace these opportunities, recognizing the risks while working to create more effective systems. Addressing the challenges posed by climate change is central to this mission and critical to our country's future. Planning for climate change and taking action now will help limit damage and costs in the coming decades and in many cases can provide near-term benefits including operational savings and job creation. This is the kind of win–win opportunity that a proactive approach to climate disruption can create.

Today, higher education institutions face clear and growing risks from climate disruption, but these risks are not evenly distributed (Adger et al., 2005; Roberts & Parks, 2006). There is now abundant evidence that the first and worst affected by climate disruption in the United States are, and will increasingly be, low-income communities and communities of color although they have the lowest carbon footprints (Congressional Black Caucus Foundation, 2004). This raises significant moral and ethical questions (Gardiner, 2010) and is the spark behind the growing movement for "*Climate justice*" (Agyeman et al., 2007).

The story of climate change is entwined with the story of universities as an institution. Scientists have played an important role not only as members of authoritative bodies such as the Intergovernmental Panel on Climate Change (IPCC) but also as whistleblowers, campaigners, and supporters of the cause, which is remarkable given the problem's political nature and consequent vilification by the climate denial lobby. Although much climate science takes place outside of universities, these institutions remain the primary source of knowledge development, transmission, and validation on the issue. An educated and technically proficient workforce is

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critical to achieving this goal because it will be able to undertake the necessary research and develop effective solutions to finally establish a truly adaptive and resilient society. Egypt already has a large pool of human talent, and vibrant scientific and technological educational institutions can help to foster and sustain these human capacities. Universities can make significant contributions to climate change adaptation; they will develop the highly trained human capital and knowledge required for tomorrow's climate-risk society. Against this background, the main objective of this work is to promote broad public awareness as an essential part of education efforts to strengthen attitudes, values, and actions, which are compatible with sustainable development.

Because contemporary societies are facing increasing challenges related to climate change, education is considered a fundamental element in the responses to those challenges in addition to mitigation and adaptation. In this context, CCE as a component of environmental education and education for sustainable development generates knowledge about climate change and encourages behavior change aimed toward sustainability.

In Egypt, there are no specific guidelines for how CCE should be integrated into national and local curricula. This is necessary to address IPCC projections, especially related to climate change impacts in the Nile Delta and Egyptian shores because Egypt has recently been experiencing extreme weather event impacts. Scientific evidence and climatic records have sharpened the focus on the relationship between the concentrations of greenhouse gases in the atmosphere and the rise in global temperature and, in the process, highlighted the roles of universities in sustainability and climate action.

Adaptation to climate change has emerged as one of the most important concerns in the global development agenda today because scientists and individual local communities are already observing variability in climates and local ecosystems. In Egypt, with its diverse natural environments and social systems, these changes are affecting different areas in different ways, with significant implications for developmental planning. The solutions Egypt creates to adapt to climate change and overcome its adverse risks must be developed locally while being supported by regional and global knowledge and experience.

Key to this is an educated and technically skilled labor force that can conduct the necessary research and develop effective solutions. The needed groups in Egypt will have considerable expertise and experience in climate science through collaborative research between independent research institutes and their external partners, and the key step forward will be how to unite this expertise with the expertise of Egyptian universities to eventually build bottom-up regional communities of researchers, educators, students, practitioners, policymakers, and local groups for climate change adaptation. Ideally, higher education institutions are well placed to conduct applied postgraduate adaptation research in close partnership with government and nongovernment agencies as well as local communities (Song et al., 2019).

Role of Higher Education in Awareness of Climate Change

To increase public awareness of climate change issues, there is a need to increase public sensitivity to the environment and to development problems to increase public involvement in their solutions as well as to increase public motivation and commitment to sustainable development. Many environmental problems derive from the absence of awareness such as waste of resources, pollution and disease spread, the imbalance between population growth and available resources, and the abuse and destruction of land.

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The main objective of this study is to promote broad public awareness of climate change issues as an essential part of education efforts to strengthen attitudes and actions related to supporting sustainable development. Egypt already has a vast pool of human talent, and this human capital can be further cultivated and sustained through dynamic scientific and technical educational institutions. Higher education can make substantial contributions to the field of climate change adaptation, and universities will produce tomorrow's highly skilled human capital that can address adaptation in a climate-risk society. Mass media offers some activities in this area but without any organized plan, and studies indicate that the press is doing very little to promote public awareness of climate change; mosques, churches, clubs, industry, unions, etc. are also doing little to foster awareness toward building an adaptive and resilient society.

All universities have some capacity to assist their communities and the broader societies beyond them, but there are clear geopolitical differences in capacity. Middle- and higher-income communities and countries contribute more to greenhouse gas emissions but also have more resources to combat climate change impacts. Conversely, adaptation is more challenging in lower-income areas whose populations are likely to be disproportionately affected by the adverse impacts of climate change and have fewer resources to combat them.

Meanwhile, the greenhouse gas emissions that are the direct cause of climate change impacts are themselves rooted in the growth of industry, fueled by consumerism and the capitalist system, and in turn by the separation of humankind from the rest of nature and the exploitation of the latter by the former. The solutions, therefore, are also rooted in human societies, albeit constrained by a range of psychological, political, economic, and cultural factors. The relevance for academia here is that understanding the causes and impacts of climate change involves not only the full range of life sciences, physical sciences, engineering, and technology but also economics, social sciences, arts, and humanities (Leal Filho et al., 2019; Filho, 2018; Filho, 2010).

Universities: A General Overview

We usually think of educational institutions as places that prepare us for our adult lives through our acquiring new specialized knowledge that we can use directly, for instance, in basic science, pharmacy, engineering, or medicine. In most cases, although not always explicitly, educational institutions also aim to instill in students certain values and ethics, whether hard work, independence of thought, adherence to a national ideology, competition, or cooperation. Whatever the example, the educational institution acts as a delivery channel for the message, in what has been called the projective function of educational institutions (McCowan, 2019). Notably, this has been the most common and sometimes the only way that higher education has been visualized.

However, we can also see educational institutions as performing an expressive function. In this case, they are community arenas in their own right where individuals can acquire and use skills, knowledge, and values and where important human interactions and dynamics occur. Here, universities can be compared with towns, villages, and, in some cases, cities: Egyptian universities such as Cairo University and Ain Shams University have up to 250,000 students and correspondingly large numbers of faculty members and campus staff.

The existing research on universities and climate change has mostly focused on greening campuses and incorporating concerns into curricula (Leal Filho et al., 2019; Molthan-Hill et al., 2019; Fahey, 2012). In response to this narrow focus, there is an immediate need to broaden the conversation to cover a wider variety of higher education roles and their linkages. In some accounts of universities' roles in climate change and sustainable development, researchers have

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identified universities' constituent elements (education, research, outreach, and so on) and emphasized the importance of integration between these various elements (Cortese, 2003; Henderson et al., 2018; Vaughter et al., 2013). However, it is also vital to investigate and theorize the trajectories of different forms of action, besides their effects on society and the environment. With this research, we do so by drawing on broader frameworks and theories of universities' influence (Brennan et al., 2004; Castells, 1994; Cloete et al., 2011; Fehlner, 2019; Oketch, 2014). We propose a novel approach aimed at addressing climate change but with ramifications for the university society connection in general.

Efforts of Egypt to Implement a Sustainable Development Model

At COP-26 in Glasgow, Egyptian President Abdel Fatah Elsisy presented a recent report regarding climate change in Egypt and reported that Egypt had taken serious steps to implement a sustainable development model; President Elsisy highlighted that climate change adaptation was at the heart of the model. The announced aim was for government-funded green projects to reach 50% of government investments by 2025 and 100% by 2030. For example, renewable energy sources today represent approximately 20% of the energy mix in Egypt, and President Elsisy announced the aim of reaching 42% by 2035 in conjunction with the rationalization of energy subsidies, besides establishing smart, sustainable cities. Egypt is also implementing projects to rationalize water use, line canals, and integrate coastal zone management. To finance these projects, Egypt recently issued the first offering of green bonds worth $750 million. To place these bonds within its institutional framework, government leaders prepared the National Climate Change Strategy 2050, which will open the way for Egypt to modernize its nationally determined contributions so that their associated policies, objectives, and procedures complement the state's development efforts and efforts to fully recover from the effects of the coronavirus pandemic.

Climate Change Education

CCE is a methodology under which people become familiar with their surroundings and secure learning, abilities, values, experiences, and passion. In theory, all of these will empower citizens to act separately and aggregately to take care of present and future environmental issues. CCE is the study of relationships and interactions between natural and human systems to give people a better understanding of the world around them and how to take care of it properly.

Education is a critical agent in addressing the issue of climate change. The UN Framework Convention on Climate Change assigns responsibility to convention parties to undertake educational and public awareness campaigns on climate change and ensure public participation in programs and information access on the issue.

Education can change people's attitudes and behaviors including helping them to make informed decisions; in the classroom, young people can be taught the impacts of global warming and how to adapt to climate change. Education empowers all people but especially motivates the young to act. Knowing the facts helps eliminate the fear of an issue that is frequently catastrophized in the public arena. In this context, UNICEF has tapped into the minds and imaginations of children around the world to capture what it means to be a child growing up in the age of rapid climate change.

CCE furnishes individuals with the mindfulness required to build up organizations, comprehend NGO exercises, create participatory methodologies for urban planning, and guarantee

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future markets for eco-business. All of these are not only good for the environment but will also benefit economies as well. The major goal of this working paper is to create a conceptual map of the numerous functions of universities in the fight to address climate change including their pathways to influencing climate change impacts. We also consider how the various arrangements of these functions and their interrelationships can influence universities' potential positive role in addressing the climate problem. The second goal of this paper is to develop a set of normative implications for the adjustments that universities and higher education systems must make to reach their full potential. The theoretical framework also serves as a guide for researchers, pointing out areas where empirical studies have been lacking.

Research Questions

With this research, we aimed to answer the following research questions:

1. To what extent does Egypt's educational system contribute to growing awareness of CCE issues and to what extent does it not?
2. To what extent do government policies aid in the implementation of CCE in university programs?
3. What are the lacking elements in Egypt's educational system that would help to improve CCE awareness or be deemed included in it?
4. To what extent could the worldwide CCE experience improve Egypt's educational system?

MATERIALS AND METHODS

Research Methodology

We conducted this mixed-design research through exploratory and descriptive studies to identify and describe the factors that could explain the intention of education on climate change and exploratory study through a review of previous studies (Caucus, 2004).

Sampling and Data Collection

We recruited participants for this study using systematic probability sampling of staff, graduates, and students of Cairo University. Specifically, we distributed a survey to the university community, and no one was allowed to participate who did not read and agree to the statement, "*Your participation is voluntary; therefore, the information obtained will be confidential and will only be used for research purposes*." The study survey had two sections, questions on sociodemographic and both original questions and questions based on other instruments in the era of global climate change.

Data Analysis

We analyzed all data on the 305 survey respondents using SPSS version 21.0 (IBM, SPSS, Chicago, IL, USA) and present their demographic characteristics and other qualitative measures as counts and percentages (%).

RESULTS AND DISCUSSION

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Although the role of education in addressing the challenges of climate change has been increasingly recognized, the education sector remains untapped as a strategic resource for climate change mitigation and adaptation. Education stakeholders in many countries have yet to develop a coherent CCE framework, and the purpose of this study was to highlight the critical role that higher education can and must play in addressing climate change in all its complexities. Our results from this study's survey provide a rationale for why CCE should be addressed in the context of education for sustainable development, which aims to provide an enhanced understanding of the causes and consequences of climate change toward the aim of increasing willingness to take action to address them.

Table 1
PARTICIPANTS' RANKINGS OF TODAY'S MOST IMPORTANT ISSUES

Issue	Count	%
Infectious diseases	245	80.38
Unemployment	254	83.28
Violence/wars	227	74.43
Crime	226	74.10
Climate change/global warming	222	72,87
Terrorism	191	62.62
Population overcrowding	184	60.32

Table 1 presents the initial study findings for the question asking respondents to rank a list of issues in the order of their significance to public life: infectious diseases, unemployment, violence/wars, crime, climate change/warming, terrorism, and population overcrowding. The table shows that respondents ranked climate change/global warming as the fifth most important issue.

Table 2
PARTICIPANTS' RANKINGS OF TODAY'S MOST IMPORTANT ISSUES IN ORDER OF IMPORTANCE

Issue	Count	%
Poverty	248	81.3
Infectious diseases	245	80.3
Unemployment	245	80.3
Violence/war	227	74.4
Crime	226	74.1
Climate change/global warming	222	72.8
Terrorism	191	62.6
Overcrowding	184	60.3

Table 2 presents the findings of study participants' responses to the question asking them to

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rate the same items on a scale of 1-5 for their importance. The table shows that in the individual rankings, climate change/global warming ranked sixth in importance to these participants.

The questionnaire next asked respondents if they believed several statements were true or false or if they did not know. In (Table 3), we present the percentages of "I do not know" responses to each of the three statements. Notably, 3.6% of respondents answered that they did not know if the temperature on earth had been rising over the past decade.

Table 3
PERCENTAGES OF STUDY PARTICIPANTS WHO ANSWERED I DO NOT KNOW TO QUESTIONS REGARDING THE ENVIRONMENT

I do not know	Count	%
Aware of your country's environmental policies	186	61
Knowledge of global policies or initiatives taken by different organizations to reduce climate change/global warming	148	48.5
The increasing temperature on Earth	12	3.9

Table 4 presents the findings for the question asking respondents, which if any climate change areas and effects they were aware of. Most reported being aware of deforestation and of climate change in general, and only 6.65% were aware of El Nino.

Table 4
PARTICIPANTS' RATINGS FOR CONTRIBUTORS TO GLOBAL CLIMATE CHANGE

Topic	Count	%
Deforestation	117	38.4
Climate ange in general	109	35.7
Melting ice or volcanic eruptions	92	30.2
Greenhouse gases	91	29.8
Air dust	64	21
Ocean Urrents	45	14.8
El Nino	20	6.6

Next, we asked participants about factors they believed had contributed to global climate change, and (Table 5) presents the results for the areas participants believed were contributors. Most participants, 83.3%, stated that greenhouse gases have contributed to global climate change, and 75% attributed climate change effects to deforestation.

Table 6 presents the findings of the survey respondents' ratings of the global importance of a group of pollution sources. The table shows that respondents placed high importance on air and water pollution and on radioactive waste and placed comparatively little importance (61.6%) on traffic jams (World Bank Open Data, 2020).

Table 7 presents the participants' responses to the question of what platforms they had learned about climate change from. The highest percentage, 88.5%, had learned about climate change from participation in environmental campaigns, whereas the smallest percentage, 26.2%, had heard about climate change from using public transport.

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Table 5
PARTICIPANTS' RATINGS FOR CONTRIBUTORS TO GLOBAL CLIMATE CHANGE

Contributor	Count	%
Greenhouse gases	254	83.3
Deforestation	230	75.4
Land use and land cover	181	59.3
Melting ice or volcanic eruptions	179	58.7
Air dust	128	42
The sun	91	29.8
El Niño or irregular warming of surface waters	47	15.4

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Table 6
PARTICIPANTS' RANKINGS OF THE IMPORTANCE OF CONTRIBUTORS TO CLIMATE CHANGE

Contributor	Count	%
Air pollution	278	91.1
Pollution of rivers and seas	274	89.8
Radioactive waste	273	89.5
Poor waste management (e.g., overuse of landfills)	268	87.9
Garbage	257	84.3
Hole in the ozone layer	256	83.9
Use of land resources	242	79.3
Extinction of species	215	70.5
Temperature rise or drop	213	69.8
Floods	203	66.6
Traffic jam	188	61.6

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Table 7
Platforms where participants had heard about climate change

Platform	Count	%	Count	%	Count	%
Participation in environmental campaigns	8	2.6	27	8.9	270	88.5
Waste recycling	22	7.2	28	9.2	255	83.6
Buy organic food	39	12.8	93	30.5	173	56.7
Purchase of more energy-efficient devices	109	35.7	39	12.8	157	51.5
Walking or cycling to work	85	27.9	70	23	150	49.2
Use of less electricity	157	51.5	32	10.5	116	38
Use public transport	174	57	51	16.7	80	26.2

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We also asked study participants what institution was responsible for the participants' intended next activities related to climate change, and (Table 8) shows that the highest percentage, 42.3%, were likely to change their actions based on government agency information. Only one respondent (0.3%) intended to take their next action based on information from libraries.

Table 8
PARTICIPANTS' RESPONSES TO WHAT IS THE REASON FOR YOUR NEXT ACTIVITIES?

Platform responsible	Count	%
Government agency information	129	42.3
TV	57	18.7
School/faculty/university	41	13.4
Academic journals/special publications	40	13.1
Friends or colleagues	12	3.9
Environmental groups	11	3.6
Internet	5	1.6
Radio	5	1.6
Libraries	1	0.3

Table 9 shows our findings in response to the question about respondents' confidence in sources of information about climate change. Most participants, 84.6%, expressed that they would be confident in information about climate change that came from scientists, and only 17.4% said they would trust climate change information from peers.

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Table 9
PARTICIPANTS' RESPONSES TO HOW CONFIDENT ARE YOU IN INFORMATION ABOUT CLIMATE CHANGE FROM THE FOLLOWING SOURCES?

Source	Count	%
Scientists	258	84.6
Environmental organizations	209	68.5
Government bodies	114	37.4
Energy suppliers	110	36.1
Media (TV, radio, newspaper, etc.)	110	36.1
Family members	71	23.3
Peers	53	17.4

Table 10 presents our findings on the question of respondents' support for or disapproval of actions related to climate change. Nearly all respondents, 97.4%, agreed with promoting a greener environment and participating in climate change initiatives, and 91.1% agreed that everyone has a role to play in reducing the effects of climate change (Cardi, 2019). Under 10% agreed with the statement that the effects of climate change were exaggerated and the topic was not actually important.

Table 10
PARTICIPANTS' APPROVAL AND DISAPPROVAL OF STATEMENTS ABOUT CLIMATE CHANGE

Statement	Approvals (count)	%
I will promote a greener environment and participate in initiatives to reduce climate change.	297	97.4
Each of us can reduce the effects of climate change.	278	91.1
Reducing energy use must be mandatory if it reduces climate change.	276	90.5
The government must increase incentives for people trying to reduce climate change.	274	89.8
Climate change must occur because of the current modern society.	255	83.6
Recent global disasters were caused by climate change.	245	80.3
There are more important things than climate change.	145	47.5
Climate change is only caused by pollution from industries.	75	24.6
Climate change is a natural phenomenon. We cannot do anything about it.	45	14.8
Logging to build infrastructure is not bad.	44	14.4
The subject of climate change is exaggerated by the media; in fact, it is not that important.	30	9.8

Table 12 presents our findings for the entities respondents felt were responsible for taking initiatives to reduce climate change. The highest percentage attributed responsibility for taking initiative to environmental groups, and only 9.8% felt that citizens themselves should be responsible for climate change action (EEAA, 2016).

We next asked survey respondents what actions they intended to take to reduce climate change impacts and their reasons for those activities; Table 11 presents those findings. The highest percentages intended to walk or ride bicycles to work and to use less electricity and to do so mostly to save money.

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Notably, however, respectively 51.5% and 56.7% intended to buy more energy-efficient devices and more organic food to preserve the environment.

Table 13 shows the findings for which climate change topics respondents were familiar with, and the highest proportion, 32.5%, were aware of renewable energy. Only 10% were aware of carbon footpr (Table 13).

Table 11
PARTICIPANTS' NEXT INTENDED CLIMATE-CHANGE-RELATED ACTIVITIES AND THEIR REASONS

Activity	To save money		To create a good image		To preserve the environment	
	Count	%	Count	%	Count	%
Walking or cycling to work	85	27.9	70	23	150	49.2
Use less electricity	157	51.5	32	10.5	116	38
Use public transport	174	57	51	16.7	80	26.2
Purchase more energy-efficient devices	109	35.7	39	12.8	157	51.5
Buy organic food	39	12.8	93	30.5	173	56.7
Recycle waste	22	7.2	28	9.2	255	83.6
Participate in environmental campaigns	8	2.6	27	8.9	270	88.5

Table 12
PARTICIPANTS' OPINIONS ON THE ENTITIES RESPONSIBLE FOR TAKING INITIATIVES TO REDUCE CLIMATE CHANGE

Entity	Yes (count)	%
Environmental groups	143	46.9
International organizations	137	44.9
National government	75	24.6
Companies and industries	32	10.5
Citizens themselves	30	9.8

Table 12 presents our findings for the entities respondents felt were responsible for taking initiatives to reduce climate change. The highest percentage attributed responsibility for taking initiative to environmental groups, and only 9.8% felt that citizens themselves should be responsible for climate change action (EEAA, 2016).

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Table 14 shows our findings for the ages respondents believed children should start learning about climate; the highest proportion, 36.4%, felt that ages 8 to 11 years were an appropriate age (World, 2021).

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We also asked respondents directly whom they believed was responsible for combating climate change, and Table 15 shows that nearly two-thirds believed that it was the government's responsibility.

Table 13
PARTICIPANTS' LEVELS OF AWARENESS OF CLIMATE CHANGE TOPICS

Topic	Very aware (count)	%
Renewable energy	99	32.5
Climate change	86	28.2
Lack of carbon	52	17
Carbon footprint	33	10.8

Table 14
PARTICIPANTS' RESPONSES TO AT WHAT AGE SHOULD EDUCATION ON CLIMATE CHANGE BEGIN?

Age	(Count)	%
4–7 years	109	35.7
8–11 years	111	36.4
12–6 years	56	18.4
16–8 years	13	4.3
18 years and above	12	3.9

Table 14 shows our findings for the ages respondents believed children should start learning about climate; the highest proportion, 36.4%, felt that ages 8 to 11 years were an appropriate age (World, 2021).

Table 15
PARTICIPANTS' RESPONSES TO WHO DO YOU THINK IS RESPONSIBLE FOR COMBATING CLIMATE CHANGE?

Responsible entity	(Count)	%
Government	202	66.2
Individual	37	12.1
Business	21	6.9
Schools	19	6.2
Councils	14	4.6
Other countries	12	3.9

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Table 16
PARTICIPANTS' AGES

Age group	(Count)	%
Under 16 years	1	0.3
16–24 years	99	32.5
25–44 years	139	45.6
45–64 years	46	15.1
65–75 years	11	3.6
Over 75 years	3	1

Table 17
PARTICIPANTS' HIGHEST EDUCATION ATTAINMENT

Level completed	(Count)	%
Ph.D.	118	38.7
College	60	19.7
Graduate	28	9.2
Secondary school	17	5.6
Middle school	3	1

By gender, 67.5% (206) of this study's participants were women, and 31.1% (95) were men (Table 16). By age, the highest proportion of respondents (45.6%, 139) was aged 25–44 years, and by education attainment, the highest proportion of respondents held doctoral degrees at 38.7% (118 participants; Table 17). Table 18 presents the positions of those study participants who were affiliated with universities (Vickers, 2017).

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Table 18
PARTICIPANTS' UNIVERSITY POSITIONS

Position	(Count)	%
Undergraduate student	13	4.3
Graduate student	5	1.6
Staff member	3	1
Faculty member	23	7.5

Survey Respondents' Opinions

The survey asked the study participants an open-ended question regarding their ideas for promoting climate change around Egypt. We present some of their feedback below:

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1. I wish the organizations tasked with developing policies to combat climate change success.
2. I would want to arrange a volunteer activity to plant trees in some locations during school holidays. Government corruption is to blame for failing to pay attention to factory misbehavior that results in pollution, as well as the installation of solar panels on building roofs to conserve energy.
3. Each individual begins to protect the environment as much as he can, and the government takes strict measures against companies, individuals, and factories that emit polluting waste without treating it, and international organizations apply pressure to governments and countries that emit large amounts of pollution. Clear plans are implemented, just as they are at the United Nations, and no one is allowed to break them.
4. The most essential decision that governments must make is to restrict the use of petroleum and its derivatives and to work as quickly as possible to discover alternatives. Incorporating the problem into all educational curricula … and more attention from governments
5. I intend to adopt the essential awareness for all segments of society and to distribute a climate change awareness lecture to all university faculties.
6. Expanding research into the direct and fundamental causes of climate change and attempting to identify workable solutions.
7. Working to address the problem begins with a broad understanding of the situation, such as what occurred during the coronavirus pandemic, and synchronizing that understanding with the problem's actual solution.
8. Strict oversight of factories and garbage disposal. People and citizens who keep their city or town clean are rewarded. Imposing fines on anyone who throws trash on the street or works in an environmentally harmful manner. To be accomplished, the government pursues slum reforms and, most significantly, creates work opportunities to remove poverty, unemployment, crime, ignorance, and illiteracy. Implementation of the aforementioned.
9. Encouraging researchers and giving financial support for research projects and the use of existing research findings.
10. Generalizing the application of ISO-14000 Environmental Management (ISO 14000) ISO 14001:2015 Environmental Management Systems ISO 14004:2016 ISO 14005:2019.
11. Imposing fines on those who cause environmental harm while also providing alternatives.
12. Planting rooftops, driving electric cars, teaching a sustainability course in schools and universities, reducing individual cars and working together, burying polluted waste, calculating the percentage of gases leaving factories, stimulating the idea of recycling and biodegrading emitting vehicles, planting trees, reducing energy consumption, and so on.
13. Pass legislation prohibiting persons from spraying water on the streets.
14. Entrusting this issue to the government does not imply that we are avoiding the problem; rather, we have chosen the most appropriate answer, which is for the government to fulfill its functions better, including directing individuals.
15. The focus should be on the category of industries, which have many negative effects in terms of environmental preservation, and the Republic should plant as many trees and green places as possible.

RESULTS SUMMARY

To summarize the results of the current study's questionnaire responses, 67.5% of the participants were women and 31.1% were men, indicating that more women in Egypt are concerned about climate change than men. We were fortunate in that we were able to recruit youth to engage in the survey, as the age group with the highest percentage of participants (45.6%) was 25–44 years, followed by 32.5% who were 16–24 years old. Most study participants held doctoral degrees, yet surprisingly given their degrees; most that were associated with universities were undergraduate students.

Participants in this study rated poverty, infectious diseases, unemployment, violence/war, and crime as more serious issues than climate change/global warming, which respondents ranked fifth and sixth in importance on two consecutive questions. A substantial percentage of study participants, 61%, were unaware of their country's environmental policies, followed by 48.5% who

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were unaware of global policies or actions implemented by various organizations to combat climate change and global warming; only 3.6% of survey respondents were not thinking about the issue of the earth's increasing temperature.

Most study participants were aware of deforestation (38.4%), climate change in general (35.2%), and ice melting, and only 6.65% reported being aware of El Niño and its impacts. Over 80% of study survey respondents had a moderate understanding and believed that greenhouse gases have contributed to global climate change, followed by deforestation (75.4%) and El Niño or irregular warming of surface water (15.4%). The largest percentage of study participants (88.5%) learned about climate change through participation in environmental initiatives, and the smallest percentage (26.2%) learned about it through public transportation. In terms of why study participants intended to take actions to address climate change, 42.3% cited government agency information as their reason for action, and a mere 0.3% cited libraries. The highest percentage of voters, 84.6%, trusted climate change information from scientists, and the lowest percentage, 17.4%, trusted such information from peers. Study participants cited engagement in environmental campaigns as the ideal next activity they could engage in to combat climate change, and participants reported the highest awareness of renewable energy followed by climate change in general. A majority of participants blamed environmental groups, international organizations, and national governments for failing to take action to combat climate change. Most participants agreed that ages 8–11 years were appropriate to begin teaching children about climate change, followed by as young as 4–7 years (36.4% and 35.7%, respectively). Nearly two-thirds of study participants, 66.2%, believe that the government is to blame for climate change.

CONCLUSION

With the present study, we aimed to answer four research questions using a survey to collect sociodemographic data and the opinions and perspectives of a group of Egyptian adults regarding global climate change and its impacts on Egypt. The questionnaire results showed that more women than men were concerned about climate change by a ratio of 2:1, and most participants were undergraduate students who held doctoral degrees; respondents showed high awareness of climate change issues. However, survey respondents ranked climate change/global warming low on two different lists of pressing social issues for Egypt, and many participants were not aware of their country's environmental policies; many were also not aware of global policies or initiatives taken by different organizations to reduce climate change/global warming. The highest percentage of study survey respondents had heard about climate change from participation in environmental campaigns, and the highest percentage cited government agency information as the reason for the next actions they intended to take related to climate change. Voters had the most confidence in climate change information from scientists and the least confidence in information from friends. The highest percentage of participants believed that the government is responsible for combating climate change.

We conclude from the obtained results that CCE is not widespread throughout Egypt's education system including in its universities. However, over the past decades, there has been great concern about climate change issues in Egypt, and allowing people to explore environmental issues in addition to participating in solving these problems creates individuals who can make responsible decisions and take responsible actions. Successful CCE in Egypt now need not merely teach environmental issues; rather, it requires a great effort from the education system and the media to deliver the message to more Egyptians.

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CCE increases people's knowledge and awareness of the environment and its associated challenges; develops the skills and experience needed to meet the challenges; and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action to improve the environment. However, although CCE helps deepen individuals' understanding of environmental issues, such education in Egypt still only consists of providing students with some environmental facts and figures. The US Environmental Protection Agency holds that environmental education should not only provide students with information regarding environmental issues, by which standard Egypt's formal education system is not providing students with all elements of environmental education.

Nevertheless, Egypt struggles against many environmental issues, particularly those related to human interactions with the environment and natural resources. Given the essential relationship between environmental protection and development and the fact that Egypt is facing serious environmental issues, it has become necessary to educate the public on environmental issues in general and on climate change in particular. Effective environmental education is needed to provide students with what is required for long-term sustainability. Unfortunately, private information on this issue in Egypt is limited or was not available to us at the time of this study. However, in an interview study conducted by the American University among three public schools in three different cities, 90% of all the students had poor knowledge of environmental issues.

To address this deficit in public schools, current curricula must be improved. We recommend that school systems add effective environmental courses and develop sound policies based on integrated systems. All of these climate change education actions will increase Egyptian students' awareness of and engagement with climate change issues, and Egypt has an opportunity at the COP 27 climate conference to motivate national interest in the environmental and scientific press regarding steps the nation can take to confront climate challenges as well as to learn from other nations' CCE experiences to enhance Egypt's education system.

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