2-2022

CLIMATE CHANGE AWARENESS IN THE UNITED ARAB EMIRATES

Mariam Matar Abdulla Mohammed Almheiri

جامعة الإمارات العربية المتحدة
United Arab Emirates University

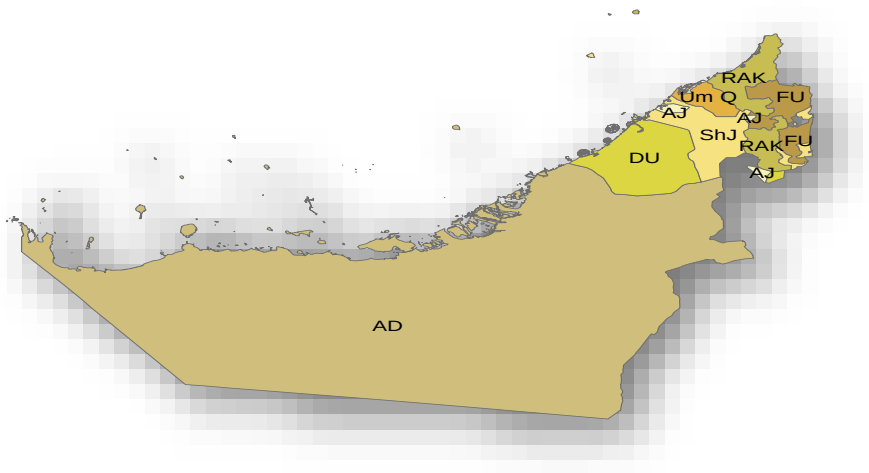
MASTER THESIS NO. 2022:1

College of Science

Department of Biology

CLIMATE CHANGE AWARENESS IN THE UNITED ARAB EMIRATES

Mariam Matar Abdulla Mohammed Almheiri



February 2022

United Arab Emirates University

College of Science

Department of Biology

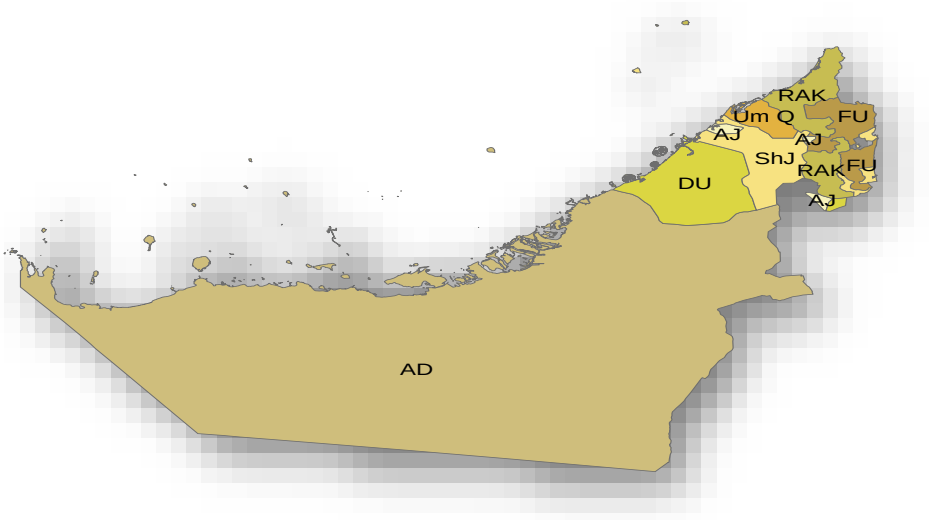
CLIMATE CHANGE AWARENESS IN THE UNITED ARAB EMIRATES

Mariam Matar Abdulla Mohammed Almheiri

This thesis is submitted in partial fulfilment of the requirements for the degree of Master of Science in Environmental Sciences

February 2022

United Arab Emirates University Master Thesis
2022:1



Cover: Arc map output for the United Arab Emirates used in the research

(Photo: Mariam Matar Abdulla Mohammed Almheiri)

Print: University Print Service, UAEU 2022

Declaration of Original Work

I, Mariam Matar Abdulla Mohammed Almheiri, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled "*Climate Change Awareness in the United Arab Emirates*", hereby, solemnly declare that this thesis is my own original research work that has been done and prepared by me under the supervision of Dr. Abdelgadir Abuelgasim, in the College of Humanities and Social Sciences at the UAEU. This work has not previously formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

Student's Signature: 

Date: 20/03/2022

Approval of the Master Thesis

This Master Thesis is approved by the following Examining Committee Members:

1) Advisor (Committee Chair): Abdelgadir Abuelgasim
   Title: Associate Professor
   Department of Geography and Urban Sustainability
   College of Humanities and Social Sciences

   Signature  Date 20/3/2022

2) Member: Salma Daiban
   Title: Assistant Professor
   Department of Clinical Psychology
   College of Medicine and Health Sciences

   Signature  Date 30/3/2022

3) Member (External Examiner): Hatim Sherif
   Title: Professor
   Department of Civil and Environmental Engineering
   Institution: University of Texas, USA

   Signature  Date 28/3/2022

This Master Thesis is accepted by:

Dean of the College of Science: Professor Maamar Benkraouda

Signature Maamar Benkraouda

Date April 8, 2022

Dean of the College of Graduate Studies: Professor Ali Al-Marzouqi

Signature Ali Hassan

Date April 8, 2022

Abstract

Climate change has focused public attention in the United Arab Emirates (UAE) on the role of society in environmental protection. The objective of this study was to determine the level of public awareness of climate change in the seven emirates of the UAE. The study also aimed to determine the spatial and geographical distribution and gender differences, as well as to investigate the possible influence of human activities on climate change impacts. In a cross-sectional survey, the researcher used the questionnaire to collect data from a sample of 4000 participants to answer the research questions. The drop-off-pick-up (DOPU) method was used to distribute the questionnaires to increase the amount of data collected, which was then analyzed quantitatively. The quantitative results showed that awareness of climate change was highest in Umm Al-Quwain emirate (52.5%) and lowest in Ajman (50.3%). When broken down by gender, awareness of climate change was lower among female participants (45%) than male participants (56%). The study argues that climate change awareness in the UAE needs to be raised in a number of ways, including the inclusion of climate change in school curricula and media campaigns to raise awareness in society. The study's findings suggest for policy makers and educators to develop a climate change education program and encourage the public to play an important role in mitigating the negative impacts of climate change in the UAE. As the demographic structure of the UAE society is multinational and multicultural, the study recommends further research on the influence of the socio-cultural background of different nationalities on promoting awareness and formulating common climate change strategies and policies.

Keywords: Climate Change, Public Awareness, Spatial Distribution, Gender Impact, Human Activities, Education Program.

Title and Abstract (in Arabic)

الوعي بالتغير المناخي في دولة الإمارات العربية المتحدة

الملخص

حظي تغير المناخ باهتمام الرأي العام في دولة الإمارات العربية المتحدة خاصة فيما يتعلق بدور المجتمع في حماية البيئة. الهدف من هذه الدراسة هو تحديد مستوى الوعي العام بتغير المناخ في الإمارات السبع بدولة الإمارات العربية المتحدة. كما هدفت الدراسة إلى تحديد التوزيع المكاني والجغرافي والاختلافات بين الجنسين، وكذلك التحقيق في التأثير المحتمل للأنشطة البشرية على تغير المناخ. في مسح مقطعي استخدم الباحث الاستبانة لجمع البيانات من عينة قوامها 4000 مشارك للإجابة على أسئلة البحث. تم استخدام أسلوب الاستلام والتسليم (DOPU) في توزيع الاستبانة لزيادة كمية البيانات التي تم جمعها والتي تم تحليلها لأحقا. أظهرت نتائج التحليل ألكمي أن إمارة أم القيوين لديها أعلى مستوى من الوعي بالتغير المناخي (552.٪)، بينما سجلت عجمان أدنى مستوى (350.٪). عند التقسيم حسب الجنس، كان الوعي بتغير المناخ أقل بين المشاركات (45٪) مقارنة بالذكور (56٪). ترى الدراسة أن الوعي بتغير المناخ في دولة الإمارات العربية المتحدة يحتاج إلى أن يتم رفعه بعدة طرق، بما في ذلك إدراج تغير المناخ في المناهج المدرسية والحملات الإعلامية لزيادة الوعي المجتمعي. تكمن الآثار المترتبة على النتائج التي تم الحصول عليها بالنسبة لواضعي السياسات والمعلمين في تطوير برنامج تعليمي حول تغير المناخ وتشجيع أفراد المجتمع على لعب دور مهم في التخفيف من الآثار السلبية لتغير المناخ في دولة الإمارات العربية المتحدة. نظرًا لأن التركيبة السكانية لمجتمع الإمارات تتسم بتعدد الجنسيات والثقافات، توصي الدراسة بإجراء مزيد من البحث حول تأثير الخلفية الاجتماعية والثقافية للجنسيات المختلفة على تعزيز الوعي وصياغة سياسات وإجراءات موحدة خاصة بتغير المناخ.

مفاهيم البحث الرئيسية: تغير المناخ، مستوى الوعي، التوزيع المكاني، والاختلافات بين الجنسين، البرنامج التعليمي لتغير المناخ.

Acknowledgements

My thanks to all who have supported me in the UAEU. I would like to thank my committee for their guidance, support and help during the preparation of this thesis, especially my supervisor Dr. Abdelgadir Abuelgasim, who steered me in the right direction of research activities and filled my knowledge gaps in this field in which I was devotedly engaged. My sincere gratitude goes to the members of the advisory committee who guided and mentored me during thesis preparation. My sincere thanks to Ahmed Taha (Library Research Desk) for reviewing and proofreading the text. My special thanks go to my brother Mohamed for guiding, encouraging, and supporting me along the way. I am deeply indebted to my beloved family members, especially my parents and dear brothers and sisters, for their active support and kindness.

Dedication

To my beloved parents and family

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ArcGIS	Aeronautical Reconnaissance Geographical Information System
CC	Climate Change
CCGW	Climate Change and Global Warming
DOPU	Drop-Off and Pick-Up Method
GW	Global Warming
SPSS	Statistical Package for the Social Sciences (Software)
UAE	United Arab Emirates

Chapter 1

Chapter 1: Introduction

1.1 An Overview

The phenomenon of climate change currently poses a challenge and threat to both human society and natural ecosystems. However, the results of studies on public opinion have shown that public awareness and concern about climate change varies greatly from country to country. Although these findings have greatly improved people's understanding of the complications of climate change, people's perceptions to climate risks change over time due to geographic, socioeconomic, and cultural differences within a country, i.e., climate change literacy is country-specific (Lee et al., 2015). It is worth to mention that the 26th United Nations Climate Change Conference (COP26), 31 October – 13 November 2021, held in Glasgow, UK, which announced Glasgow Climate Pact that addresses a wide range of issues to be solved globally and collaboratively (UNFCCC, 2021).

Climate change refers to a long-term change in the global climate while global warming refers to climate change that causes an increase in the average temperature of the lower atmosphere (Riebeek & Simmon, 2005). Climatic history has been roughly divided into two geoclimatic states: i) hothouse (or greenhouse), when the earth's climate was generally warm, and ii) icehouse, when ice masses spread ubiquitously over land and water (Riebeek & Simmon, 2005; Zalasiewicz & Williams, 2021).

Spencer (2008) reported that scientists, as early as 1820, knew that certain gases (e.g., Carbon Dioxide, Methane, Nitrogen Oxide) had the ability to trap the sun's heat to cause what has recently been called the greenhouse effect. Carey (2012) argued that this noticeable increase in atmospheric temperature is related to massive consumption of hydrocarbon

energy resources and increased greenhouse gas (GHG) emissions. These human activities (anthropogenic) have caused global warming resulting in an increase in global ambient temperature of 1.53°F (Fahrenheit) or 0.8°C (Celsius) between 1880 (post-industrial era) and 2012- (technology dominant era).

Since the post-petroleum discovery era, the UAE has experienced rapid urbanization in support of infrastructure, which has been accompanied by increased consumption of hydrocarbon energy (oil and gas) in cooling, heating, and transportation. Therefore, this increased energy demand eventually led to an increase in greenhouse gas emissions in urban areas of the UAE. Therefore, the UAE is currently facing a typical challenge from the effects of climate change. Accordingly, the UAE has established the Ministry of Climate Change and Environment to actively participate in researching and combating global climate change. In 2023, the UAE is hosting the forthcoming UN Climate Change Conference (COP28) in Dubai to express the UAE's special concern to participate in global efforts to combat the effects of climate change.

The UAE government's concern about climate change has triggered active funded research in this field from various aspects, such as climate change and environmental public awareness (Al Blooshi et al., 2019), potential impacts of climate change on agricultural and livestock production, besides water resources development (Al Blooshi et al., 2020), public and environmental health (Salam, 2015), water resources management (Elhakeem et al., 2015), air transportation (Bernabeo et al., 2018), climate policy integration (Al-Sarihi & Mason, 2020), and high-building cooling and heating (Sallam, 2020).

This study investigates whether people in the UAE are aware of climate change and global warming and whether they are aware that these are caused by human activities. The study specifies these activities and their potential impacts to raise public awareness. The aim of this study is to provide sufficient information about climate change awareness and literacy in the UAE, its spatial and geographical distribution, awareness among different genders, and the impact of climate change causing factors on human activities in business, industry, and lifestyle in the UAE.

To achieve these goals of the study, a questionnaire was developed and distributed throughout the seven emirates to determine the public's level of knowledge about climate change and global warming. The questionnaire asked respondents if they knew that climate change phenomenon exists, that it is caused by human activities, such as exhaust emissions from transportation and smoke from industrial facilities. This study is examining the level of climate change awareness and literacy in terms of its distribution in different geographical regions of the UAE.

1.2 Statement of the Problem

Currently, the issue of climate change has become an international concern, as this environmental phenomenon is widely seen as a man-made hazard. The United Arab Emirates is also very concerned about this issue, as the rapid growth of cities and the associated change in the lifestyle of residents in recent years has led to an undesirable dependence on products and activities that are not considered environmentally friendly, such as hydrocarbon uses, transportation emissions, plastic waste, home cooling and heating, and deplantation.

This study is crucial in tackling awareness level of the UAE residents about the impact of climate change on their lifestyle activities.

This study argues that raising awareness among the residents through diverse channels, such as public education, media, and society cooperation will minimize the adverse of climate change (Stevenson et al., 2017). So, geographical location and socio-cultural background have been reported to play a key role in developing awareness of the surrounding environment and its conditions (Al Blooshi et al., 2019).

1.3 Research Objectives and Outcomes

a) Provide information and guidance on the geographical distribution of low awareness of climate change and identify key targets for awareness campaigns.
b) Provide guidance and expertise for the development and dissemination of materials, tools and information resources to support climate change education and the teaching process.
c) Provide guidelines for integrating climate change education programs with community organizations to jointly assess and address climate change impact issues.

The expected outcomes of this study are (i) to develop a climate change education program that could be implemented in UAE schools, (ii) to explore the types of programs that could work in different regions, and (iii) to present the program to researchers and environmental educators for further improvement.

1.4 Research Aim

This study aims to identify the awareness of climate change in different emirates of UAE focusing on spatial and geographical distribution, genders, and the potential impact of various human activities on inducing climate change-related effects.

1.5 Research Questions

The proposed research questions guide the investigation of the research problem and validate the research hypotheses regarding climate change awareness in the UAE. These research questions are:

a) RQ1: Does geographic location affect individual's climate change awareness?
b) RQ2: Is there a significant difference between gender climate change awareness?
c) RQ3: What is the impact of education on climate change awareness?

1.6 Research Hypotheses

The following research hypotheses are formulated to measure the level of awareness of climate change in the UAE population:

a) H1: Climate change awareness is shaped by geographic location.
b) H2: Climate change awareness and response varies by gender.
c) H3: Inclusion of climate change curricula in schools increases awareness.

Climate change has many different causes, but it is primarily associated with human intervention and the emission of greenhouse gases. These man-made effects of climate change and global warming can be mitigated by contributing to mitigation of emissions and adaptation to the effects of climate change in developing countries. Mitigation means reducing greenhouse gas emissions, while adaptation aims to reduce the risks posed by the impacts of climate change (Czunyi, 2018). The next section reviews the existing relevant literature that discusses climate change issues of interest to this study.

1.7 Relevant Literature

The aim of this literature review is to highlight patterns of climate change awareness, adaptation strategies, geographical scaling, impact of public opinion on climate change awareness, gender awareness of climate change, implementation of climate change education program in different regions, such as America, Africa, and Asia.

1.7.1 Vulnerability and Adaptations to Climate Change

The environmental risks and influence of climate change have attracted massive research activities in developing countries for future adaptation. Adger et al. (2005) stated that the global climate is changing and will be continuing to keep changing into the next century at a pace unprecedented in recent human history. Nevertheless, all societies need to improve their adaptive capacity to cope with both current and future climate change outside their existing coping domains. They argue that all societies are fundamentally adaptive and that there have been many situations in the past where societies have adapted to climate change and similar risks successfully.

The challenges of climate change for development are in the present. Observed climate change, current climate variability and future expectations of change are changing the course of development strategies - development agencies and governments are now planning for this adaptation challenge. So, the key challenge for developing countries at the level of local natural resource management and at the level of international collaboration and policies, is to promote adaptive capacity in the context of competing sustainable development goals (Adger et al., 2002).

Society's vulnerability to the climate change-associated risks may worsen existing social and economic challenges, particularly for those

segments of society in rural populations in developing countries that depend on natural resources that are sensitive to climate change, such as agricultural, fisheries, and livestock production (Al Blooshi et al., 2020).

1.7.2 Successful Adaptations to Climate Change Across Scales

Climate has physical and environmental impacts that affect different levels of society, requiring them to take the necessary actions to decrease the generated impacts of climate change as adaptation strategy; these actions are often constrained by institutional processes. Adapting to climate change requires decisions across a landscape of various actors, ranging from individuals, businesses and civil society to public institutions and governments at local, regional, and national levels, as well as international organizations.

Adger et al. (2003) investigated vulnerability to future climate change in three developing countries (Brazil, Tanzania, and Bangladesh), which is likely to have distinct characteristics and create new vulnerabilities. They argued that successful adaptation to climate change depends on a specific spatial and temporal scale related to the adaptation strategy. Therefore, the achievement of a country's adaptation objectives depends on the effectiveness of the objectives being achieved through the legality of the measures taken by the country.

Regarding adaptability to climate change impact, Vincent (2007) reports that adaptive capacity or is a multi-dimensional phenomenon determined by complex interactions between multiple factors at different levels. Adaptive capacity is often used when assessing the potential to adapt to future climate change by allocating assets and resources to facilitate adaptation actions. To represent this multidimensionality, Vincent has proposed two empirical indices of adaptive capacity that can

be used at different levels of analysis in the African context: (i) a national index for cross-country comparison and (ii) a household index for cross-household comparison; however, the structure of each index is scale-specific. The author argues that understanding the different adaptive capacities is a prerequisite for targeting interventions to reduce the adverse impacts of climate change.

Cash and Moser (2000) note that in the practice of environmental assessment and management, the importance of using scale and cross-scale dynamics to understand and address global climate change is evident. Assessing the challenges posed by climate change could be enabled through the application of these scales or models by (i) leveraging frontier organizations, (ii) leveraging scale-dependent comparative advantage, and (iii) employing adaptive assessment and management strategies.

Wilbanks (2002) reasons that issues of geographic scale in integrated climate change assessments enhance the ability to address scaling issues in the following ways:

a) Increasing the availability of data at the local or small-regional level.
b) Referring to key themes and indicators.
c) Improving longitudinal databases related to complex nature-society interactions and multiple pressures.
d) Identifying key aspects of macro- and micro-scale interaction.
e) Improving the understanding of these key interactions and exploring tools for dynamic modeling of complex systems.

In a survey conducted in the United States, for example, people's opinions about climate change and global warming were inconclusive. This study was the first to provide high-resolution estimates of the public's

beliefs about climate change, risk perceptions, policy preferences, and behavior in the United States.

1.7.3 Climate Change Core Issues

1.7.3.1 Public Opinion and Individual Related to climate change core issues

Leiserowitz (2006) indicated that public perceptions of risk can fundamentally force or constrain political, economic, and social actions to address risk. For example, public support for or opposition to climate policies (e.g., treaties, regulations, taxes, subsidies, etc.) is strongly influenced by public perceptions of the risks and dangers of global climate change. However, the climate measures imposed can influence the behavior and beliefs of different groups of people. In this context, the public risk perception of climate change is crucial in many countries. Leiserowitz argued that it is important to be aware of the knowledge, cultural preferences, responsibility, and trust that influence individual views on climate change.

Kelly and Adger (2000) discuss approaches to assessing vulnerability to climate change and variability and attempt to clarify the relationship between the concepts of vulnerability and adaptation. In the context of developing a policy-relevant framework, the authors defined the concept of vulnerability to as the ability of individuals and social groups to respond to, i.e., cope with, recover from, or adapt to external stresses that affect their livelihoods and well-being from socioeconomic perspective. From this perspective, the vulnerability or security of a group is determined by the availability of resources and by the entitlement of individuals and groups to avail themselves of those resources.

Sampei and Aoyagi-Usui (2009) pointed out that much of the change in public opinion about climate change in the United States and European countries can be attributed to media coverage, which have a major impact on public concern and trends. The authors also note that electronic media and mass communication efforts are unlikely to be effective in influencing public opinion regarding the accumulated fact about climate change. They also report that the issue of climate change should be addressed in the future through a national strategy, also found that individuals will not act and change their behavior unless the whole society tends to do the same regarding climate change.

According to Whitmarsh (2009), community members should realize that they play a role in causing some types of climate change impacts; therefore, they are affected by the impacts produced and have a social responsibility to deal wisely with climate change/global warming issues. The author argues that the differences between climate change and global warming must be clearly understood. The author also examined the awareness of the main causes of climate change and global warming in different geographical areas where the misconceptions that may arise. The author asserts that a distinction between public understanding and commitment to climate change/global warming is essential.

Whitmarsh claimed there was a lack of knowledge and a weak link between climate change and global warming. So more effective communication efforts need to be made to draw attention to the danger of the problems. Moreover, the problem may be that there is an imbalance between the importance of communication and the public impact of climate change/global warming. Therefore, future research needs to find appropriate ways to reduce the knowledge and information gap.

1.7.4 Global Climate Change

Parmesan and Yohe (2003) assessed the extent to which recent observed changes in natural biological systems were caused by climate change by measuring a globally coherent fingerprint of the effects of climate change in a natural system. They found that the coherence characterizing distinct climate change impacts on different species and geographic regions was variable. Their study defined the relationship between climate change and biological systems to minimize the factors influenced by climate.

Parson et al. (1997) Integrated assessment models of global climate change are a process that seeks to integrate knowledge from multiple disciplines that address information policy, knowledge structuring, prioritization of key uncertainties, and advance knowledge of broad system interrelationships and feedbacks. Researchers have found Integrated Assessment to be a challenge for boundary assessment to inform policy and decision making. Integrated assessment refers to processes that have diverse knowledge that can be used to explore how human development and societal decisions interact with and influence the natural world.

1.7.5 Climate Change Awareness

The advent of the media has helped raise awareness of climate change among various social groups. With this increase in awareness, care has been taken to examine the impact of awareness on the behavioral intentions of individuals. Arlt et al. (2011) investigated the relationship between climate change awareness and media use and how it can improve people's behavior. They argue that there is no exact effect of behavior change due to media influence. Although the researchers found no direct effect of media on awareness, they claimed that there is an indirect effect

of political television and magazines on awareness. However, the media can affect people's attitudes in the long run. Ultimately, the researchers concluded that the media does not always affect climate change awareness or change people's behavior.

Marshall et al. (2013) found that climate change awareness is associated with improved adaptive capacity, i.e., the human potential to transform existing primary resources into successful adaptation strategies. The authors also focused on how to develop awareness of climate change that began to impact industries. They claim that climate change awareness is most important in primary products. Developing climate change awareness programs for people in industries and business will therefore help them adapt successfully in the future. Marshall and others also argue that research and development are important for the adaptive capacity of industries in the future. Government agencies, communities and other institutions that support primary industries will also play an important role in implementing knowledge and reducing the risk of climate change.

Adio-Moses and Aladejana (2015) assessed knowledge and awareness of global warming among residents of industrial areas of an urban community in a developing country using Nigeria as a case study. The authors focused on the level of knowledge and awareness of the causes and effects of global warming among residents of an industrial area in Ibadan to have found that awareness of global warming is low, and people do not pay due attention to the importance and implications of this issue. They argue that residents are aware of the concept of global warming and the activities that lead to this problem, but people have a misconception about this issue and do not understand that the impact and threat will be felt in the coming decades. The main cause of this misunderstanding among people was the high level of poverty and the

level of illiteracy. The researcher stated that it is difficult to mitigate the effects of global warming if people cannot change their lifestyle.

Lee et al. (2015) shed light on the potential predictors of public awareness of climate change in relation to risk perception worldwide. The authors argue that population screening, improving social characteristics, geography, perceived well-being, and beliefs influence public awareness of climate change and opinion in Latin America and Europe. They claim that the strongest factor in predicting climate change awareness is education worldwide. Education, climate literacy, and public understanding of local climate change need to be improved. The impact of human activities is one of the risks associated with climate change that the public around the world needs to understand.

The first global assessment of the factors underlying both climate change awareness and risk perception is based on a cross-sectional survey. The result of this survey will support various research cultures in anthropology, which has studied people's connection to their culture and society, as well as psychology, sociology, geography, and other fields. The authors stated that communicators addressing climate change risks should develop strategies based on the predictors of public awareness of climate change and their target audience's perception of risk.

Gender awareness of climate change has attracted much research attention. Shahid (2012) discussed climate change awareness and adaptation through local planning in Punjab, Pakistan. Shahid argued that climate change awareness in the region was low. The author claimed that gender inequality was a reason for low awareness among women, which was even more complicated in Pakistan due to old cultural traditions. This gender inequality has resulted in a very large gender imbalance in Pakistan's education system, especially in primary education. On the other

hand, women in Pakistan face socio-cultural barriers even in primary school and women in Pakistan do not have the same rights and opportunities as men.

According to Shahid, many parents do not want to send their girls to schools because the nearest schools are mixed-sex. Inadequate women's schools, lack of access and very few female teachers in schools prevent women's education in Pakistan. In conclusion, the researcher stated that the female literacy rate in Pakistan is only 36% while the male literacy rate is 64%. Moreover, women's lack of participation in the family economy and society in Pakistan is an obstacle to their education. She explains that most parents think that their daughters will be housewives in the future and will not earn anything for their families, so it is meaningless for them to educate their daughters. Women's education in Pakistan is a problem due to severe poverty, dowry issues, social norms, and early marriage.

1.7.6 Climate Change Education Program

The United Nations Organization strives to integrate its Sustainable Development Goals (SDGs) into the different levels of the education system. According to Demaidi and Al-Sahili (2021), students' knowledge and daily behaviors related to climate change were studied and included the important role of the college in spreading and raising awareness. The authors examined the role of the college in climate change issues and the level of students' awareness of climate change in developing countries. They found that the interest of female and male students in environmental issues and activities was not satisfactory and gender equality, i.e., treating men and women fairly with equal opportunities, did not seem to be an issue.

Female students have less knowledge about climate change compared to male students. It has a positive impact on the awareness of female students if they study engineering or are members of student societies. Demaidi and Al-Sahili found that female students from engineering faculties or members of student associations had higher awareness than female students from other faculties or who were not active in student associations. The authors found that students' awareness of climate change was low regardless of gender or faculty. The existing university curriculum did not provide students with information about climate change. The authors reported that courses on climate change are needed at the university level and need to be introduced.

Dal et al. (2015) examined the extent to which professional development workshops in climate change awareness and adaptation are related to Turnkey social studies and science teachers' awareness of climate change. They argue that the more awareness teachers have of climate change, the greater it is among their students. The authors contend that all young people in society or the new generation need to increase their level of knowledge and awareness through science education. Science education has helped to raise teachers' awareness of climate change and environmental issues and improve their ability to teach students.

The argument was that the more their students are, the greater their teachers' awareness of climate change. The authors claim that all young people in society or the new generation need to increase their level of knowledge and awareness through science education. Science education has helped to raise teachers' awareness of climate change and environmental issues and improve their ability to teach students. They state that teachers who are trained and qualified have an effective impact on climate change awareness.

Climate change education in the context of education for sustainable development has received particular attention from educators and policy makers. Haichour et al. (2007) pointed out that the concept of sustainable development can be easily taught and explained in the context of climate change education. Education for sustainable development (ESD) refers to the knowledge that people must grow or change their behaviors and cause little or no damage to the environment so that it will last for a long time. In this article, researchers have highlighted the importance of the role of education in dealing with and responding to climate change.

Climate change education (CCE) refers to processes aimed at improving the level of preparedness and response to the challenges of climate change in the education system. Mochizuki and Bryan (2015) argue that CCE is best addressed within the framework of ESD, which is one of the pedagogical theories or methods and theories of teaching to enable learners to engage with the complexities of climate science. The framework of ESD must successfully work with learning skills which are knowledge, skills or competencies, attitudes, behaviors, and values. The authors claim that this will improve the response of the education sector to climate change.

Mochizuki and Bryan indicate that one of the most important mechanisms through which national governments can ensure and demonstrate their commitment and loyalty to national and international frameworks related to human rights, education, environment, and sustainable development. Consequently, people should take responsibility for creating a sustainable future by demonstrating the multiple opportunities that exist through individual and collective choices to initiate change and create solutions for a sustainable lifestyle. Furthermore, the

authors stated that awareness raising efforts are the concepts of mitigation and adaptation, which are an overall strategy to reduce greenhouse gas emissions and the effects of climate change.

Much research has attempted to identify effective climate change education strategies using a variety of methods. McNeal et al. (2014) reviewed the results of educational strategies from the literature to develop effective climate change teaching methods. The need to raise awareness of climate change is a challenge for educators. Effective teaching techniques were a necessity to raise awareness on climate change, which was seen as a challenge for educators. Therefore, researchers need to develop an environmental education program that will enhance educators' skills and knowledge on the subject. Monroe et al. (2019) identified two themes common to most environmental education programs: focusing on personally relevant and meaningful information and using active and engaging teaching methods. The first theme states that it was important to link the unclear threats of climate change to personal views and make them meaningful to learners. The second theme: activities were intentionally designed to engage people to improve climate change education and attract learners.

Dresner (2010) describe the implementation of the two themes, music, and graphics for a lesson in high school to help students understand the risk of the climate problem, role-playing, and simulations used in environmental education materials to understand other perspectives. Mutlu and Tokcan (2013) used visual images that explained the idea of climate change with words or pictures in books. They also conveyed content about climate change through activities that asked questions and laboratory investigations that explored the topic. In contrast, Klosterman and Sadler (2010) examined four other themes of instructional strategies: Discussions

and conversations that help learners think more deeply about concepts, compare perceptions, understand different opinions, and reflect on their knowledge.

Interacting with the scientific community and scientists and using their various study data and technologies facilitates understanding of the process of climate science (Faria et al., 2015). Similarly, they addressed misconceptions or misconceptions they threw when developing workshops for secondary science teachers to conduct climate change projects for schools and created a community for students to communicate with each other about climate change concepts (Liu et al., 2015).

Monroe et al. (2019) summarizes several outcomes of the education programs, including increasing awareness and knowledge of the science of climate change and its potential impacts, both locally and globally. The programs aim to go beyond imparting knowledge and attitudes about climate change by building skills to evaluate scientific conclusions. In addition, a review of research cannot begin to describe the state of climate change education and policy, but additional research could better understand how nations address climate change, the value or cost of a national curriculum that determines how this topic is presented, gaps in education, and whether texts and programs strive for the lowest level of agreement or the greatest vision. Their findings suggest that climate change education programs that build on the successes of others can play an essential role in developing communities that embrace such practical visions.

In science education, one framework, the Knowledge Integration Framework, suggests that educators should make content accessible by connecting to personally relevant experiences or building on students'

ideas; help students learn from each other by allowing them to compare ideas and discuss points of view; make thinking visible by using models, visual representations, data collection, and analysis; and promote lifelong learning by creating an inquiry process and motivating its use (Linn et al., 2000).

Wynes and Nicholas (2017) highlight the gap in climate action, defined as the recommendation of education and government missing the most effective individual action. The authors argue that there is a gap between education and government recommendations that reduces individual actions that cause climate change. They concluded that there are opportunities to improve existing education and communication structures to promote the most effective emission reduction strategies and close this gap. The researchers recommended reducing an individual's greenhouse gas emissions by having one less child, living without a car, avoiding air travel, and eating a plant-based diet (Murtaugh & Schlax, 2009).

Using interactive technology to enhance students' understanding of the greenhouse effect and global warming is considered an innovative approach to teaching. Varma and Linn (2012) used computer program to describe and share information about the greenhouse effect and global warming for middle school students. The authors wanted to investigate whether a technology-enhanced curriculum module could help middle school students engage with complex science topics. They designed a technology-enhanced curriculum module called Global Warming: Virtual Earth for students to learn about the science of the greenhouse effect and global warming. Students organized experiments using the computer or the Internet instead of going to a place to meet people. The students used experimental activities with visualization in which a picture was created to represent the greenhouse effect. The authors believe that students'

understanding of the phenomena has increased, but still has room for improvement.

Teachers from the West Coast implemented the curriculum unit for two years for students in schools in the Southeast. The curriculum covered the topic of global warming Virtual Earth unit created a Web-Based Inquiry into Science (WIS), learning environment which was a system that worked by connecting the documents to the internet." The environment WIS combines information and resources from the Internet with visualizations to provide students and teachers with meaningful experiences in the classroom. The WIS environment contained six activities in the curriculum units that students can complete to follow the steps in the Inquire Map.

Varma and Linn (2012) summarized these activities as asking students to first watch a short video clip introducing the phenomenon of global warming and then use an online ecological footprint calculator to calculate their impact on the environment with various activities. Second, students learned about the Earth's energy balance and observed the energy conversion shown in the greenhouse visualization. Third, students conducted experiments with the visualization to learn about greenhouse gasses. Fourth, all students participated in an online discussion to share their knowledge. In the fifth activity, students used a more complex visualization to learn how population size affects greenhouse gas emissions and global warming. Finally, students created a family plan to reduce their own greenhouse gas emissions and recalculated their ecological footprint based on their planned behavior changes. The authors claim that the use of virtual experiments helps students gain a deeper understanding of the greenhouse effect and develop their behavior. They report that comparing additional practice in designing experiments for the

future with direct instruction on the science content of the unit was necessary.

1.7.7 Regional Climate Change Educational Programs

1.7.7.1 North America

Gharis et al. (2018), a research team from the North American Association for Environmental Education (NAAEE), challenged state environmental education associations in Wisconsin to develop professional certifications for individual environmental educators. The research team argues that professional certifications have several benefits for individuals, which include enhancing professionals' content and pedagogical knowledge, i.e., practice and methods for teaching, providing professional development opportunities, helping to increase competitiveness for needed research for positions, and providing recognition that relates to the ability to compete for positions and legal agreements. The benefits of professional certifications to the community included promoting respect for environmental education, which encourages people to believe in environmental education and increases the field credibility to improve their confidence quality, provide guidelines for professional development, and support continuous professional development opportunities.

The goal of the research team was to understand perceptions related to possible, professional certification for environmental educators in the state of Wisconsin. They note that future research should examine where professional certification or professional development makes the most sense for an environmental educator's career. Research should evaluate the effectiveness of individual environmental educators to make improvements in states that offer professional certification and whether certificates can be linked to nature center needs to improve the community.

1.7.7.2 South Africa

Teachers are considered one of the most important conduits for imparting knowledge to their students about the concepts underlying the causes, impacts, and solutions of climate change. Anyanwu and Grange (2015) examined the level of knowledge of high school geography teachers in the Western Cape region of South Africa about the science of climate change. The authors found that most participating teachers had significantly high levels of knowledge in climate science, with their knowledge levels higher in climate processes and causes of climate change than in climate change impacts and solutions.

Anyanwu and Grange also argue that misconceptions about the science of climate change among geography teachers could be transferred to their students and other teachers. They found that the solution to this problem is for teacher educators and policymakers to remain engaged in education. Geography teachers will develop a deeper scientific knowledge and understanding of climate change and promote the development of scientific knowledge of climate change in schools. The research was necessary to understand the dimension and level of scientific knowledge of climate change among geography teachers in each school district in the Western Cape and other parts of South Africa, and to explore the relationship between climate change and sustainable development and geography teaching. They suggested that teacher educators and policy makers should improve professional development programs that promote international knowledge and understanding of climate change concepts for teachers to improve education in schools.

Wals (2010) examines the three South African cases of developing materials for teacher education, designing materials for high schools, and designing and implementing a new course of study focused on teaching

and learning for climate change. This work was one of the first attempts in the country to incorporate deeper learning approaches to climate change education. The three tasks of teaching materials and curriculum design for climate education included a revised curriculum process known as CAPS (Curriculum and Assessment Policy), in which the Department of Basic Education in South Africa placed a strong emphasis on content delivery for teachers and caregivers. Development of EnviroTeach materials that provide key resources for teachers who have limited access to climate change teaching, training, and facilitation materials. The third case focused on curriculum development at the University of the Witwatersrand.

Vogel et al. (2015) shared and discovered more cases to illustrate what might be needed to enable learning for flexible and deep thinking about climate change. The researchers explore that the use of learning materials and curriculum development in the field of climate change can be used from a variety of perspectives. This work was one of the first attempts in the country to incorporate deeper learning approaches into climate education. They created a new curriculum for global change at the master's level. This curriculum sought to expand thinking about climate change and knowledge as it was presented in the university with the design process. One member of the team spent time interacting with other educators around the world and with local stakeholders to gain some ideas about learning for sustainability in the face of change. The authors summaries that incorporating skills and knowledge while facilitating critical dialogue and reflection from multiple perspectives will lead to new behaviors in addressing climate change.

Akrofi et al. (2019) highlighted some influential factors and the impact of knowledge gaps in South Africa to enable university students to respond to and influence climate change. Their findings showed that

university students were aware of the most common and direct causes and effects of climate change. However, they were not very aware of how factors such as meat consumption, improper waste disposal and car use, which they usually practice daily basis, can lead to climate change and how climate change affects some problems. They argued that students would not be able to educate others on how such factors contribute to climate change or how climate change affects major issues in South Africa.

Akrofi's research team examined how climate change affected the region and students when it occurred. Regional representations of climate change impacts and student engagement with climate change through workshops and campaigns had a significant impact on student knowledge, while membership of climate-related student clubs did not. The goal of the workshops was to increase students' understanding and awareness of climate change. The authors noted that organizations working on climate change should be encouraged to increase public engagement of students, especially in schools.

1.7.7.3 Asia

Selvaraj et al. (2017) explained an effective approach to promote climate change education to raise public awareness in India through multimedia. Multimedia introduces a framework in creating awareness and how rapidly the people using the framework can able to understand the importance of climate change. The impact of the changing climate is observed in all sectors that are basis of living like agriculture, water resources, coastal areas, forests and biodiversity, human health. They argued that raising public awareness through appropriate channels helps the public to understand the importance of climate change education. The

authors used various media as computers, television, and newspapers to share information with people. Selvaraj and other authors disseminated the impact of climate change regionally and internationally to address the problem, focusing on school children and communities where people who cannot read and write live. They presented a case study for Tamil Nadu and proposed a framework to explain what can be done at each level of communication.

Selvaraj's research team wanted to make the idea simple between people, take an action, and make all levels of people in the community aware of climate change. The five levels of community include people seeking information about climate science to discuss and make decisions about climate-related issues, people seeking and wanting to use climate data for their research and development work, people wanting to know more about climate conditions and how climate science is done, people seeking resources to teach others about climate, and people reporting on climate in the public media. They summarize that the impact of the framework, and the awareness created at various levels, will help students to have positive attitudes toward the environment and work to improve it at school, at home, and in the community with ability to define their climate change goals.

Chapter 2

Chapter 2: Methods

2.1 Introduction

This chapter discusses the procedures used to answer the research questions, resulting in the following questions:

1) Does geographic location affect individual awareness of climate change?
2) Is there a significant gender difference in climate change awareness?
3) What is the influence of education on climate change awareness?
4) What is the influence of human activities on climate change causation in the United Arab Emirates?

The chapter describes participants, materials, design, and data collection procedures.

2.2 Participants

The population used for the study included citizens and residents of the United Arab Emirates. According to Gay et al. (2012), an appropriate sample is the one that meets the requirements of the study. The sample for the study was selected based on the different geographical regions of the UAE and the willingness of the participants to participate in this study. Systematic random sampling was used to select participants for this study. This sampling procedure ensures that the sample is accurate and representative, i.e., the characteristics of the population were selected without any bias. 4000 males and females were randomly selected in different emirates (Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al-Quwain, Ras Al-Khaimah, Fujairah) with different levels of education (high school, bachelor, master, PhD and no formal education). Finally, locations with

greater population diversity are selected, such as large shopping malls and cafes.

2.3 Materials

The objective of this study was to determine the level of public awareness of climate change in the seven emirates of the United Arab Emirates. The study also aimed to determine the spatial and geographic distribution and gender differences, as well as to investigate the possible influence of human activities on the impact of climate change. In 2017, Abuelgasim developed a survey to achieve the objectives of the study. This survey consists of two sections. The first section of the survey included demographic information about the participants and asked them about their background.

Demographic information for this study included: Gender (male, female), age group (18-30, 31-40, 41-50, 51+), social status (single, married, divorced, widowed), employment status (public sector, private sector, unemployed), Education level (high school, bachelor's, master's, PhD, no formal education), nationality (UAE citizen, expatriate), and geographic residence (Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al-Quwain, Ras Al-Khaimah, Fujairah).

The second part of the survey included closed-ended questions to collect quantitative data from respondents. There was also a Likert question (see question 11) with a 5-point Likert scale from "not familiar" to "expert." Likert (1932) developed a method of measuring attitude scales that can be used to measure people's attitudes toward something. The Likert scale uses a series of questions with five response alternatives: strongly agree (1), agree (2), undecided (3), disagree (4), and strongly

disagree (5). Likert used the responses from the series of questions to create a scale to measure attitude (Sullivan et al., 2013).

In answering the questions, participants had to indicate the extent to which they were aware of climate change in the UAE, i.e., they were asked if they knew or had heard about climate change. Participants had a choice between "yes" and "no." Participants who answered "Yes" were then asked to rate their knowledge of climate change and indicate whether they believed that climate change was caused by human activities. Participants had to answer the question by indicating their knowledge or awareness of climate change on a five-point Likert scale with the following choices: Not aware (1), Little aware (2), Well aware (3), Very well aware (4), Expert (5). The rating system included a scale of 1to 5, where 1 meant that participants had no awareness or knowledge of climate change and 5 meant that participants were experts and believed that climate change was caused by human activities.

2.4 Reliability

Moses and Yamat (2021) argue that reliability is defined as the degree of accuracy of the instrument. Reliability means that accurate instruments can be used many times over different time periods and show clear and consistent results. Reliability is the degree to which the instrument consistently measures what it is intended to measure (Gay et al., 2012). Cronbach's alpha formula is one of the most commonly used reliability tests in social and organizational science (Brulle et al., 2012).

To ensure the reliability of the study, Cronbach's alpha was used for the (13) items of the survey in this study. The number of items was (13) and after deleting the items that describe with unreliable, the number of items reduces to (6) and was excluded from the total sample. According

to Cronbach (1984), the value of reliability is between 0.00 and 1.00, and values close to 1.00 mean that the studied items can be measured (Mohamad et al., 2014). Table 14 shows that the Cronbach's alpha values for the items were roughly the same for respondents with knowledge (α = 0.59) and without knowledge (α = 0.65), which means that the studied items can be measured.

Table 1: Reliability for awareness and unawareness

Items	Items No.	Reliability (α)
With knowledge (CC Awareness)	6	0.59
Without knowledge (CC Ignorance)	6	0.65

As we can see from Table (14), the reliability of the items for the study was close to 1, namely 0.59 for conscious respondents and 0.65 for unconscious respondents. This means that this survey has good reliability and can be used.

2.5 Design

To answer the research questions, the study was designed as a cross-sectional survey. This type of study is considered the most appropriate design when assessing participants' attitudes and knowledge. Cross-sectional studies are characterized by the collection of relevant information, i.e., data. Data are collected and there is no time dimension in this type of study, so the researcher can refer to data collection around time. The cross-sectional study to explore the extent of climate change in the United Arab Emirates was a descriptive study because it provided estimates of people's attitudes, their behavior in human activities, and their knowledge or awareness about climate change. Descriptive cross-sectional

studies are based on data on the entire population or a representative sample (Kesmodel, 2018). The researchers used a cross-sectional survey design to collect quantitative data. Quantitative data in surveys are usually self-reported, that is, respondents may describe their own behavior, attitudes, or knowledge in the survey (Lynne & Connelly, 2019). In addition, the design of a cross-sectional survey is a type of observational study (Setia et al., 2016). In this research, the level of awareness of climate change in the UAE, is an observational study that allows the researcher to measure the outcome of awareness in the UAE population.

2.6 Questionnaire

A structured questionnaire on the level of awareness about climate change was used to collect data from respondents. The Survey on Global Warming (GW)/Climate Change (CC) Awareness questionnaire, found in the Appendix, was designed to measure the level of public awareness and opinion about climate change in the UAE. The questionnaire started with demographic questions, followed by questions on public awareness and opinion, knowledge about climate change, such as the media source from which respondents heard about GW/CC, agreement that human activities are a major cause of GW/CC and in Emirati society that could contribute to GW/CC, and practices related to climate change. The questionnaire ended with a question on adaptation and whether there is a need for GW/CC public education in adaptation and mitigation.

To collect the primary data, the researcher used two methods, quantitative and qualitative. According to Creswell and Clark (2011), the results of a combination of qualitative and quantitative methods can contribute to an accurate understanding of the research problem. The author argues that the use of mixed methods allows the researcher to use numbers and words and apply skills in observing and recording human

behavior. The first part involves the collection and analysis of quantitative data, and the second part involves the collection of qualitative data to explain the quantitative results (Creswell, 2007).

In this study, the survey was distributed to measure respondents' awareness of climate change. In addition, this study also used a descriptive design to describe the population's awareness of climate change in the United Arab Emirates. This design method included residents from all emirates in the UAE. The respondents (n=4000) were randomly selected from the UAE population. The data obtained were statistically analyzed using Statistical Package for the Social Sciences (SPSS) and Aeronautical Reconnaissance Geographical Information System (ArcGIS) to interpret the survey results.

2.7 Data Collection Procedure

As the first step to conduct the study, the research topic was selected, which was climate change awareness in the United Arab Emirates. Then, a questionnaire to assess public awareness about climate change was used and distributed in the seven emirates. The questionnaire focuses on the assessment of climate change awareness and the level of awareness in relation to gender, the impact of geographic location, and human activities. Data collection and analysis took approximately one and a half study years. Questionnaire distribution took four weeks and data analysis took three semesters.

Data for this study were collected and entered into SPSS and ArcGIS statistical software. The two programmes were used to calculate the statistical analysis for each question in the survey and to measure the geographic distribution of the population. The survey attempted to represent and evaluate awareness, opinions, and policies in addition to the

introductory questions through the statistical analysis of the statements. Then, the results were interpreted based on the statistical analysis of the questions.

2.8 Ethical Considerations

Prior to data collection, a sample of the questionnaire was submitted to the appropriate authorities along with documentation outlining the purpose, objectives, and expected results of the study. Approval was obtained for the questionnaire, the survey method, and the geographic regions in which the questionnaire would be distributed. Each participant was informed of the purpose of the survey and study and the expected scientific contribution of the study. Participants were assured that their responses would be kept confidential and used only for the purpose of the study.

The survey officers did not record the names or identifiers of individual participants. The survey was distributed to participants using probabilistic random methods. A systematic random sampling method was used to survey participants. This method was chosen because it ensures a high level of confidence and accuracy, and also because each member of the group has an equal chance of being selected. The method is also simple, easy to understand and explain to data collectors, has a low risk factor, and is easily repeatable.

Chapter 3

Chapter 3: Results and Discussions

3.1 Overview of the Main Findings

This part of the study summarizes the data collected and the statistical results. Two types of software were used: SPSS for the analysis of the percentages and ArcGIS for the transfer and analysis of the data into maps for the analysis of the geographical regions.

3.2 Profile and Statistics of Respondents

Figure 1 shows where the survey was conducted in the seven emirates (Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al-Quwain, Ras Al-Khaimah, and Fujairah).

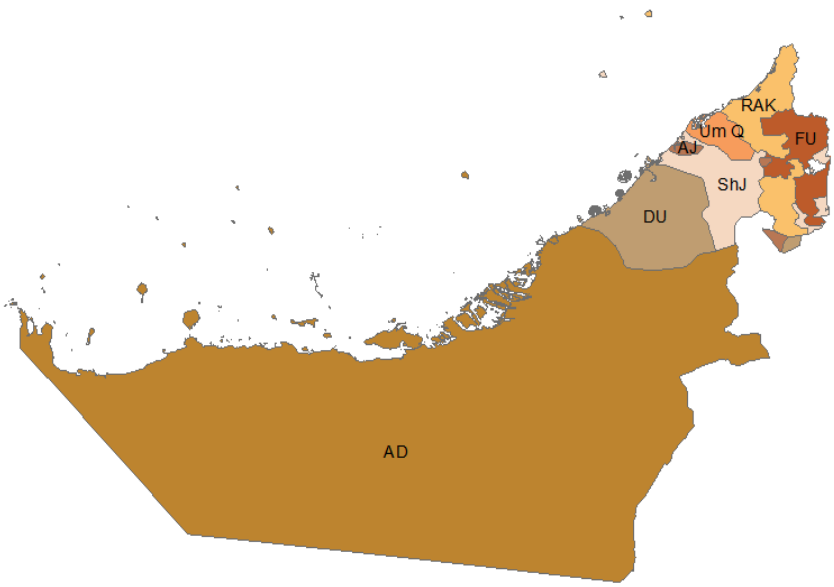


Figure 1: The UAE regions where the survey was conducted

As shown in Table 2 and Figures 2 and 3, 52.5% of respondents from Umm Al-Quwain are aware of the CCGW. 51.9% of respondents

were from Ras Al-Khaimah, 50.8% were from Abu Dhabi, Sharjah, and Fujairah, and the remaining 50.7% and 50.3% were from Dubai and Ajman, respectively. The highest percentage of awareness was found in Umm Al-Quwain and Ras Al-Khaimah. The percentage did not exceed 50.8% in the other emirates either. In contrast, the percentage of ignorant respondents was practically the same in all emirates: 48.1% in Ras Al-Khaimah, 49.2% in Abu Dhabi, Sharjah and Fujairah. The remaining ignorant respondents were from Dubai, Umm Al-Quwain and Ajman with 49.3%, 47.5% and Ajman with 49.3%, 47.5% and 49.7%, respectively. Therefore, it can be stated that Ajman has the highest value of ignorant respondents, while Ras Al-Khaimah has the lowest value of ignorant respondents. Table 2 and Figure 2 and Figure 3 illustrate the percentage of awareness and ignorance of CCGW in each emirate of the UAE. The study needed to cover the geographic area to measure the relationship between location and awareness.

Table 2: Awareness/ignorance of CCGW percentage in each emirate

Emirate	Aware of CCGW (%)	Unaware of CCGW (%)
Abu Dhabi	50.8	49.2
Dubai	50.7	49.3
Sharjah	50.8	49.2
Ajman	50.3	49.7
Umm Al-Quwain	52.5	47.5
Ras Al-Khaimah	51.9	48.1
Fujairah	50.8	49.2

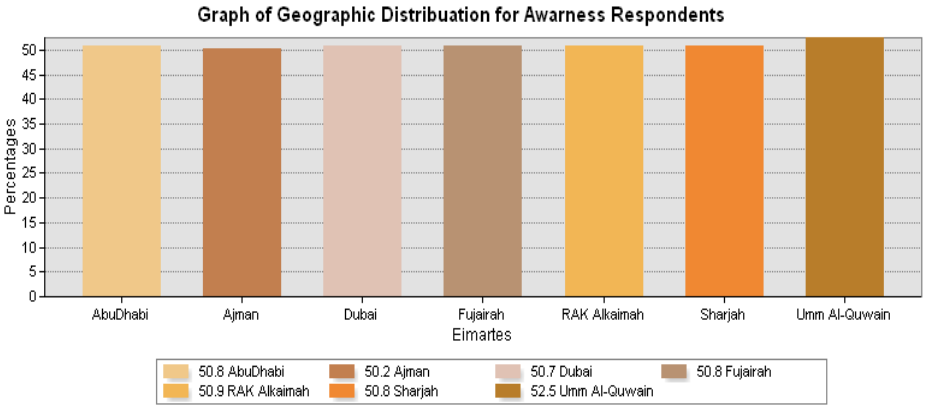


Figure 2: Climate change awareness percentage in each emirate

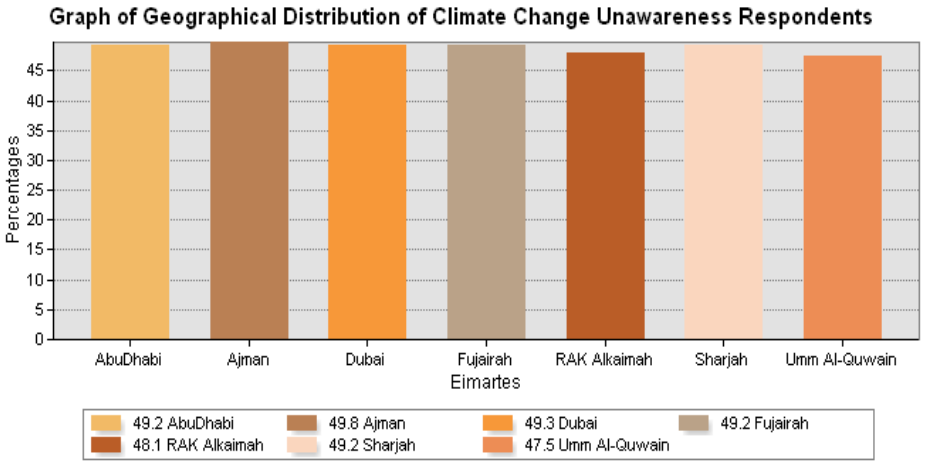


Figure 3: Climate change ignorance percentage in each emirate

The reason for this could be the high population density, which includes many foreign residents. Therefore, people who come from abroad can positively influence the knowledge pool of the local population. In addition, these two emirates are industrial areas in the UAE that deal with renewable resources that need to be environmentally friendly. For example, Sharjah has launched some solar energy projects which provide an alternative source of energy to reduce the emission of carbon dioxide

(CO_2) and save the environment. So, this initiative increases the knowledge of people about the importance of CCGW.

In contrast, the percentage of ignorant respondents was practically the same in each emirate, with Ajman having the highest value of 49.7%. The reason for this could be the lower interest of the residents in environmental issues and the smaller population compared to the other emirates. The study compared the percentage of awareness of climate change and globules (CCGW) with ignorance. Figure 4 shows the UAE map for gender while Figures 5 and 6 show awareness and ignorance for males. The study compared the level of awareness by gender. Table 3 shows that awareness and ignorance of CCGW per respondents' gender.

Table 3: Awareness and ignorance of CCGW by gender

Gender	Aware of CCGW (%)	Unaware of CCGW (%)
Male	56	44
Female	45	55

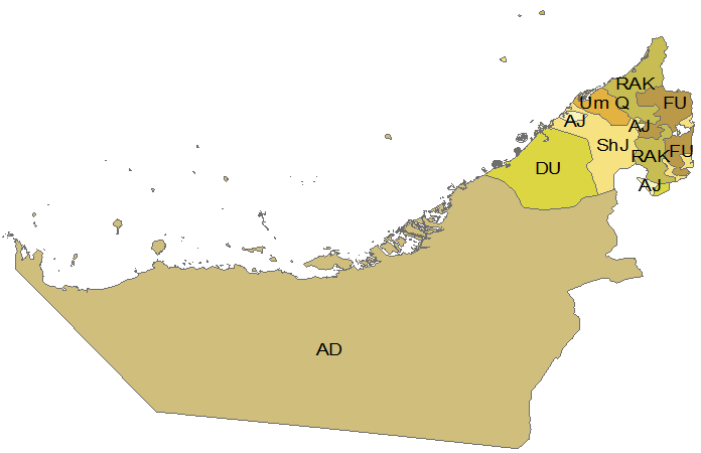


Figure 4: The UAE map for male respondents

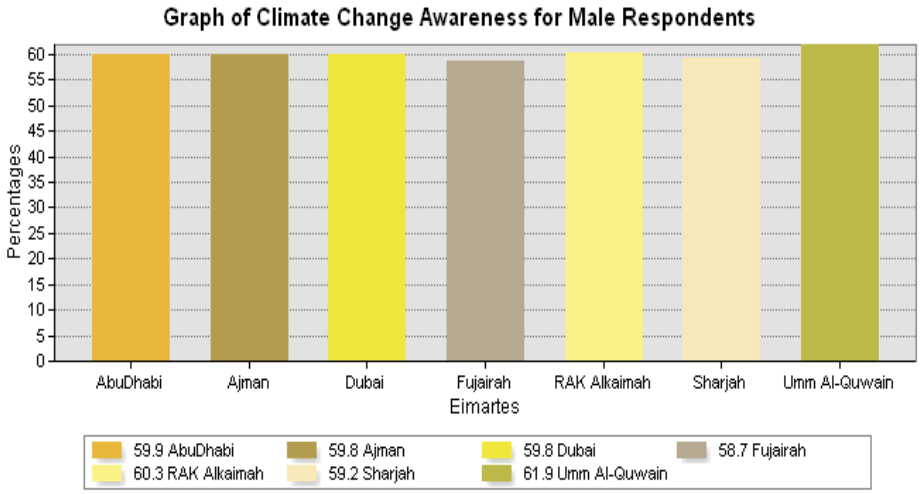


Figure 5: Climate change awareness- male respondents

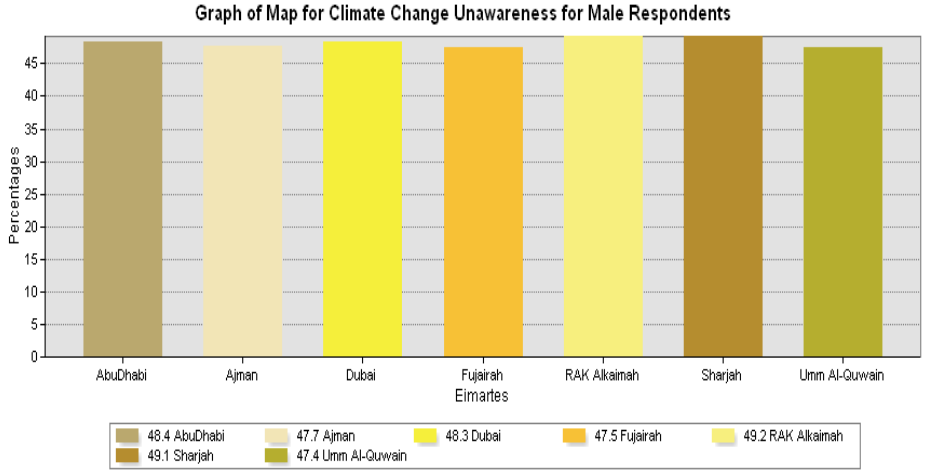


Figure 6: Climate change ignorance- male respondents

Figure 7 shows the UAE map for female respondents, while Figures 8 and 9 show awareness and ignorance feedback by females.

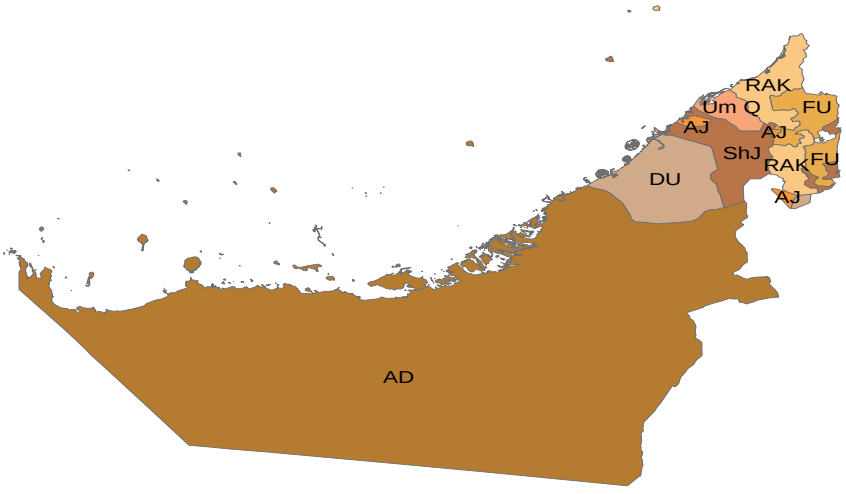


Figure 7: UAE map for climate change awareness- female respondents

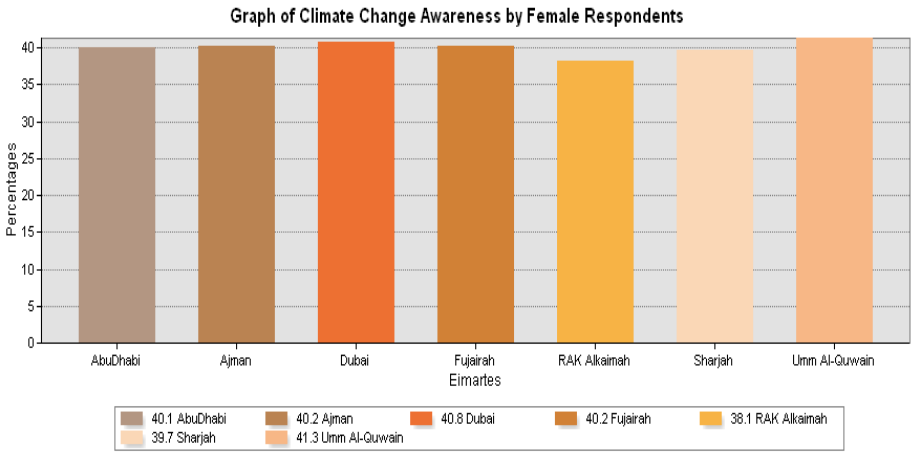


Figure 8: Climate change awareness- female respondents

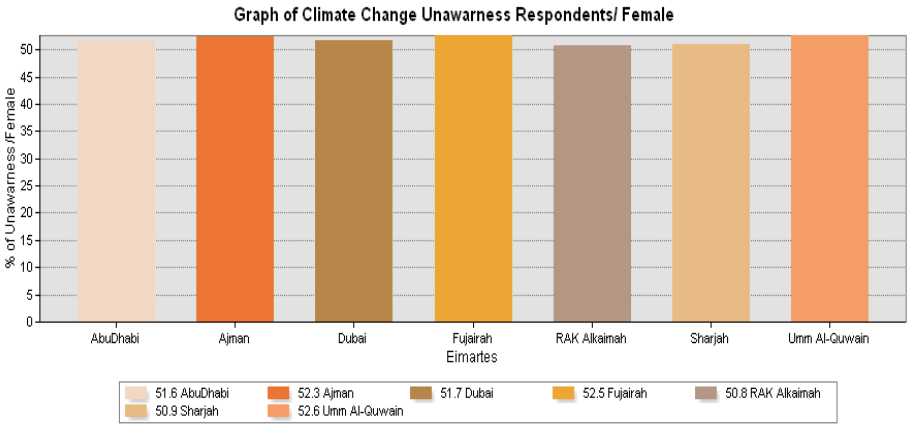


Figure 9: Climate change ignorance- female respondents

When measuring ignorance, UAE women had a higher percentage of the same problem than men. The percentage of women is 55%, while it is 44% for men. The reason for these results could be that men in the UAE can get knowledge more easily due to their different fields of study. For example, in some cities, women cannot take courses that require fieldwork or scientific studies. The second reason could be that men care more about the economy and factors of the country such as climate change negatively affect the country's economic growth.

The United Arab Emirates is considered one of the richest countries in the world; therefore, women do not work in agriculture. This could result in women having less information about climate change and global warming than men. Accordingly, researchers should focus more on raising awareness of climate change among women in the UAE by finding different ways to encourage women to participate in reducing the impacts of CCGW. For example, in recent years, there have been many clubs with various activities specifically for women, such as distributing containers for plastic, coins, and paper, which can help raise their awareness of the

issue. We can also organize lectures and workshops about the importance of reducing CCGW in our country.

The study focused on the level of education in relation to climate change awareness because education reflects the level of knowledge of a nation. Different categories of education were compared, including high school, bachelor's, master's, PhD, and no formal education. Moreover, the young generation was more aware as most of the UAE citizens belong to the elderly who have not completed their education.

Table 4 shows the educational levels with the awareness and ignorance about climate change. It compared different categories of education which including high school, bachelor, master, Ph.D., and no formal education. Most of awareness's respondents (40.4%) were form high school, 29.6% were for master's student, 15.2% were for no formal education, and 6.4% and 8.4% were for bachelor's and Ph.D. degrees, respectively. However, respondents who were ignorant, the majority of respondents were from bachelor's (33.8%), 26.0% were from no formal education, following by high school and PhD students with 23.0% and 17.2%, respectively. Only 0% of respondents were for master's students.

Table 4: Respondents' educational levels

Educational levels	Aware of CCGW (%)	Unaware of CCGW (%)
High School	40.4	23.0
Bachelor	6.4	33.8
Masters	29.6	0.0
PhD	8.4	17.2
No Formal education	15.2	26.0

To measure CCGW awareness, respondents were asked which type of media source they preferred and which they trusted more. The question in the survey asked which media source they learned about CCGW from. The choices were newspaper, TV, internet, radio, and educational workshops. Table 5 shows the primary sources of information that play a role in raising awareness of climate change among respondents. As we can see, 40.4% of the respondents reported knowing about CCGW through radio, while 23.1% learned about the issue through the internet and 21.3% from educational workshop. Only 15.2% from TV, whereas newspapers had the lowest percentage with 0% of the respondents' answers. On the other hand, among respondents who were ignorant, 42.8% was for newspaper, 23.6% for radio, 17.2% and 16.3% were for TV and educational workshop while internet source was the lowest with 0%.

Table 5: Climate change awareness- information and media sources

Media Sources	Aware of CCGW (%)	Unaware of CCGW (%)
Newspaper	0	42.8
TV	15.2	17.2
Internet	23.1	0
Radio	40.4	23.6
ED Workshop	21.3	16.3

Table 5 shows that 40.4% of the respondents reported knowing about CCGW through radio, while 23.1% learned about the issue through the internet. The source newspaper had the lowest percentage with 0% of the respondents' answers. The expected reason for trusting the radio could be that people in the UAE trust information that comes from the government. The government in UAE can inform the people with a clear

picture and the truth about news and global issues. Moreover, the UAE government is making great efforts to protect the environment and make the people aware of the problem of climate change. For example, the UAE has established an environmental authority that plays an important role in providing information about CCWG to residents.

The UAE Environment Agency uses various media to reach out to people and raise their awareness about CCGW. For instance, the agency has an official account on various media, such as Instagram, which has become one of the easiest ways to get news. In contrast, there are multiple accounts on Instagram that provide people with the latest news locally and globally. However, in recent days, Instagram has become a faster source of news than the newspaper.

Moreover, there are many official accounts that are run by professionals to inform the residents about the current situation in the world. The number of people following an Instagram account in the UAE is in the millions, such as UAEBARQ™, a leading media outlet in the UAE news sector. This shows how important these accounts are and how keen the government is to keep its citizens up to date with current events. It also shows that people follow their presidents and leaders, reflecting good communication between them. Table 6 measures the percentage of agreement that human activities are the main reason for CCGW.

Table 6: CCGW awareness / ignorance

Human Activities	Aware of CCGW (%)	Unaware of CCGW (%)
Not sure	0	100
Disagree	27.56	72.43
Somehow agree	56.84	43.15
Agree	100	0
Strong agree	76.32	23.67

Most of awareness respondents said they agreed that human activities are one of the main causes of CCGW (100%). 76.32% stated that they strongly agreed, 56.84% somehow agreed, 27.56% disagreed, and 0% of respondents were not sure. However, among ignorance respondents, most of them (100%) said they were not sure that human activities are a primary reason of CCGW and (72.43%) of respondents disagreed. Only (43.15%) said they Somewhat agreed and very few of ignorance's respondents (23.67%) were strongly agree while (0%) of them said they agreed.

To measure awareness of the most harmful impacts of CCGW on UAE, the survey asked question about respondents' opinions. As Table 7 shows, respondents who were aware (87.82%) of them said nothing and 77.12% of respondents said that less rainfall. (26.96%) of respondents said sea level rise and (20.79%) of them said hot temperatures. Alternatively, among ignorance respondents ,79.20% of respondents indicated that hot temperatures are the most detrimental impact, following by sea level rise and less rainfall with 73.03% and 22.87%, respectively. Only few respondents were said nothing with 12.17%., as shown in Table 7.

Table 7: Concerns about potential harmful effects of CCGW

CCGW Concerns	Aware of CCGW (%)	Unaware of CCGW (%)
Nothing	87.82	12.17
Sea level rise	26.96	73.03
Less rainfall	77.12	22.87
Hot temperatures	20.79	79.20

To investigate the respondents' feelings about GW and CC in UAE, a question was asked to measure the percentage of their concern about this issue. From this, it is clear that most of the people do not think that CCGW will have a negative impact on UAE as 73.90% of the awareness's respondents said that CCGW will have less impact on the country (Table 7). 56%of respondents reported for fearful and approximately similar percentage for powerless, does not concern me, and expect to adapt with 48%,40.62%, and 40%, respectively. However, for ignorance's respondents most of them reported for expect to adapt (60%), following by Does not concern me (59.37%), Powerless (52%), and Fearful (45%). Only (26.09%) of ignorance respondents, as shown in Table 8.

Table 8: Concerns about CCGW in the UAE

GWCC Concerns	Aware of CCGW (%)	Unaware of CCGW (%)
Fearful	56	45
Expect to adapt	40	60
Powerless	48	52
Less impact	73.90	26.09
Does not concern me	40.62	59.37

The percentage of respondents who said they are expected to adapt is low (40%), which means that people do not have enough information to predict the harmful effects of CCGW. For example, people do not take appropriate actions to reduce the damage they can cause to the UAE environment from CCGW problems, such as using energy resources and rare water more efficiently. Conversely, about 60% of the respondents who were not aware said that they expected to adapt. This result expresses that these respondents may need more knowledge on measures to protect UAE from CCGW and its negative impacts

One of the main objectives of the study was to measure the impact of human activities in UAE society that could contribute to CCGW. Therefore, respondents were asked to rate the following activities: emissions from industry, emissions from cars or trucks, use of non-biodegradable materials such as plastic, lifestyle of people and not safe. For awareness respondent's lifestyle and not safe were the highest with 100%. A majority of respondents (27.40%) and (26.82%) said emission from cars/trucks and Use of non-biodegradable were the activities of Emirate society. But very low percentage were for emission from Industry (0%). Then, for ignorance respondents, emissions from industry were the highest with 100%. Use of non-biodegradable materials and emissions from cars or trucks were similar percentages with 73.17% and 72.59%, respectively. while People lifestyle and not sure had the lowest percentages with 0%, as seen in Table 9.

Table 9: Hazards of human activities in UAE

Human Activities	Aware of CCGW (%)	Unaware of CCGW (%)
Emission from Industry	0	100
Emission from cars/trucks	27.40	72.59
Use of non-biodegradable	26.82	73.17
People lifestyle	100	0
Not sure	100	0

The reason for this could be the lifestyle in Emirati society which heavily relies on the use of non-biodegradable materials. Also, the hot weather and high temperatures most days of the year make people dependent on air-conditioners which consume a lot of energy. The highest percentage of ignorant respondents was due to industry emissions at 100% and the lowest percentage was due to people's lifestyle at 0%. The expected reason could be that they used to hear that greenhouse gasses and carbon dioxide (CO_2) are the only causes of climate change and global warming. Therefore, ecologists and environmental specialists should educate society about the new causes of climate change, such as the daily use of plastic bottles in homes and workplaces.

To measure the respondents' level of awareness of the importance of reducing pollution to reduce the impact of CCGW, they were asked whether they encourage recycling of recyclable materials such as paper and plastic in their home or workplace. Most of the awareness's respondents indicated that they recycle (64.57%), while only 30.03% of the respondents indicated that they do not promote recycling at their residence. Nevertheless, for ignorance respondents, most of respondents indicated that they do not promote recycling (69.96%), while only 35.42% indicated that they recycle, as shown in Table 10.

Table 10: Recycling motivation

Encourage Recycle	Aware of CCGW (%)	Unaware of CCGW (%)
No	30.03	69.96
Yes	64.57	35.42

The expected reason for this high percentage could be that the UAE government has established many wastes management companies to recycle waste materials. For example, a waste company called *Tadwer*™, which means recycling in Arabic, provides recycling bins for residents to separate their waste such as plastic, paper, cans, and glass. Among the ignorant respondents, about 70% said that they do not recycle materials. This percentage means that these people should be educated about the negative effects of not recycling and how recycling reduces the amount of waste sent to landfills, which is considered one of the main causes of air pollution in the UAE. Therefore, researchers need to find ways to get people to make recycling a habit in their daily lives. For example, researchers can communicate the environmental benefits of recycling materials to their family and community through social media or provide them with information on how and where to recycle.

Regarding the measures that have been imposed to reduce impacts of factors causing CCGW in UAE, the analysis revealed that the highest percentages were for recycling resources and use less resources like water with 100% but the surprise result was for plant mangrove with 0%. 46.75% of respondents said reduce harmful emissions and 32.76% of them said protect marine life. Nevertheless, among the ignorant respondents, the highest percentage was 100% in favors of planting mangroves and the lowest was 0% in favors of recycling or reusing and using less resources. 67.23% of respondents said protect marine life and 53.24% of them said

reduce harmful emissions. Few respondents said restore damaged ecosystems with 28.10%.

The reason could be that in recent years, UAE residents have become accustomed to hearing about the importance of recycling and reusing materials to protect the environment and reduce CCGW in the daily news and on websites. Instead, people still need to know that mangroves play an important role in reducing harmful greenhouse gases, which are one of the causes of climate change in the UAE. Table 11 illustrates respondents' opinion about the significant activities for CCGW adaptation in the UAE.

Table 11: Measurers in UAE to reduce impacts

Measure to reduce impact of	CCGW Aware (%)	CCGW Unaware (%)
Plant mangrove	0	100
Harmful emissions	46.75	53.24
Recycle/Reuse	100	0
Protect marine life	32.76	67.23
Use less resources	100	0
Restore damaged ecosystems	71.89	28.10

As shown in Table 12, to determine what lifestyle changes respondents are willing to make to reduce the impact of climate change on the UAE, they were asked about some activities, such as recycling or reusing, reducing household waste or pollution, car emissions and natural resource use, and using biodegradable materials. Among awareness's respondents, the percentages for car emission reduction and recycling or reuse were 74.88% and 55.42%, respectively. Reduce household/pollution and recycle/reuse were had similar percentages with 50.72% and 55.42%.

While 0% were reported for the use of biodegradable materials. Conversely, the result for the ignorant respondents was highest for use biodegradable materials at 100% and lowest for car exhaust reduction at 25.11%. while had approximate percentages for reduce natural resources use, reduce household/pollution, and recycle/reuse with 58.66%, 49.27%, and 44.54%, respectively.

Table 12: Lifestyle changes

Lifestyle Changes	Aware of CCGW (%)	Unaware of CCGW (%)
Recycle/Reuse	55.42	44.54
Reduce household pollution	50.72	49.27
Reduce car emission	74.88	25.11
Use biodegradable materials	0	100
Reduce natural resources use	41.33	58.66

Regarding needs for public education and awareness, 73.76% of the awareness's respondents were not sure, 47.09% answered (No) and 33.4% answered (Yes). Moreover, 52.9% of the ignorance respondents who do not know answered "No" while 66.5% answered "Yes" and 26.23% answered "Do not know". The reason could be that some people do not care about the importance of education in their lives. Therefore, people need to change their attitude and pay more attention to the importance of climate change education in the UAE society. They need to be aware of the impact and harm that CCGW could cause to the whole community. Whereas Table 13 illustrates the need for public education on CCGW in adaptation and mitigation measures.

Table 13: Public education needs

Public Education Needs	CCGW Aware (%)	CCGW Unaware (%)
No	47.09	52.90
Yes	33.40	66.59
Not sure	73.76	26.23

3.3 Descriptive Statistics

Descriptive statistical analysis has been carried out for the study variables and is displayed in the Table 14.

Table 14: Descriptive statistics

Variables	Minimum	Maximum	Mean	Std. Deviation
Gender	1	2	1.46	0.008
Age Group	1	4	2.33	0.017
Social Status	1	4	2.57	0.016
Employment Status	1	3	1.95	0.013
Level of Education	1	5	3.30	0.024
Citizenship	1	2	1.52	0.008
Residence Geographic Region	1	7	2.23	0.023
Heard About GWCC	1	2	1.49	0.008
Media Source	1	5	3.11	0.023
Rate of Awareness	1	5	3.35	0.025
Agreedance of Human Activities	1	5	3.00	0.021
The Most Harmful Effects	1	4	2.67	0.019
Feeling of GWCC	1	5	2.98	0.025
Human Activities in Emirates Society	1	5	3.06	0.019
New Lifestyle Changes to Reduce CC	1	5	2.83	0.025
Encourage Recycling at Home or Workplace	1	2	1.60	0.008
Activities for GWCC Adaptation	1	6	3.74	0.029
Last Year Action to Reduce GWCC	1	2	1.45	0.008
The Need for Public Education	1	3	2.00	0.013
The Best Policy for GWCC	1	3	1.96	0.012

Descriptive statistical analysis was carried out for demographic information, awareness and opinions, and adaptation measures and indicated that the minimum variables = 1 for all variables and maximum variables of demographic information with 2 it had the mean of 1.46, 1.52, 1.49, 1.60, and 1.45 while with 3 it has the mean of 1.95, with 4 has the man of 2.57, with 5, the mean with 3.30 and with 7 the mean was 2.23. The S.D. = 0.008, 0.013, 0.016, 0.017, 0.024 and 0.023. Similarly, for awareness and opinions the maximum (with 2, 4, 5) it had the mean (M) of 1.49, 3.11, 3.35, 3.00, 2.67, 2.98 and 3.06 with S.D. = 0.008, 0.023, 0.025, 0.021, 0.019, 0.025. Adaptation measures (with 2, 3, 5, 6) had a mean of 2.67, 2.98, 3.06, 2.83, 1.60, 3.74, 1.45 and S.D. = 0.019, 0.025, 0.019, 0.025, 0.008, 0.029, 0.008. A high mean of all the chosen variables indicated that participants need to be more aware of the climate change issue in the UAE. For instance, it has been observed that the mean of heard about climate change 2.23 while the maximum score for the variable is 7. Therefore, the study concludes that participants of the climate change awareness questionnaire have little awareness percentage.

Chapter 4

Chapter 4: Discussion

This Chapter discusses the results of the quantitative analysis of the research data obtained from the questionnaire survey. The chapter also explains the results with further interpretations of the research findings that are addressed in the existing relevant academic literature to provide meaningful recommendations to increase awareness of climate change among the UAE population. In this study, five themes are explored to raise awareness and find solutions to help UAE residents adapt to and mitigate climate change to protect the environment. The study started with the relationship between awareness and geographic zone to measure which cities have lower awareness and to try to raise awareness to protect the country from environmental problems. The spatial distribution of awareness of CCGW was approximately the same between emirates, with ignorance being the highest.

The results show that the percentage awareness is similar in most emirates, but Umm Al-Quwain and Ras Al-Khaimah were the highest. The reason could be the high population density, which includes many foreign residents. The study then examined the level of knowledge between genders and found that men have a greater awareness of climate change than women. It also examined the relationship between awareness and media sources to determine which type of media people trust more. Radio had the highest percentage, showing that people in the UAE trust government news more than other sources such as the Internet. It also looked at awareness and human activity to determine whether or not people think they play a role in climate change. The study examined the impact of education on CCGW in order to develop an environmental education program.

However, based on the results of similar studies, the possible explanation for the results could be the following: The diversity of national, cultural, and geographic factors plays an important role in shaping individual perceptions of climate change (Lee et al., 2015). Therefore, people who come from abroad can positively influence the knowledge pool of the local population. The UAE government is also making great efforts to protect the environment and raise people's awareness of the problem of climate change. For example, the UAE has established an environmental authority that plays an important role in informing residents about CCWG. Education plays an important role in raising awareness about climate change and global warming.

The increase in climate change impacts in the UAE will increase national vulnerability and affect the UAE's potential growth. Impacts include extreme heat, storm surges, sea level rise, water stress, dust and sandstorms, and desertification. In addition, the small differences in weather patterns could affect economic, environmental, and social security in the UAE (Al Blooshi et al., 2019). Another study found that the UAE government organizes awareness campaigns to promote environmental behavior among citizens and to preserve the country's natural resources. For this reason, environmental education has become one of the most important elements in the UAE education system.

According to Al Sawaleh, the Ministry of Education has proposed as a top priority to teach students the importance of environmental sustainability and wildlife conservation to create a sustainable environment for future generations (Al Sawaleh, 2015). To achieve the goal of the National Strategy for Environmental Education and Awareness of both ministries, environmental awareness programs are being developed and implemented to support the sustainability goals of schools in the UAE.

There are many initiatives in the UAE to help achieve the sustainability goal, such as the development of sustainable schools and innovation centers in Dubai's Sustainable City. There were plans to open an environmentally sustainable school in Dubai in 2017. This type of school is also important to educate the new generation about the environment they live in (Nami, 2016).

Somewhat surprisingly, the younger generation of high school students had the highest level of awareness compared to all other levels of education. Conversely, respondents with bachelor's and doctoral degrees had the lowest percentages on questions about CCGW in the UAE. The reason for this result could be that they need to be more aware of the issue and the factors that affect society. Therefore, academic programs at different levels of education will help students solve problems to protect their environment. Raising teachers' awareness of climate change and environmental issues will lead them to improve their ability to teach students. In addition, professionals and teachers can conduct workshops for community members in geographic areas with low awareness of climate change to educate them about the issue.

Education has an important impact on minimizing the effects of climate change by reducing human influence. For the implementation of the CCGW education programme, it is important that decision makers in the UAE participate in and apply CCGW education guidelines and policies. It is equally important to have sustainable schools and campuses that use water and energy efficiently and sustainably. CCGW should be integrated into the curriculum at various levels of education. The curriculum will encourage students to apply what they learn in class to their daily lives, which will help them change their lifestyles.

In addition, the curriculum will improve students' skills and enable them to apply critical thinking to solve environmental problems related to CCGW. The result shows that 0% of the respondents who were aware were in favour of industrial emissions, while 100% of the respondents who were not aware were in favour. The reason could be that people have no other way to reduce emissions in different production sectors, but in recent years the UAE has started to look at renewable energy which reduces emissions.

These findings should be considered when considering climate change awareness and how geographic location might affect individuals in the UAE. The significant difference between gender awareness of climate change and the impact of education and the impact of human activities on climate change in the UAE. In addition, the generalizability of the results is limited by the small sample size. In addition, the generalizability of the results is limited by the small sample size and the cost of increasing the number of questionnaires. Another limitation of the study is that the questionnaire was a self-report instrument. The majority of participants did not complete some questions.

Overall, this study suggests that environmental education needs to influence the behavior of UAE people to change their daily habits. Education has an important impact on minimizing the effects of climate change by reducing human influence. In order to implement the CCGW education program, it is important that decision makers in the UAE participate in and apply CCGW education guidelines and policies. It is equally important to have sustainable schools and campuses that use water and energy efficiently and sustainably. CCGW should be integrated into the curriculum at different levels of education.

The curriculum will encourage students to apply what they learn in class to their daily lives, which will help them change their lifestyles. In addition, the curriculum will enhance students' skills and enable them to apply critical thinking to solve environmental problems related to CCGW. It must be kept in mind that this study was conducted on only a small group of the total UAE population over a short period of time. Further research on the importance of awareness, education, and the impact of human activities in UAE society is needed and should be considered in future studies. In addition, people in the UAE should realize that environmental education can contribute to the development of their country.

Chapter 5

Chapter 5: Conclusion

In summary, climate change continues to be a major challenge for governments and global environmental scientists working to reduce the impact of this threatening problem. Effective climate change control practices will reduce the causes of climate change worldwide (Czunyi, 2018).

5.1 Managerial Implications

The key issues discussed in this study will help raise awareness of climate change in the UAE. The study suggests that awareness needs to be raised in the UAE in a number of ways, such as establishing educational programs on climate change and helping people reuse and recycle materials. Effective educational programs will also help create a better and sustainable future. For example, educators in the UAE should encourage parents and students to use what they learn to protect their society by learning more about climate change. Finally, effective strategies by educators to inform people about the problem are not enough. People need to change their attitudes and social behaviors to prevent the problem from progressing. They need to become more aware of the impact of climate change on the next generation.

5.2 Research Implications

The results of the study show that awareness of CCGW is lower among females (45%) than males (56%) and that awareness in UAE is higher at the high school level than at all other levels of education. In addition, the level of awareness is similar across the UAE, so it is not influenced by the geographical location of the respondents. Adaptation is about correcting people's behaviors to change the climate effect that reduces the harmful impacts globally and creates a safer world for the next

generation. This study does not address the exact reasons for some findings, such as the low percentage of PhDs. Therefore, future studies in this regard should have a larger sample of the population to be more meaningful and cover more areas in the UAE.

5.3 Research Limitations

The main limitations of the study were the small sample size. The number of participants was (3210) while the number of questionnaires distributed was 4000. Due to funding the cost of increasing the number of questionnaires, it is difficult for the researcher to increase the number of questionnaires. Therefore, the sample cannot be considered representative of all UAE residents or at least half of the population. Another limitation of the study is that the questionnaire was a self-report instrument. The majority of the participants did not complete some questions. For example, there was a question asking participants to indicate what they have done in the last year to reduce the impact of climate change in the UAE. The majority of participants did not answer this question, which limited the analysis for the researcher. The researcher attempted to address this potential problem by asking participants if they would be willing to spend more time completing the questionnaire.

5.4 Research Recommendations

To improve the results of this study, the following recommendation can be made:

i) In order to change human behavior so that they do not add to the causes of greenhouse gas emissions, policy makers in the UAE should ban the use of individual plastic bags and bottles. This could reduce the human activities that cause climate change in the UAE and provide reusable products or eco-friendly products in the UAE market.

ii) Human activities, changing the lifestyle of people and providing information about the impact of climate change on UAE will help to protect the environment from climate change.

iii) The research study proposes to develop an educational program in schools and other educational institutions that will play an important role in raising awareness about climate change among students and young generation. This will help to change the behavior of students and will have a positive impact on their families and society.

iv) Focus on the young generation in different levels of education and provide curricula on environmental issues in the UAE.

v) Campaigns and workshops that develop decision makers among the people for the cause of climate change will raise awareness and mitigate the effects of climate change in the UAE.

vi) Based on the findings of the study that women's awareness is lower than men's awareness, women's awareness should be raised by engaging them in various fields that deal with the environment and climate change in the UAE, such as participating in research that some organizations conduct to raise their awareness.

References

Adger, W. N., Huq, S., Brown, K., Conway, D., & Hulme, M. (2003). Adaptation to climate change in the developing world. Progress in Development Studies, 3(3), 179-195.

Adger, W. N., Kelly, P. M., Winkels, A., Huy, L. Q., & Locke, C. (2002). Migration, remittances, livelihood trajectories, and social resilience. AMBIO: A Journal of the Human Environment, 31(4), 358-366.

Adger, W., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. Global Environmental Change, 15(2), 77-86.

Adio-Moses, R. O., & Aladejana, J. A. (2015). Assessment of knowledge and awareness of global warming among inhabitants of industrial areas of an urban community in a developing country. The Business & Management Review, 7(1), 421-427.

Akrofi, M. M., Antwi, S. H., & Gumbo, J. R. (2019). Students in climate action: a study of some influential factors and implications of knowledge gaps in Africa. Environments, 6(2), 12-25.

Al Blooshi, L. S., Ksiksi, T. S., Aboelenein, M., & Gargoum, A. S. (2019). The impact of climate change on agricultural and livestock production and groundwater characteristics in Abu Dhabi, UAE. Nature Environment & Pollution Technology, 19, 1945-1956.

Al Blooshi, L. S., Ksiksi, T. S., Gargoum, A. S., & Aboelenein, M. (2020). Climate change and environmental awareness: A study of energy consumption among the residents of Abu Dhabi, UAE. Perspectives on Global Development and Technology, 18(6), 564-582.

Al Sawaleh, M. (2015). MOCCAE News | Media Center | UAE Ministry of Climate Change and Environment. Retrieved December 27, 2021, from: https://www.moccae.gov.ae/en/media-center/news

Al-Sarihi, A., & Mason, M. (2020). Challenges and opportunities for climate policy integration in oil-producing countries: the case of the UAE and Oman. Climate Policy, 20(10), 1226-1241.

Anyanwu, R., & Grange, L. (2015). Climate change science: the literacy of geography teachers in the Western Cape Province, South Africa. South African Journal of Education, 35(3), 1-9.

Arlt, D., Hoppe, I., & Wolling, J. (2011). Climate change and media usage: Effects on problem awareness and behavioral intentions. International Communication Gazette, 73(2), 45-63.

Bernabeo, R. A., Khalifeh, H. A., Andretta, A., Al Khatib, I. T., & Ghori, M. H. (2018, February). The impact of climate change and weather on air transport in the UAE: Reduction of CO 2 emissions. In 2018 Advances in Science and Engineering Technology International Conferences (ASET) (pp. 1-7). IEEE, USA

Brulle, R. J., Carmichael, J., & Jenkins, J. C. (2012). Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the US, 2002–2010. Climatic Change, 114(2), 169-188.

Carey, M. (2012). Climate and history: A critical review of historical climatology and climate change historiography. Wiley Interdisciplinary Reviews: Climate Change, 3(3), 233-249.

Cash, D. W., & Moser, S. C. (2000). Linking global and local scales: designing dynamic assessment and management processes. Global Environmental Change, 10(2), 109-120.

Creswell, J. W. (2007). Differing perspectives on mixed methods research. Journal of Mixed Methods Research, 1(4), 303-308.

Creswell, J. W., & Clark, C. (2011). Best practices for mixed methods research in the health sciences. Bethesda (Maryland): National Institutes of Health, 20, 541-545.

Cronbach, L. J. (1984). A research worker's treasure chest. Multivariate Behavioral Research, 19(3), 223-240.

Czunyi, S. (2018). Climate change, communications, and collaboration. Retrieved November 3, 2020, from: https://www.idrc.ca/en/perspectives/climate-change-communications-and-collaboration.

Dal, B., Ozturk, N., Alper, U., Sonmez, D., & Cokelez, A. (2015). An Analysis of the Teachers' Climate Change Awareness. Athens Journal of Education, 2(2), 111-122.

Demaidi, M. N., & Al-Sahili, K. (2021). Integrating SDGs in higher education—Case of climate change awareness and gender equality in a developing country according to RMEI-TARGET strategy. Sustainability, 13(6), 3101-3113.

Dresner, M. (2010). Changing energy end-use patterns as a means of reducing global-warming trends. The Journal of Environmental Education, 21(2), 41-46.

Elhakeem, A., Elshorbagy, W. E., AlNaser, H., & Dominguez, F. (2015). Downscaling global circulation model projections of climate change for the United Arab Emirates. Journal of Water Resources Planning and Management, 141(9), 45-57.

Faria, F., Klima, K., Posen, I. D., & Azevedo, I. M. (2015). A new approach of science, technology, engineering, and mathematics outreach in climate change, energy, and environmental decision making. Sustainability, 8(5), 261-271.

Gay, L. R., Mills, G. E., & Airasian, P. W. (2012). Educational research: Competencies for analysis and applications. Pearson.

Gharis, L., Franzen, R. L., Liddicoat, K., & Remington, T. N. (2018). How do Wisconsin environmental educators perceive a potential, professional certification for individual environmental educators?. Applied Environmental Education & Communication, 19(1), 44-61.

Haichour, E. H., Metzger, J., & Pigozzi, M. J. (2007). Learning in the 21st century: Supporting and guiding education reform for 21st century learning. Journal of Education for Sustainable Development, 3, 112-126

Kelly, P., & Adger, W. N. (2000). Theory and practice in assessing vulnerability to climate change and facilitating adaptation. Climatic Change, 47(4), 325-352.

Kesmodel, U. S. (2018). Cross-sectional studies – what are they good for?. Acta Obstetricia et Gynecologica Scandinavica, 97(4), 388-393.

Klosterman, M. L., & Sadler, T. D. (2010). Multi-level assessment of scientific content knowledge gains associated with socioscientific issues-based instruction. International Journal of Science Education, 32(8), 1017-1043.

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C. Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. Nature Climate Change, 5(11), 1014-1020.

Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. Climatic Change, 77(1), 45-72.

Likert, R. (1932). A technique for the measurement of attitudes. Archives of Psychology, 22, 55-67.

Linn, M. C., John, F., & Hsi, S. (2000). Computers, teachers, peers: Science learning partners (pp. 3-38). London: Routledge.

Liu, S., Roehrig, G., Bhattacharya, D., & Varma, K. (2015). In-Service teachers' attitudes, knowledge and classroom teaching of global climate change. Science Educator, 24(1), 12-22.

Lynne, M., & Connelly, H. (2019). Cross-Sectional Survey Research-ProQuest. Retrieved March 9, 2022, from: https://www.proquest.com.

Marshall, N. A., Park, S., Howden, S. M., Dowd, A. B., & Jakku, E. S. (2013). Climate change awareness is associated with enhanced adaptive capacity. Agricultural Systems, 117, 30-34.

McNeal, K. S., Libarkin, J. C., Ledley, T. S., Bardar, E., Haddad, N., Ellins, K., & Dutta, S. (2014). The role of research in online curriculum development: The case of EarthLabs climate change and Earth system modules. Journal of Geoscience Education, 62(4), 560-577.

Mochizuki, Y., & Bryan, A. (2015). Climate change education in the context of education for sustainable development: Rationale and principles. Journal of Education for Sustainable Development, 9(1), 4-26.

Mohamad, M. M., Sulaiman, N. L., Sern, L. C., & Salleh, K. M. (2014). Measuring the Validity and Reliability of Research Instruments. Procedia - Social and Behavioral Sciences, 204, 164-171.

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: a systematic review of the research. Environmental Education Research, 25(6), 791-812.

Moses, R. N., & Yamat, H. (2021). Testing the Validity and Reliability of a Writing Skill Assessment. Assessment, 11(4), 202-208.

Murtaugh, P. A., & Schlax, M. G. (2009). Reproduction and the carbon legacies of individuals. Global Environmental Change, 19(1), 14-20.

Mutlu, H., & Tokcan, J. (2013). Success effect of documentary use in teaching of global warming subject. Retrieved December 5, 2020, from: https://www.researchgate.net/publication/269832935.

Nami, A. (2016). Dubai Sustainable School Plants Roots for a Sustainable Future | Sail Magazine. Retrieved March 27, 2021, from: https://sailemagazine.com/2016/06/sustainable-school-plan-for-dubai-eco-friendly-community/

Parmesan, C., & Yohe, G. (2003). A globally coherent fingerprint of climate change impacts across natural systems. Nature, 421(18), 37-42.

Parson, E. A., Brown, R., & Fisher-Vanden, A. K. (1997). Integrated assessment models of global climate change. Annual Review of Energy and the Environment, 22(1), 589-628.

Riebeek, H., & Simmon, C. (2005). Paleoclimatology: Understanding the Past to Predict the Future. NASA Earth Observer, Goddard Spaceflight Centre. Retrieved December 8, 2020, from: https://earthobservatory.nasa.gov/features/Paleoclimatology_Understanding

Salam, A. (2015). Climate change: the challenges for public health and environmental effects in UAE. WIT Transactions on Ecology and the Environment, 193, 457-466.

Sallam, D. (2020). Resilience of UAE high-rise buildings to climate change: Impacts of projected climate changes on annual energy demands (Doctoral Dissertation). The British University in Dubai, UAE.

Sampei, Y., & Aoyagi-Usui, M. (2009). Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. Global Environmental Change, 19(2), 203-212.

Selvaraj, V., Leelamani, A., Divya, S., & Divya, K. (2017). Communicating Climate Change Importance through Interactive Multimedia Frame Work for Promoting Education and Effective Public Awareness on Climate Change. International Journal of Applied Environmental Sciences, 12, 409-420.

Setia, M. S. (2016). Methodology Series Module 3: Cross-sectional Studies. Indian Journal of Dermatology, 61(3), 261-264.

Shahid, Z. (2012). Climate change awareness and adaptation by local planning in Punjab, Pakistan (Doctor of Philosophy). University of Western Sydney, Australia.

Spencer, W. (2008). The carbon dioxide greenhouse effect. The Discovery of Global Warming. Retrieved June 27, 2021, from: http://www.aip.org/history/climate/co2.htm

Stevenson, R. B., Nicholls, J., & Whitehouse, H. (2017). What is climate change education?. Curriculum Perspectives, 37(1), 67-71.

Sullivan, G. M., & Artino, A. R., Jr. (2013). Analyzing and Interpreting Data from Likert-Type Scales. Journal of Graduate Medical Education, 5(4), 541-542.

UNFCCC (2021). Glasgow Climate Pact. Outcomes of the Glasgow Climate Change Conference (COP21). Retrieved October 22, 2021, from: https://unfccc.int/process-and-meetings/the-paris-agreement/the-glasgow-climate-pact-key-outcomes-from-cop26

Varma, K., & Linn, M. C. (2012). Using interactive technology to support students' understanding of the greenhouse effect and global warming. Journal of Science Education and Technology, 21(4), 453-464.

Vincent, K. (2007). Uncertainty in adaptive capacity and the importance of scale. Global Environmental Change, 17(1), 12-24.

Vogel, C., Schwaibold, U., & Misser, S. (2015). 'Teaching and learning for climate change'-The role of teacher materials and curriculum design in South Africa. Southern African Journal of Environmental Education, 31, 78-97.

Wals, A. E. (2010). Mirroring, Gestalt switching and transformative social learning: Steppingstones for developing sustainability competence. International Journal of Sustainability in Higher Education, 11(4), 380-390.

Whitmarsh, L. (2009). What's in a name? Commonalities and differences in public understanding of "climate change" and "global warming". Public Understanding of Science, 18(4), 401-420.

Wilbanks, T. J. (2002). Geographic scaling issues in integrated assessments of climate change. Integrated Assessment, 3(23), 100-114.

Wynes, S., & Nicholas, K. A. (2017). The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters, 12(7), 44-53.

Zalasiewicz, J., & Williams, M. (2021). Climate change through earth history. New York: Elsevier.

Appendix

Survey on Global Warming (GW)/Climate Change (CC) Awareness

1) Gender: Male ☐ Female ☐

2) Age Group: 18-30 ☐ 31-40 ☐ 41-50 ☐ 51+ ☐

3) Marital Status: Single ☐ Married ☐ Divorced ☐ Widowed ☐

4) Employment Status: Public Sector ☐ Private Sector ☐ Unemployed ☐

5) Level of Education: High school ☐ Bachelor ☐ Masters ☐ PhD No formal education ☐

6) Citizenship: UAE National ☐ Expatriate ☐ Visitor ☐

7) Residence geographic region: _____

Residence geographic region: Awareness and Opinions Questions

8) Have you heard about GW/CC? Yes ☐ No ☐

9) From what media source did you hear about GW/CC? Newspapers ☐ TV ☐ Internet Radio ☐ Workshops ☐

10) How do you rate your awareness of GW/CC? Unaware ☐ Little Awareness ☐ Knowledgeable ☐ Very Knowledgeable ☐ Expert ☐

11) Do you agree that human activities are a primary reason for GW/CC?

Not sure ☐ Disagree Somehow ☐ Agree ☐ Strongly agree ☐

12) What do you think the most harmful effects of GW/CC on the UAE?

Nothing ☐ Sea level rise ☐ Less rainfall ☐ Hotter temperatures ☐

Others (specify) _____

13) How do you feel about GW and CC on the UAE?

Fearful ☐ You expect to adapt ☐ Powerless ☐ Less Impact ☐ Does not concern me ☐

14) Rate the human activities you see in Emirates society that might contribute to GW/CC? Emissions from Industry ☐ Emissions from cars/trucks ☐ Use of non-biodegradable materials (e.g., plastic) ☐ People's lifestyle Not sure ☐

Adaptation means doing something NEW/DIFFERENT to what you did in the past to adapt to climate change

15) What kind of new lifestyle changes are you willing to do to reduce the effects of climate change on the UAE?

Recycle/Reuse materials ☐

Reduce my household/workplace pollution ☐

Reduce car emissions by using smaller size cars ☐

Use biodegradable materials ☐

Reduce my natural resources consumption ☐ Nothing of the above ☐

16) In your home or workplace do you encourage recycling of recyclable materials (paper, plastic etc.…) to reduce pollution?

No ☐ Yes ☐

17) Rate the activities that you think are important for GW/CC adaptation in the UAE?

Plant mangrove/tree ☐ Reduce harmful emissions ☐ Recycle/Reuse materials ☐ Protect marine life ☐Use less resources (e.g., water) ☐ Restore damaged ecosystems ☐

18) In the last year, have you done anything to adapt or reduce the effects of GW/CC in the UAE? No ☐ YES ☐ (specify) _____

19) Specify what you have done last year to reduce the effects of GW/CC in the UAE?

_____

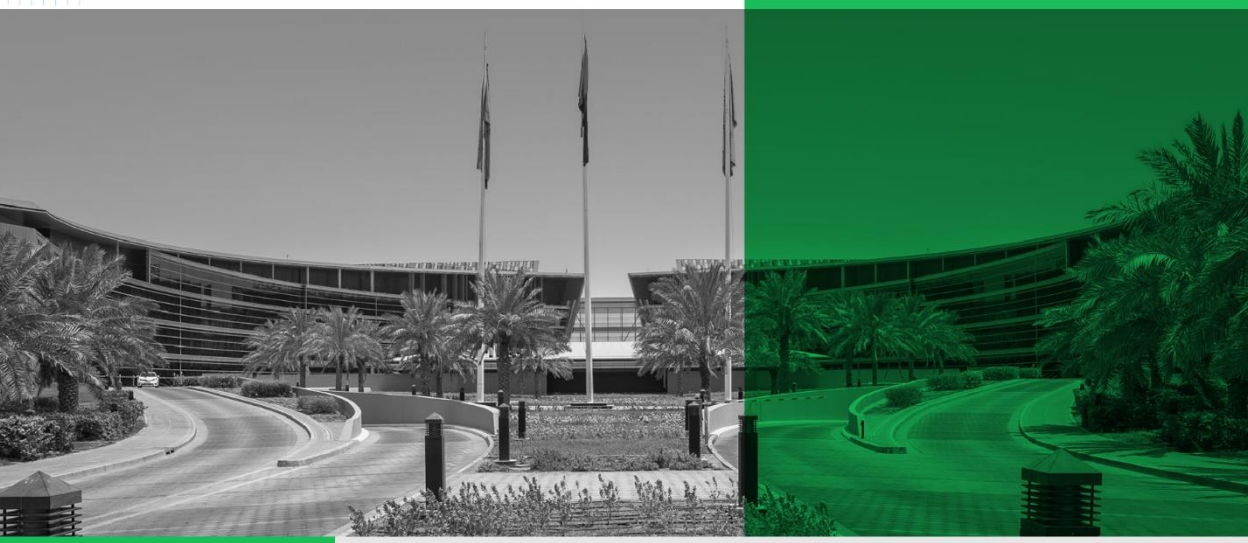
20) Do you think further public education is needed for GW/CC adaptation/mitigation? Yes ☐ No ☐ Not sure ☐

21) What do you think the best policy towards GW/CC in the UAE?

Adaptation ☐ Mitigation ☐ Nothing ☐

UAEU

جامعة الإمارات العربية المتحدة
United Arab Emirates University



UAE UNIVERSITY MASTER THESIS NO. 2022:1

This thesis determines the level of public awareness of climate change in the seven emirates of the UAE. The study aimed to determine the spatial and geographical distribution and gender differences, as well as to investigate the possible influence of human activities on climate change impacts. The study recommends further research on the influence of the socio-cultural background of different nationalities on promoting awareness and formulating common climate change strategies and policies.

Mariam Almheiri received her Master of Science in Environmental Sciences from the Department of Biology, College of Science and her Bachelor of Business and Administration from the College of Business and Economics, UAE University, UAE.

www.uaeu.ac.ae

Online publication of thesis:
https://scholarworks.uaeu.ac.ae/etds/