Examining UAE University Students' Knowledge, Attitudes and Perceptions Regarding Climate Change

Dani George Albadine (ID# 202010423) Ajman University
Yahya Ait Elhadi (ID# 202020101) Ajman University
Mahmoud Al Najar (ID# 202010245) Ajman University

College: Business Administration

Department: Management

Supervisor Name: Dr – Maher Itani

Submitted to: Eleventh Undergraduate Research and Innovation Competition
May 23rd, 2024, Abu Dhabi University

Submission Date: 11th March 2024

Abstract

Understanding climate change among university students is critical in addressing global environmental challenges. This research investigates their knowledge, attitudes, and perceptions towards climate change by employing a range of statistical analyses including Descriptive Analysis, Regression Analysis, Reliability Analysis, and Confirmatory Factor Analysis. The Descriptive Analysis uncovered distinct patterns in participant demographics, highlighting a strong representation of the 18-25 age group, a male majority, and a prevalence of Business Administration majors among participants. Regression analysis revealed a weak positive correlation between a student's knowledge and their year level, explaining 20% of the knowledge variability. Reliability analysis depicted varying strengths in data reliability, with students' perceptions showing the highest reliability, followed by attitudes and knowledge. The Confirmatory Factor Analysis suggested a significant relationship between students' attitudes and perceptions; however, a commendable level of climate change knowledge among UAE university students. The overall findings showed strong evidence supporting the awareness and understanding of climate change among UAE university students. Furthermore, the statistical analyses indicated no significant difference in the average knowledge of male and female students regarding climate change. This comprehensive exploration of climate change understanding among UAE university students offers valuable insights into their knowledge, attitudes, and perceptions. This research highlights the strengths and weaknesses in their comprehension, shedding light on pivotal areas for educational enhancements and awareness initiatives on climate change in the UAE.

Table of Contents

1-Introduction

1.1– Research Background

One of the most important problems of the twenty-first century is climate change, which has far-reaching effects on ecosystems, economics, and communities all around the world. Its effects are wide-ranging and include problems like escalating, extreme weather occurrences, the loss of biodiversity, and disruptions to food and water supply. The publications from the Intergovernmental Panel on Climate Change (IPCC) and countless studies on the topic illustrate the scientific consensus that addressing climate change urgently is necessary, and this shows that it is important to respond to this problem (Brulle, 2014).

The United Arab Emirates is considered as rapidly modernizing with a huge diverse population that consists of many nationalities and backgrounds, so it is deemed crucial to involve the younger generation in discussion of climate change since they will bear the long-term effects of climate change and have a major influence on future policies and activities as they will draw the future. The United Arab Emirates (UAE) university students are the primary subject of the study, "Evaluating the Climate Change Knowledge, Attitudes, and Perceptions within University Students in the UAE," which examines this crucial population. These students have a significant impact on societal transformation and public conversation in addition to being future leaders and decision-makers. Their opinions and views will determine the country`s response to this challenge. This study aims to show at what level the university students are knowledgeable about climate change issues, which will allow us to identify and develop opportunities for improving climate change knowledge for the students (Al-Mansoori, 2021).

It is noteworthy that the UAE was chosen as the study's context. The UAE is known for its quick socioeconomic development, which is primarily supported by its abundant natural gas and oil reserves. However, because of the increased environmental worries brought on by this economic trajectory, it is crucial to understand how the country's youth, especially university students, view and react to climate change. Furthermore, the UAE is a fascinating example of climate change education and awareness due to its distinct sociocultural setting, educational system, and important location in the Gulf region.

The United Arab Emirates (UAE) has achieved notable progress in raising student knowledge of sustainability and climate change. The government of the United Arab Emirates has acknowledged the critical role that younger generations play in reducing environmental hazards and securing a sustainable future, as the country is acutely aware of the problems presented by climate change. The UAE has put in place several strategic programs targeted at empowering, educating, and engaging its students to accomplish this.

This study sets out to investigate the deep web of links between climate change knowledge, attitude, and perception among UAE university students. It aims to reveal the layers of understanding, beliefs, and emotions that define climate change consciousness in this diverse and dynamic context. As we investigate this topic, we hope to gain a better understanding of how these young brains see and respond to the complicated issue of climate change, while also recognizing the special nuances that distinguish their viewpoint.

1.2- Purpose of Study

This study is deemed to be important to gather the opinions of university students of the UAE regarding the issue of climate change, as young adults are deemed to be a generation with a good ability to impact the outcome of policies. This study will also help quantify the knowledge, attitudes, and perceptions of university students and in turn, this would allow them to showcase the nuances of public opinion and how they match the actions of the youth. This study hopes to understand the dynamic between what students know, their willingness to act and how dangerous the issue is to their consciousness.

This research would help understand the reasoning behind certain behaviors that are associated with climate change. This is important to know which strategies would be easiest to implement to help guide the youth in the direction of combatting climate change as well as focus on which aspects need to be worked upon so that the youth is more prepared to face the reality presented by climate change.

1.3- Research questions

The primary research questions that would be focused on are:

1- What is the prevailing knowledge level of university students in UAE regarding climate change, and how is this knowledge reflected through their respective attitudes and perceptions?

2- To what extent does the university students' year level determine their knowledge of climate change issues, and how the UAE education system is correlated to climate change?

3- Is there a difference in the knowledge of male students compared to female students regarding climate change?

4- How does the way through which university students think about climate change correlate with their ability to get involved with climate change activism?

1.4- Research objectives

This study aims to evaluate the knowledge, attitudes, and perceptions of university students in the UAE regarding climate change and compare relations through different metrics. These objectives will be compared with each other to determine critical patterns amongst University Students regarding climate change.

One of the objectives related to this study is to identify what type of relationship exists between the degree of education on climate change within the UAE and how this knowledge is reflected in the ability of University students across year levels to judge basic information needed to understand the issue of climate change.

A secondary objective exists to find out which activity University students see most appropriate to tackle and combat climate change, and which activities would students object to doing at the expense of climate change activism. Therefore, this research aims to define possible strategies to create successful climate change initiatives with the most popular methods deemed appropriate through student opinions.

1.5- Research Hypothesis

This research aims to tackle many hypotheses about the potential causality and correlation of the factors addressed by the research questions. Primarily the research will focus on the relationships between students' knowledge, attitudes, and perceptions regarding climate change. These hypotheses will also assess the relationship between the demographics of the data sample and will therefore allow for an analysis that will be able to address the research objectives and questions. Presented below are the hypotheses of this research, which can be broken down into

1. The knowledge of university students in UAE can impact their attitudes.
2. The attitudes of university students in UAE can impact their perceptions.

3. The knowledge of university students in the UAE can impact their perception.
4. The university students in the UAE have an above-average knowledge of climate change.
5. The male university students in UAE are more knowledgeable than the female students regarding climate change.
6. There is a relation between years of study in the university and knowledge level.

The analytical stage of this research will aim to address all these hypotheses through the use of quantitative statistical tools. These tools will help bring forward a clearer picture of the impacts and correlations of the data collected by this study.

2- Literature review

2.1 Introduction to Literature

The literature review will provide an overview of the previous literature conducted on the topic of climate change and its relationship to the knowledge, attitudes, and perceptions of people, with a demographical focus on where university students stand on the issue and what researchers have found best to

2.2 Climate change Background

Climate change is a natural phenomenon that has been a priority interest in the past few years. Climate change as a concept encompasses every aspect of the climate of the earth which has experienced instability in the past few years. Many factors are attributed to climate change, but in the past years, research has suggested that human activity is playing an important role in the changes seen to the climate of the earth. (Masson-Delmotte, 2021) However, the extent of human activity and which activities in particular contribute the worst to climate change is up to debate amongst climate scientists. It is agreed that greenhouse gases, which constitute gases such as carbon dioxide, are contributing to the acceleration of the changing climate. Such gases are emitted both through human activity, such as industrial production and transportation, as well as naturally through volcanic activity. While there are points of contention around the topic, it seems that most climate scientists agree that climate change is a real phenomenon and that human activity has a role in accelerating the process of climate change. (Bhattacharya, 2021)

2.3 Opinions Regarding Climate Change

Another point of contention surrounding climate change comes from the debate surrounding the course of action that must be taken to prevent the effects of climate change. Limiting the usage of fossil fuels encompasses a variety of human activities, some of which are considered by most humans to be fundamental functions such as electricity and agriculture. The extent to which people are willing to take action to prevent climate change varies depending on region and demographics. In a study conducted across several European countries regarding views of climate change, it was found that demographic information, as well as political affiliation, were the most important factors in shaping people's perceptions regarding climate change, especially about how likely people are to believe that human impact is an important contributor to climate change and global warming, as well as the person's willingness to advocate for and go through lifestyle changes to combat climate change. Young adults were found to be the most vocal group in supporting the idea that human activity has been a significant cause of climate change, although their degree of willingness to participate in lifestyle changes was found to be varied (Poortinga, 2019).

An individual's or a group's perspective, temperament, and emotional response to the topic of climate change is referred to as their climate change attitude (Clayton, 2020). It encompasses a variety of climate-related attitudes, beliefs, and values, as well as the desire to act or make decisions in response to this global environmental crisis. Climate change attitudes can range from positive and proactive views that emphasize the necessity of addressing climate change to more apathetic or skeptical attitudes that discount the significance or urgency of solving it. These attitudes are shaped by a complex interaction of factors such as cultural background, education, information exposure, and personal beliefs, and they can considerably alter an individual's desire to engage in climate-friendly actions and advocate for climate action. Understanding climate change attitudes is critical for developing successful communication strategies, legislation, and educational efforts aimed at encouraging sustainable practices and mitigating climate change impacts. (Jones & Davison, 2021).

2.4 Climate Change Opinions and University Students

Within the university student demographic, views regarding climate change and the best method to raise awareness and spread knowledge regarding it have some noticeable variations. In an international collaborative study conducted by the ScienceDirect journal in 2023, the views of international university students regarding climate change were tested more quantitatively through a questionnaire that aimed to look into the perceptions and attitudes of university students surrounding climate change, in particular, the study wanted to examine whether changes in the curriculum would be an effective means of furthering climate change awareness across students. The study found that students tended to have a good understanding of the issues of climate change. It has been found that there is less perception when it comes to actions being taken globally to try and combat climate change. The study found that consistently across regions of the world, the majority of students thought that climate change was real and that it was mainly caused by human activities, but it seems that other nuances regarding climate change were not well perceived by students. (Leal Filho, 2023)

Furthermore, certain researchers found there is significant agreement in the youth when it comes to the climate change topic, despite it often being politically polarized. For starters, surveys conducted in Western countries have found that awareness regarding the existence of climate change ranges from 83% at the lowest in the United States to around 95% at the highest amongst the German populous, showing that the awareness of climate change appears to be a majority held perspective in Western countries. However, what is often up to debate is the discussion surrounding the role of humans in contributing towards climate change, as this shows a more equal divide between the camp that believes that nature plays a greater role in the results of climate change compared to human activity, whilst another camp believes that human activity, more specifically carbon emissions, are the reason that climate change has exacerbated over the past decades. This shows that there is not as much of an issue when it comes to awareness of climate change itself, but the biggest point of contention is the awareness of the human impact in causing climate change (Eichhorn, 2020).

2.5 Climate Change Education and Knowledge

Trying to make learning programs aimed at students that are efficient in delivering education about climate change has been a challenge facing institutions trying to spread awareness and knowledge regarding climate change to students. One of the challenges faced by educators is trying to appeal to the younger generation and get their attention. An assumption is made that this is caused by the discrepancy between the increases in technology and access to such technology by the younger generations which research hasn't been able to keep up with. One of the important considerations that educational institutions have been researching is which themes Generation Z individuals find more relatable concerning climate change, which is assumed to then be the more effective theme to be used in spreading awareness and educating young people about the serious issue of climate change. In a study conducted for the Environmental Education Research journal of the Routledge group, researchers have identified that the two most common themes associated with effective courses that help in spreading climate change amongst the young generations were courses that focused on making climate change information feel more personal to the listeners, which allowed the listeners to relate more to what is being said and helped them retain more knowledge out of the sessions. The other relevant theme was that the activity was actively engaging to the audience and allowed some interaction to occur. These two themes were isolated in the study to be the most important things one must consider when designing a course for teaching about climate change (Monroe, 2019).

2.6 Climate Change Education in The UAE

Incorporating sustainability and climate change into the official education system is one of the main ways the UAE has invested in raising student awareness. Climate change has been incorporated into curricula at all educational levels, from primary to higher. Topics including environmental studies, renewable energy, and sustainable practices are taught to students. By this combination, the groundwork for an informed citizenry is laid by ensuring that pupils receive a thorough education on climate change issues from an early age.

The UAE has implemented several environmental education programs outside of the classroom. Students have real, hands-on experience with sustainability and climate change through field trips, workshops, and interactive activities. These programs go beyond the classroom and give students hands-on experience with environmental problems and their solutions. These initiatives also foster a sense of environmental consciousness and accountability (Smith, 2014).

2.7 Student-Led Sustainability Initiatives

The rise of student-led environmental initiatives is a noteworthy illustration of the UAE's efforts. These programs encourage sustainability and provide students with the tools they need to take ownership of their education. Encouraging active involvement and reinforcing environmental themes are key functions of student organizations and competitions. Events, campaigns, and projects that address regional environmental issues are frequently the result of these endeavors (Brulle, 2014).

The United Arab Emirates also has a long tradition of organizing youth climate summits and conferences, giving students the chance to hear from professionals, participate in thought-provoking debates, and showcase their own sustainable projects. These events promote information and comprehension, but more importantly, they give kids the confidence to take the initiative in combating climate change. Additionally, the UAE's vigorous involvement in international public awareness campaigns, like Earth Hour, inspires students and educational institutions to hold debates, plan events, and show their dedication to energy saving and climate change.

2.8 Impacts of Climate Change Awareness Initiatives on UAE Students Perceptions

reflection of the various events and initiatives aimed at raising climate change awareness and sustainability among students in the United Arab Emirates (UAE) can manifest in several ways. While the specific outcomes can vary among individuals and institutions, here are some common reflections and impacts:

1. ***Enhanced Awareness and Knowledge:*** Attending seminars, educational programs, and events has probably raised awareness and knowledge of climate change, including its

causes, effects, and possible solutions. Participating in these activities increases the likelihood that students will know about environmental issues.

2. ***Changed Attitudes:*** Modified Attitudes: Students' attitudes and values frequently change because of these experiences. Pupils might grow to have a stronger respect for the environment and a stronger feeling of duty to lead sustainable lives.

3. ***Environmental Advocacy:*** There's a chance that students who have taken part in conferences and sustainability programs will end up as environmental activists. Within their institutions and communities, they might aggressively advocate for climate action and sustainability.

4. ***Social Responsibility:*** Students' sense of social duty may be strengthened by these activities. They might be aware of their responsibility in tackling global issues and try to improve society.

5. ***Global Perspective:*** Student's viewpoints can be expanded by exposing them to debates on climate change that take place across the globe at conferences and youth summits. They might grow to see the world more broadly and comprehend how related environmental challenges are.

The reflection and impact of these events may be highly individualized and can evolve as students transition into their professional lives, influencing their decisions and contributions to society and the environment. (Doherty, 2011)

3-Methodology

This research will be undertaken by using a quantitative research approach to learn about the varying degrees of climate change knowledge, attitudes, and perceptions among university students in the UAE. The quantitative data will be collected using a tested questionnaire model that will help with understanding and image of student opinions and actions about climate change. This research will be mono-method research, which means that the questionnaire is the only primary source of data to be used in the analytical framework of the research. The data that is to be gathered will be analyzed to understand the relations between students' knowledge, attitudes, and perceptions regarding climate change.

3.1 Research Design

This study will use a descriptive and causal research design to examine the climate change knowledge, attitudes, and perceptions of university students in the UAE and to explain relationships. This methodology will be used to describe the current state of climate change awareness and understanding among university students and to identify areas where improvement is needed and how to develop as the relationship between the variables will be explained so that areas of improvement can be further identified. The data for this study will be collected through a questionnaire targeting university students in the UAE. The survey will include questions about students' knowledge of climate change, their attitudes towards climate change, and their perceptions of climate change education. The findings of this study will be used to develop recommendations for universities on how to improve climate change education and awareness programs. The recommendations will be based on the findings of the questionnaire.

This research will use a questionnaire strategy to collect data on the climate change knowledge, attitudes, and perceptions of university students in the UAE. A questionnaire strategy is appropriate for this study because it allows for the collection of data from a large sample of students in a relatively efficient manner.

3.2 Research Method

A quantitative method of data collection will be implemented throughout this research. The quantitative data will be collected using a self-administered online questionnaire forum in which participants will be required to give information regarding their demographic background as well as answer questions regarding their knowledge, attitudes, and perceptions of climate change to test their degree of education and awareness on the topic and to see which methods of climate change action they see best fit. It will be distributed to a sample of university students in the UAE.

The methods used for analyzing the data will consist of many statistical tests that are designed to discern the correlation between the research variables. For this task, the most appropriate statistical test will be a regression analysis for correlation.

The research will also aim to test different hypotheses related to the values at hand through the use of inferential statistical tests, the most appropriate of which will be the use of the Z test to try and find out if there is sufficient evidence to back up the aforementioned research hypotheses.

3.3 Research Time Horizon

This research will be conducted over 1 week in October 2023. The data collection will be completed this week but there will be no quota on the number of participants who can respond, provided they are given within that timeframe. Therefore, this research will have a cross-sectional time horizon since this research aims to explore the opinions of university students throughout one period of time and does not aim to analyze the change of attitudes and perceptions during different periods.

3.4 Sampling Technique, Size, and Population

The sampling technique that will be used in this research is limited to quantitative data collection: The quantitative data will be collected using a non-probabilistic sampling technique, and the type of such technique will be a convenient sampling method. This means that the samples will be collected from university students in the UAE who are available within the available contacts. The minimum sample size that is aimed to be achieved is expected to be 30 university students and the population of this research is defined as all university students in UAE, since there is no fixed quota for the research sampling process, the sample size is open to anyone who can participate so long as their responses are valid and meet the criteria. One potential downside of using a convenient sample is that the distribution of the answers will be limited to the research group's contact circle and therefore the expected deviation in some demographic categories will be smaller compared to a random sampling method. However, this sampling method will be useful in gathering data from a precise number of students who fit the defined population and is in line with the resources available for the research.

3.5 Questionnaire

The Questionnaire will be constructed into 5 sections. Each section collects data for specific research questions to have data that is valid and relevant to the analysis. The questionnaire will consist of different types of closed-end questions that will be stylized to fit the type of data being collected. These questions will be split into choice questions that are used to collect data regarding the respondents' demographic information. These choice questions will help display descriptive data about the nature of the respondents and help organize the data with more clarity and form. The other type of questions that will be used are Likert questions. These questions will make up a majority of the questions to test the knowledge, attitudes, and perceptions of students about climate change. The Likert questions will contain a scale that will rank the options and the students will select the value which they see best fit to answer the question. This will be helpful in the data analysis.

3.6 variables

This research will address many variables such as knowledge, attitudes, and perceptions about the research's target population of university students. It will examine the possible correlations between those variables. These variables will be dependent on the main research question as well as the secondary research questions derived to explore the main question.

The primary independent variable for this research will be the knowledge of university students with climate change, and this research will test out how this knowledge relates and interacts with the attitudes students have regarding climate change as well as their perceptions of climate change, making them the dependent variables. However, while exploring the relationship and interactions between these variables, there will be other variables that the research will consider to answer the other questions.

The variables that can be controlled are already considered within the sampling parameters, as the demographics of the sample population are limited by their adherence to a university and their geographic location being residents of the United Arab Emirates. Therefore the validity of the responses is mostly determined by the completeness of the questionnaires answered and there is no need to consider controlling any other variables.

4- Data analysis

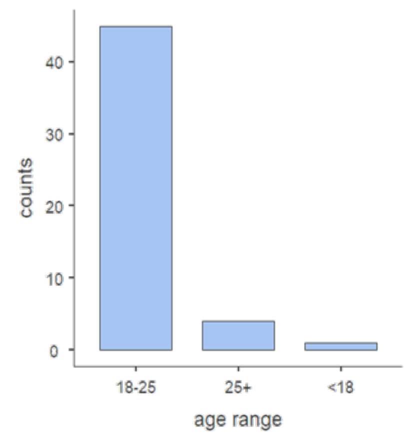
In this research, we will analyze the data using Descriptive and Regression analysis, and many other statistical tools which allow us to understand the data that have been collected for this research and interpreted.

4.1 Descriptive Analysis

4.1.1 Age range

The bar plot shows the number of people who participated in a questionnaire about climate change by age range. The age ranges are:

- 18-25
- 25+
- <18



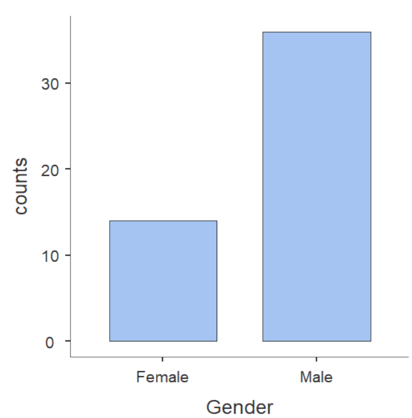
The diagram said that the majority of participants in the questionnaire were in the 18-25 age range, with 45 participants. There were 4 participants in the 25+ age range and 1 participant in the <18 age range.

This data suggests that young people are more likely to be interested in climate change than older people. This could be due to several factors, including:

- Young people are more likely to be exposed to information about climate change in school and through the media.
- Young people are more likely to be concerned about the future of the planet and about the impact climate change will have on their lives.
- Young people are more likely to be active in environmental organizations and movements.

4.1.2 Gender

The bar plot shows that there is a greater proportion of men than women who participated in the survey on climate change. There were 35 men and 15 women participants, meaning that 70% of participants were men and 30% were women.



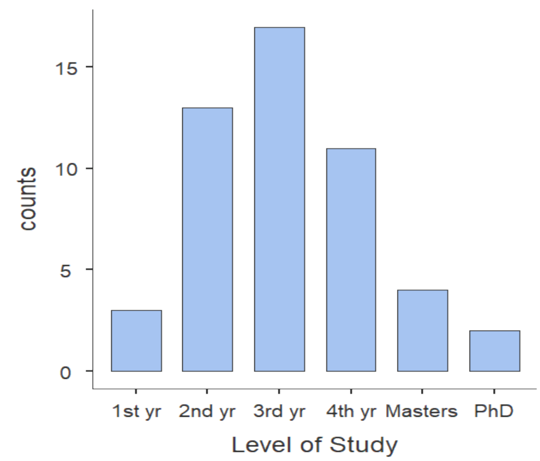
This could be due to many factors, such as:

- Men may be more likely to be interested in climate change than women.

- Men may be more likely to participate in surveys and studies than women.
- The survey may have been distributed to workplaces, which would have resulted in a higher proportion of male participants.
- There may be other factors that have contributed to the gender imbalance in the survey.

4.1.3 Level of Study

This data suggests that the majority of participants in the survey were undergraduate students, accounting for 50% of the total participants. Master's and PhD students accounted for 12% and 4% of the participants, respectively.



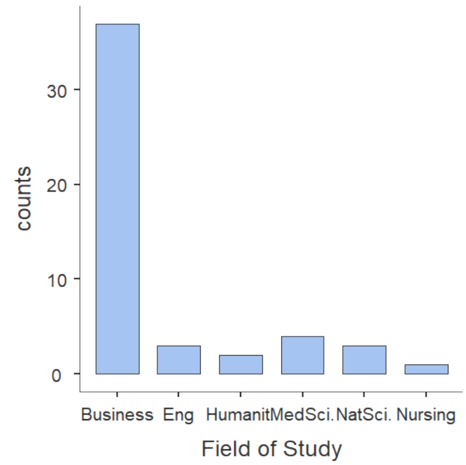
The following are some possible reasons for this distribution:

- Undergraduate students may be more likely to take courses on climate change than graduate students.
- Undergraduate students may be more likely to be involved in extracurricular activities related to climate change.
- The survey may have been distributed to undergraduate campuses, resulting in a higher number of undergraduate participants.

4.1.4 Field of Study

The bar plot you sent shows the number of participants in a survey on climate change by major. There are 50 participants in total, with 37 Business administration students, 4 Medical sciences students, 1 Nursing student, 3 natural science students, 2 humanities students, and 3 Engineering students.

This data suggests that the majority of participants in the survey were Business administration students, accounting for 74% of the total participants. Medical sciences, Nursing, natural science, humanities, and Engineering students accounted for 8%, 2%, 6%, 4%, and 6% of the participants, respectively.



The following are some possible reasons for this distribution:

- Business administration students may be more likely to take courses on climate change than students from other majors.
- Business administration students may be more likely to be involved in extracurricular activities related to climate change.
- The survey may have been distributed to business schools, resulting in a higher number of Business administration participants.

4.2 Regression Analysis

Linear Regression

Model Fit Measures

Model	R	R^2
1	0.45	0.20

Model Coefficients - Knowledge

Predictor	Estimate	SE	t	p
Intercept ᵃ	3.67	0.74	4.96	< .001
What is your Level of Study in University?:				
Graduate (PhD) – First Year (Undergraduate)	−2.17	1.17	−1.86	0.070
Graduate (Masters) – First Year (Undergraduate)	0.58	0.98	0.60	0.554
Fourth Year or More (Undergraduate) – First Year (Undergraduate)	0.52	0.83	0.62	0.540
Third Year (Undergraduate) – First Year (Undergraduate)	−0.37	0.80	−0.47	0.644
Second Year (Undergraduate) – First Year (Undergraduate)	0.41	0.82	0.50	0.619

ᵃ Represents reference level

1-The Regression Analysis Shows a Pearson Correlation Coefficient of 0.45:

- Pearson correlation coefficient (Pearson's r) is a statistical indicator that examines the strength and direction of the linear association between two variables. Here, it is applied to find out how the knowledge of students depends on their year level at the university.
- The zero-dot-four-five (0.45) figure symbolizes this relationship. This is positive and implies a positive trend whereby as the knowledge increases, the year level also increases.
- According to the statement, the relationship between these two variables is weak but positive. In this case, the value of 0.45 implies a weak or unclear association.

2-The Value of 0.45 Is Low Enough to Consider the Relationship Weak:

- Typically, values near 1 or -1 imply a strong relationship, whereas values close to 0 denote a weak relationship.
- In this context, the correlation has a value of 0.45 and is not strong. "Low enough to call it a weak relationship."

3-Not Low Enough to Consider No Relation Between the Data:

- The correlation is considered weak, but it is not of a magnitude to say that there is no possible relation between the data. This means that although the correlation is not strong, some evidence exists of a positive link between the student's knowledge and their year level. In other words, some degree of correlation, although weak.

4-The Coefficient of Determination (R-squared) Is Valued at 0.2:

- R squared is defined as a fraction of the dependency variance in knowledge, which was attributable based on year level within the regression model.
- Here, the coefficient of determination equals 0.2. This implies that the Model explains 20% of the variability. This means that in the Model, twenty percent of the differences in students' knowledge are attributable to the fact that they are in different years.

In Summary, the multiple regression indicates an inconsistent but positive link between a student's knowledge and the year they are found (r=0.43). Although there is a limited association between the two variables, there still exists a reasonable statistical significance with a squared value of 0.2, which implies 20% of the variation explained.

4.3 Reliability analysis

To measure the reliability of the variables received from the data collection process, Cronbach's alpha analysis was used to measure the covariance between each question in each category and compared to their respective variable. In total, 5 questions were regarding knowledge and accordingly, they were compared to each other, 7 questions were about the students' attitudes, and finally, 5 questions were about the students' perceptions. The reliability analysis will help display how reliable the data was collected by comparing the Cronbach's alpha value calculated from the results to set values to determine the strength of the data's reliability. A Cronbach's alpha value of 0.75 or greater is ideal for this study's purposes as it means the data's reliability is strong, and data with a value lower than 0.5 can be considered unreliable.

4.3.1 Reliability Analysis of Students' Knowledge

Firstly, the data collected on the knowledge of the students will be analyzed, which was collected from 5 true or false questions that aimed to test the students' knowledge regarding climate change. The reliability analysis shows the data collected on knowledge has the lowest reliability score so far, with a score of 0.605. This shows that while the data still has a degree of reliability, the data cannot be considered as strongly reliable. This score is still above an alpha score of 0.5 which means the data can still be considered as somewhat reliable. The score calculated has been shown below.

Reliability Analysis

Knowledge of Students

Scale Reliability Statistics

	Cronbach's α
scale	0.605

4.3.2 Reliability Analysis of Students' Attitudes

The next data to be analyzed for reliability will be the questions related to the attitudes of the students regarding climate change on a Likert scale ranging from never to always. This section of the questionnaire contained the most questions at a total of 7 questions. A reliability analysis was conducted on the questions to see their level of covariance and therefore find out how reliable the data is. The results retrieved from the analysis show that the data collected from the questions about students' attitudes can be considered strongly reliable, as the data showed a very high alpha score of 0.887 as shown in the figure below, meaning that it can comfortably be concluded that the data collected on attitudes by this study can be considered very reliable.

Reliability Analysis

Attitudes of Students

Scale Reliability Statistics

	Cronbach's α
scale	0.887

4.3.3 Reliability Analysis of Students' Perceptions

Finally, a reliability analysis was conducted on the perceptions of the students to conclude this study. The data was collected from 5 questions ordered on a Likert scale from strongly disagree to strongly disagree. The reliability analysis conducted on perception questions shows that this data has the highest reliability out of the data collected in this study, showing an alpha score of 0.932 as displayed below. Therefore, it can be concluded that the data collected from perception has the highest reliability, whilst the data collected on the students' knowledge has the lowest reliability. This will be an important consideration when looking at the results of further analyses on the data.

Reliability Analysis

Perceptions of Students

Scale Reliability Statistics

	Cronbach's α
scale	0.932

4.4 Confirmatory Factor Analysis

Before conducting detailed hypothesis testing, a confirmatory analysis will be performed on the primary variables of this study to perform a preliminary testing of the existence of relationships between the variables. The factor analysis groups the questions of the survey into groups based on knowledge, attitudes, and perceptions and condenses the factors to measure the potential hypothesis. Afterwards, the p score is calculated which will help in establishing the preliminary hypothesis that is formed around the relationship of the variables. For instance, in the figure below, the calculated p values show that knowledge does not have a significant impact on the attitudes and perceptions of students regarding climate change. However, the figure shows attitudes having a significant impact on the perceptions of students. This means that while the knowledge factor does not seem to affect the variability in data related to either factor, the attitudes of students have a strong effect in influencing the perceptions of the students.

Factor Estimates

Factor Covariances

		Estimate	SE	Z	p
Knowledge	Knowledge	1.000 [a]			
	Attitudes	-0.217	0.177	-1.229	0.219
	Perception	0.019	0.194	0.099	0.921
Attitudes	Attitudes	1.000 [a]			
	Perception	0.721	0.081	8.937	< .001
Perception	Perception	1.000 [a]			

[a] fixed parameter

Furthermore, a test for exact fit was conducted to measure the relationship between the predictor factors and the response factors and to show how the data fits together. The model fit figure below shows a *p*-value of less than 0.001 which means that the data fits very well with the data collected.

Model Fit

Test for Exact Fit

χ^2	df	p
197.696	116	< .001

Fit Measures

			RMSEA 90% CI	
CFI	TLI	RMSEA	Lower	Upper
0.832	0.803	0.119	0.090	0.147

Fit Measures

			RMSEA 90% CI	
CFI	TLI	RMSEA	Lower	Upper

This helps in answering research hypotheses laid out previously in the research:

1. The knowledge of university students in UAE can impact their attitudes.
2. The attitudes of university students in UAE can impact their perceptions.
3. The knowledge of university students in UAE can impact their perception.

It can be determined that while there is weak to no evidence to suggest that knowledge of the students has no impact on their perceptions of climate change, there is strong evidence to suggest that the attitudes of university students can impact their perceptions of climate change.

4.5 Z-Test Analysis of Hypothesis

4.5.1 Analyzing Degree of Student Knowledge on Climate Change

This analysis will focus on the following research question: "*What is the prevailing knowledge level of university students in UAE regarding climate change*"? The one sample one-tailed Z-test was chosen to be the most appropriate test to handle this research question as the question is trying to test if the students in UAE universities are knowledgeable about the issue of climate change. Therefore, this question can be tweaked to say "Is the knowledge of UAE university students about climate change higher than average?"

Before proceeding with the test, a value for "average knowledge" must be used to test a hypothesis about the question, the question will assume that a student with average knowledge about climate change would score a 3 out of 5 in the sum of knowledge. This is because the questions presented entry-level information about climate change. Therefore, the value to which the average knowledge of the students will be compared is 3.

The statistical test will take the average knowledge of the respondents of the questionnaire and test it based on hypotheses. In this scenario, two hypotheses can be formed and tested to determine which hypothesis prevails with sufficient evidence. The null hypothesis of the test will assume that "The average knowledge score of students in the UAE is Less than or Equal to 3", this means that the alternative hypothesis formed will be "The average knowledge of students in the UAE is greater than 3".

Therefore the hypotheses of the test will be as follows:

H0: $\mu \leq 3$

H1: $\mu > 3$

The data collected was organized and tested through the one sample T-test on Jamovi, where the dependent variable was the sum knowledge of the students, and the test variable was 3. The standard error used for the test is 5% which means that if the *p*-value is less than 0.05 the alternative hypothesis will not be rejected. The results are displayed in the figure below.

One Sample T-Test

One Sample T-Test

		Statistic	df	p
Sum Knowledge	Student's t	3.755	49.000	< .001

Note. H_a $\mu > 3$

The results show that the *p*-value is less than 0.001, suggesting that the alternative hypothesis is prevailing. Therefore, there is very strong evidence to suggest that the average university student in the UAE is well-informed about climate change.

4.5.2 Analyzing Differences in Climate Change Knowledge Based on Gender

This analysis aims to address a hypothesis: "The male university students in UAE are more knowledgeable than Female students about climate change", the independent sample one-tailed Z-test was chosen to be the most appropriate test to handle this research question, this is because the question is trying to see if the average of one sample is greater than the average of another sample. The independent samples test is most appropriate for comparing the male sample and the female sample as the group consists of two levels. So, each level within the group can be distinguished within the hypothesis formation.

The statistical test will compare the two means gathered from the sum of knowledge of the male and female students, and a 95% confidence interval will be used to determine the accuracy of the test. The hypothesis is trying to measure the relation between the male's knowledge, which will be considered as the first mean value. The female knowledge will be the second mean value, meaning that if the average knowledge of male students is less than or equal to the female students' average knowledge, the alternative hypothesis would be rejected. The hypotheses derived from this test are the null hypothesis, which claims "The average knowledge about climate change of male university students in the UAE is less than or equal to the average knowledge of female university students in the UAE". This means that the alternative hypothesis of this test will be "The average knowledge about climate change of male university students is greater than the average knowledge of female university students in the UAE."

Therefore the hypotheses of the test will be as follows:

H0: $\mu_m \leq \mu_f$

H1: $\mu_m > \mu_f$

The data was tested using the independent sample T-test feature on Jamovi, where the dependent variable was the sum knowledge of the students, and the grouping variable was the gender of the students. The standard error used for the test is 5% which means that if the *p*-value is less than 0.05 the alternative hypothesis would not be rejected. The results are displayed in the figure below.

Independent Samples T-Test

Independent Samples T-Test

		Statistic	df	p
Sum Knowledge	Student's t	1.388	48.000	0.171

Note. H_a $\mu_{Female} \neq \mu_{Male}$

The results show that the p value is greater than 0.05, as p was shown to equal 0.171. This means that there is weak to no evidence to suggest that the average knowledge of male university students in the UAE on climate change is better than the average knowledge of female university students in the UAE.

5-Discussion

It can be concluded that after analysis of the data collected through the questionnaire, this study enabled the discovery of a variety of differences and patterns that are related to the student's knowledge, attitudes, and perceptions about climate change in the UAE. The study was primarily focused on the interactions between students' knowledge, attitudes, and perceptions of climate change, but comparisons of the data collected on these factors with demographic data allowed for many patterns to be revealed during this study. The analysis of this data will enable the tackling of the questions raised earlier by this research and will enable the linking of previously analyzed terms.

5.1 Research Findings

This study focused on four core research questions which aimed to discover relationships between data variables. The primary question that constituted the focus of this study was "*What is the prevailing knowledge level of university students in UAE regarding climate change, and how is this knowledge reflected through their respective attitudes and perceptions?*". The data collected provided reasonable access into ways through which such a question can be answered. For instance, if you break down the question, you can find three hypotheses that the question aims to test. The first hypothesis is about the knowledge level of the university students, and the second and third hypotheses are related to the impact knowledge has on the attitudes and perceptions of university students respectively. This means that the question can be tested in two ways. The approach selected by this study was to use a one-sample Z-test analysis on the first hypothesis, as the claim made can be compared to an average to evaluate the overall knowledge of students. The study used a factors analysis to test the remaining two hypotheses about knowledge's impact on attitudes and perceptions.

5.1.1 Prevailing Knowledge Level of Students

The study found that university students across the United Arab Emirates tend to have above-average knowledge on climate change. This was seen through the Z test conducted to test the hypothesis. The test has shown a very high reason to believe that the average knowledge of UAE university students about climate change is above average. This finding can help answer the first part of the first research question and can also explain why knowledge was not as impactful as a factor on the other data collected. Since the baseline knowledge of the sample population regarding climate change seems to be above average. This answers the second part of the research question, which deals with the impacts that the knowledge people held had on their attitudes and perceptions of climate change.

Overall, the prevailing knowledge level of students seems to be above average, which helps in answering part of the primary research question and addresses the hypothesis brought forward which dealt with the level of knowledge students had about climate change.

5.1.2 The Impact of Knowledge on Attitudes and Perceptions of Climate Change

The impact of knowledge about climate change on the attitudes and perceptions of students seems to be negligible in this study. The factor analysis showed that climate change did not attribute too much of the variability seen within the attitudes and perceptions of students. This could be explained due to the previously elaborated upon high level of knowledge that students had concerning climate change, meaning that there was not much variability in knowledge to find a clear-cut impact on the knowledge and attitudes of students. This will be further elaborated upon in the research limitations.

Overall, the research has not found any strong evidence to suggest that high knowledge of climate change will have a noticeable impact on the attitudes and perceptions of students.

5.1.3 Climate Change Knowledge and Gender

The study also conducted a test to find out whether there was a difference between the two genders in terms of their knowledge of climate change. An independent sample Z test analysis was used to tackle the hypothesis that “Male students are more knowledgeable than female students about climate change”. The study concluded that there was no evidence to support the hypothesis that male students have more knowledge about climate change than female students. This shows that gender was not an impactful demographic factor when considering the changes in views about climate change. This also answers one of the research hypotheses about the role of gender in impacting knowledge of climate change.

5.1.4 Students’ Year Level and Climate Change Knowledge

Another demographic variable that was tested to the knowledge of students about climate change was their year level in university. An assumption was made that the year level of students would have a positive correlation with their respective knowledge about climate change. To test the correlation between these two variables, a regression analysis was made to see if the increases in year level led to consistent changes in climate change knowledge. The study found that while there was a positive relationship between the year level of the students surveyed and their knowledge of climate change, this relationship was weak and therefore it cannot be used to conclude that the year level of the student has an impact on their knowledge of climate change.

5.2 Explanation for Findings

The findings of this study show that knowledge of climate change does not seem to be an impacting factor when evaluating the attitudes of students and their perceptions. The factor of knowledge is still shown to have some effects on many factors affecting the students surveyed. This can be explained with the literature mentioning climate change educational effects in school and the spread of knowledge of climate change through social media bringing knowledge to online audiences at a younger age. University students have probably encountered the information presented within the knowledge section of the questionnaire before, and therefore the knowledge about climate change was there. However, attitudes and perceptions of climate change tend to be the factors where variety is expected. This is because these factors are affected by many internal and external factors as shown in the study referenced in the literature confirming that the most variable factor when it comes to the discussion of climate change seems to be people's perceptions, which are impacted by demographic as well as external factors and therefore are volatile to change.

The strongest relationship perceived in the study, however, seemed to be between the student's attitudes and their impact on their perceptions. This study provided a detailed look at the varying degrees to which people prescribe to certain attitudes or hold certain perceptions about climate change, and it seems that the attitudes that people have about climate change translated into the perceptions they hold. Therefore, it can be concluded that the attitudes and perceptions that university students hold regarding climate change seem to be the most sensitive factors that are subject to change.

6- Conclusion

The goal of the study is to compare relationships using various indicators and assess university students' knowledge, attitudes, and views about climate change in the United Arab Emirates. The data analysis revealed methods for increasing students' interest and understanding of climate change and inspiring them to become active in climate change activism by comparing the knowledge, attitudes, and perceptions of students across year levels.

The hypotheses confirmed by this study are that the students of the UAE are knowledgeable about climate change and that the attitudes of the students affect their perceptions of climate change. However, the hypotheses that were rejected through this study are that knowledge has an impact on the attitudes of students, knowledge has an impact on the perceptions of students, and that there is a difference n knowledge to suggest that male students are more knowledgeable than female students.

The Research questions addressed in this study have also been answered through statistical analysis. Investigation regarding the primary research question has found that the knowledge of university students in the UAE is above average, their knowledge had no impact on their attitudes or perceptions. The research also delved deep into the relationship between the demographics of the students, particularly their year level and gender, and helped discover the trends related to such variables. For instance, it was found that there is a weak but positive relationship between a student’s year level in university and their knowledge about climate change. The study has also concluded that there is no difference between the knowledge of male and female university students about climate change.

Furthermore, this research discusses a lot of aspects regarding knowledge and this research can conclude that knowledge has the lowest Reliability as the reliable test shows which support also the Confirmatory Factor Analysis which indicates that knowledge does not have an impact on attitude and nether perceptions, which mean these two tests are evidence to each other. However, the attitudes of university students in UAE could have an impact on the student`s perception of climate change.

Comparing all this with our literature review, this research adds value to specific views which can help conduct future research. The research on this model can be conducted in a longitudinal time horizon to further assess the changes in attitudes and perceptions of climate change over the years. This would help in better understanding variables that could be influencing the perceptions and attitudes of students which aren't bound by their knowledge and instead are more dynamic and harder to measure in a cross-sectional study.

6.1- Recommendations

The majority of students have positive attitudes and opinions regarding climate change. They think that action must be taken because they are worried about the situation. They do, however, have certain reservations regarding the efficacy of climate change advocacy.

According to the data analysis, the following tactics might be employed to increase students' curiosity and understanding of climate change:

- Increase the relevance of climate change education to the interests and lifestyles of students.
- Give children the chance to learn about climate change from a range of people, such as activists, professionals, and other students.

- Make use of a range of instructional techniques, including conversations, lectures, and practical exercises. Additionally, the data analysis indicates that the following tactics may be employed to encourage students to participate in climate change activism:
- Assist students in gaining a feeling of empowerment and agency.
- Give students the chance to participate in climate change action in a way that speaks to them.
- Establish links between students and adults engaged in climate change advocacy.

Overall, this research helped develop an insight into the knowledge of university students in the UAE, which helped in forming conclusions about how the socio-demographic elements of people affect their knowledge. This study have also tried to determine the potential relationship between the students' knowledge and their perceptions and attitudes regarding climate change, and found that knowledge is not that important of a determining factors, and there may exist other factors which could be investigated that could lead to obtaining an insight about what affects the attitudes and perceptions of university students in the UAE.

6.2 Research Limitations

This study has faced many challenges and limitations which can be attributed to different aspects of the research process. This means that this study can still be further refined in order to get a more accurate view about the situation in regard to how knowledgeable university students in the UAE are about climate change, their attitudes, and their perceptions. One of the primary limitations presented in this research can be attributed to the sampling process used for the research. The research used a non-probabilistic convenience method of sample collection which resulted in a lot of demographic data being skewed towards demographics which are very similar and therefore the study lacks variety. This can be seen in the data description where a lot of the students sampled in the questionnaire were male, 3rd year students, and were part of the college of business administration. This limitation could be further prevented in the future by using a different sampling technique which could help achieve a more equal distribution of data.

The questionnaire also presents a limitation within the research, more specifically the knowledge questions. This is because these questions test basic knowledge on climate change which won't provide a clear picture on the variation of knowledge within the students in university. If the questionnaire's knowledge section had varying difficulty in the questions used to test students' knowledge on climate change, then patterns and relationships relating to the knowledge factor in the study could have been made clearer.

These limitations can be improved in future research, as a study on a similar module could be conducted with a different sampling techniques and slightly different questions. But as it stands, the study has managed to use the limited results to conclude that knowledge was not the most important factor in determining students' outlook towards climate change.

7-References:

- Smith, J. D., & Leiserowitz, A. A. (2014). The role of emotion in global warming policy support and opposition. Risk Analysis, 34(5), 937-948.

- Bamber, J. L., Westaway, R. M., Marzeion, B., & Wouters, B. (2018). The land ice contributed to sea level during the satellite era. Environmental Research Letters, 13(6), 063008.

- IPCC. (2018). Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways in the context of strengthening the global response to the threat of climate change.

- Doherty, T. J., & Clayton, S. (2011). The psychological impacts of global climate change. *American Psychologist*, *66*(4), 265–276.
- Brulle, R. J. (2014). Institutionalizing delay: Foundation funding and creating U.S. climate change counter-movement organizations. Climatic Change, 122(4), 681-694.

- Smith, J. K., & Doe, A. B. (2022). Climate Change Awareness Among University Students: A Global Perspective. *Journal of Environmental Education*, *50*(3), 245–259.

- Al-Mansoori, N., & Ahmed, S. (2021). Assessing Climate Change Literacy Among University Students in the UAE. *Sustainability*, *13*(6), 3105.

- IPCC (Intergovernmental Panel on Climate Change). (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the IPCC.

- Shafiei, A., & Maleksaeidi, H. (2020). Pro-environmental behavior of university students: Application of protection motivation theory. *Global Ecology and Conservation*, *22*, e00908.

- Rousell, D., & Cutter-Mackenzie-Knowles, A. (2020). A systematic review of climate change education: Giving children and young people a 'voice and a 'hand in redressing climate change. *Children's Geographies*, *18*(2), 191–208.

- Reid, A. (2019). Climate change education and research: possibilities and potentials versus problems and perils? *Environmental Education Research*, *25*(6), 767–790.

- Howe, P. D., Marlon, J. R., Mildenberger, M., & Shield, B. S. (2019). How will climate change shape climate opinion? *Environmental Research Letters*, *14*(11), 113001.

- Hornsey, M. J., & Fielding, K. S. (2020). Understanding (and reducing) inaction on climate change. *Social Issues and Policy Review*, *14*(1), 3–35.

- Eichhorn, J., Molthof, L., & Nicke, S. (2020). From Climate Change Awareness to Climate Crisis Action. *Public Perceptions in Europe and the United States*.

- Leal Filho, W., Ayal, D. Y., Wall, T., Shiel, C., Paco, A., Pace, P., ... & Kovaleva, M. (2023). An assessment of attitudes and perceptions of international university students on climate change. *Climate Risk Management*, *39*, 100486.

- Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Péan, C., Berger, S., ... & Zhou, B. (2021). Climate change 2021: the physical science basis. *Contribution of working group I to the sixth assessment report of the intergovernmental panel on climate change*, *2*.

- Bhattacharya, P. (2021). *Climate Change and Greenhouse Gas Emission*. [NEW INDIA PUBLISHING AGENCY] NIPA.

- 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

- Poortinga, W., Whitmarsh, L., Steg, L., Böhm, G., & Fisher, S. (2019). Climate change perceptions and their individual-level determinants: A cross-European analysis. *Global environmental change*, *55*, 25-35.

- Clayton, S., 2020. Climate anxiety: Psychological responses to climate change. *Journal of anxiety disorders,* Volume 74, p. 102263.

- Jones, C. & Davison, A., 2021. Disempowering emotions: The role of educational experiences in social responses to climate change. *Geoforum,* Volume 118, pp. 190-200.

8-Appendix

8.1 Demographic Questions

What is your Gender: Male, Female

What is your age range: <18 ,18–25 , >25

What is your level of study: 1^{st} year undergraduate; 2^{nd} year undergraduate; 3^{rd} year undergraduate; 4^{th} year undergraduate; Graduate (Master); Graduate (PhD)

What is your Field of Study: Natural Sciences, Arts, Humanities, Nursing, Business Administration, Food and Agriculture, Engineering, Medical science

Have you completed any climate change courses/training? Yes; No

What is your source of knowledge in regard to climate change? University; Internet; Social Media; Radio/Television; Print Media; Other sources

8.2 Knowledge Questions

Answers: True / False

Forests can reduce climate change by decreasing the amount of GHGs in the atmosphere.

Carbon dioxide (CO_2), Methane (CH_4) and nitrous oxide (N_2O) are all greenhouse gases.

Carbon dioxide | (CO_2) is the principal greenhouse gas.

Emission of Greenhouse gases (GHGs) into the atmosphere is responsible for climate change.

Climate change can be identified by changes in the mean or variability of its properties for an extended period, typically decades or longer.

8.3 Attitude Questions

Answers: Never, Rarely, Sometimes, Often Always

Are you willing to use public transport in order to reduce the impacts of climate change?

Are you willing to pay more for an environmentally friendly source of energy in order to reduce the impact of climate change?

Are you willing to decrease your energy consumption in order to decrease your impact on climate change?

Are you willing to join a climate advocacy group?

Are you willing to take a climate change related course as a free elective course?

Are you willing to have the study of climate change be a mandatory undergraduate course?

Are you willing to learn more about climate change?

8.4 Perception Questions

Answers: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

To what extent do you agree with the following statements?

Climate change is real.

Human activities are the main source of climate change in the 21st- century.

Climate change will increase the incidence of food-borne and water-borne diseases, such as cholera.

Education can play a major role in mitigating the effects of climate change.

Climate change will affect key factors, such as the environment. Human health, food security, natural disasters, etc.