Cape Peninsula
University of Technology

TERTIARY STUDENTS' AWARENESS OF CLIMATE CHANGE: A CASE STUDY OF A SELECTED UNIVERSITY OF TECHNOLOGY

by

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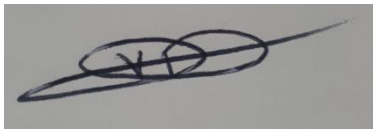
DECLARATION

I, Vuyolwethu Dyani, declare that the contents of this thesis represent my own unaided work and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



5 July 2021

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ABSTRACT

Introduction: Climate change (CC) is harming the planet. All of society should be involved in managing climate changes or it will become uncontrollable. Students should not be left out as they are regarded as important to the society and in a good position to deal with the changes because they will become tomorrow's decision makers and influencers.

Problem statement: It is unclear whether students at tertiary institutions are aware of climate change.

Aim of study: The aim of the research was to explore the level of climate change awareness of tertiary students.

Research methodology: The research adopted the objectivist ontology. A positivist approach was followed and the research approach was deductive. The intent of the study was to generalise what tertiary students think and know about climate change, therefore, the survey strategy was appropriate. Questionnaires were used to collect data from 603 students who participated in the study. The data were analysed using MS Excel and SPSS available at the university. A factors analysis was also performed. In total, 42 findings were identified.

Ethics: Participants were informed of the purpose of the study and their rights to privacy. No cultural or any other sensitive questions were asked, and participants had the option to participate in the study and withdraw at any time.

Finding: Students are aware of climate change, but more needs to be done to empower students to become advocates of climate change.

Keywords: Climate change, tertiary students, awareness

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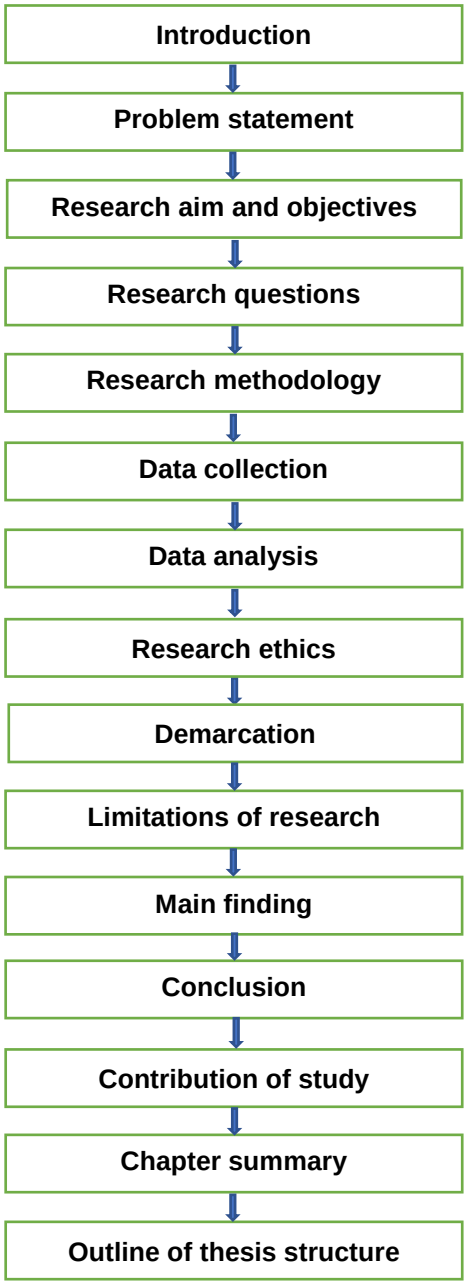


Figure 1.1: Chapter One layout

1.1 Introduction

This research focuses on tertiary students' awareness of Climate Change (CC). University students' knowledge and awareness of CC is of utmost importance as it equips them with skills to cope with the future impact of CC (Mugambiwa & Dzomonda, 2018). Climate change has become a reality. It affects everyone in society. According to Jamshidi et al. (2018:1369), CC "is one of the most important environmental problems facing the world today". Rother and Godsmark (2018) state that CC now forms a major part of the global debate. The planet faces a major upheaval in the making and it is essential that all role-players become involved in the battle against negative climate change.

Zewdie (2014) suggests that there is no single agreed definition of the term CC because of diverse opinions. CC can be referred to as "a change which is recognised directly or indirectly to human actions that change the structure of the universal atmosphere and which are in addition to natural climate changeability witnessed over comparable time phases" (United Nations, 1992:3). Bakaç (2018:240) argues that CC is commonly "dependent on natural causes and human activities". CC can also be defined as major environmental change, which may include rain, temperature, heat, wind, and other weather conditions (Lubos & Lubos, 2019). The United Nations Framework Convention on Climate Change (UNFCCC, 2009) views CC as natural changes that are linked to human actions directly or indirectly, and happening over a long timeframe. Ogunsola et al. (2018) suggest that CC is a change in the mean state of the environment happening over a long timeframe, even decades or longer, which may be attributed to natural changes.

Currently, there is general agreement in the scientific community and among some students that CC does exist; it is a reality and we are now experiencing it and its impact. The impact of CC awareness differs internationally. It has been a threat to the achievement of sustainable development goals and to humankind (Mugambiwa & Tirivangasi, 2017).

The 2015 Paris Agreement (COP21), which is supported by 187 countries, is regarded as the turning point in the struggle against climate struggle (Rogelj et al., 2016). By 15 December 2015, 187 states had submitted their planned Nationally Determined Contributions (INDCs) briefing their climate activities after 2020 in line with the Paris Agreement. The Paris climate contract intends holding universal warming lower than 2 degrees Celsius (^{o}C) and pushing efforts to restrict it to 1.5 ^{o}C (Rogelj et al., 2016).

This assemble set clear targets to limit global temperature increase to below 2 °C and to decrease warming to no more than 1.5 °C above pre-industrial values (World Health Organisation, 2018). This 2 °C warming goal is perceived by all as a commonly accepted target, acknowledged by scholars as a harmless limit that escapes unsafe CC (Knutti et al.,

2015). Failure to achieve the projected Paris Agreement will result in serious risks to human, ecology, agricultural, economic productivity, health, water and other resources (Maúre et al., 2018).

World leaders, decision makers and opinion formers are a critical part of the debate on CC. The youth is becoming more aware of CC, taking a bigger responsibility towards CC and they are better positioned to deal with the legacy of CC (Rousell & Cutter-Mackenzie-Knowles, 2018). According to Barreda (2018), student and youth awareness on CC must be considered in CC agendas by all nations. Their opinions and ideas are growing in popularity and need to be taken seriously. Therefore, in addressing the question of CC and global warming, combining a persuasive message with individual solutions, students, youth and other generations is deemed a potentially valid and valuable technique (Parant et al., 2016).

CC consciousness is vital to realise sustainability in developing nations (Shahid & Piracha, 2010). There is minimal awareness of CC among emerging nations (IPCC, 1996). Emerging countries have the ability to contribute to the fight against CC through research and technology, but little awareness of CC became a problem (Afrifa et al., 2020). Awareness simple means being mindful, concerned about, and having a well-informed interest in a particular situation, development or consciousness about CC. The research therefore was conducted to explore the level of tertiary students' awareness of CC – a subject that is critical to the survival of the planet. The CC effects began threatening the globe and human nature as a whole, and these effects will carry on increasing. Dealing with challenges related to CC will require a motivated, active and educated citizenry (Zhang, Ye, et al., 2020).

Students have a possibility of living longer and that makes them more vulnerable to the effects of CC. From a threat-declining point of view, students are a critical target audience as they are at an age where permanent habits linked to mitigation and adoption are shaped (Di Giusto et al., 2018). Tertiary students represent the future leaders and managers of their countries. Because the youth have a longer time horizon they are more vulnerable to the longer-term results of CC and as a result, their sentiments on this matter are of considerable interest. As the upcoming generation of citizens and leaders, understanding their awareness and attitudes will aid in predicting future trends (Wachholz et al., 2014). Very few studies have been done to assess the knowledge, awareness and attitudes of tertiary students towards climate change.

1.2 Problem statement

CC has a detrimental effect on the planet. According to Edwards (2020), the planet is in the midst of CC disaster in slow motion. According to Kennedy and Lindsey (2015), the planet

has challenge with CC. CC is the defining health and environmental crisis of the twenty-first century (Gordon, 2020).

Future generations need to be aware of the problem and become involved in the management of CC (O'Brien et al., 2018). Narksompong and Limjirakan (2015) suggest that empowering young people on issues related to CC is essential. Trott (2021) also supports that everyone should become knowledgeable about CC already at childhood. Without the involvement of all the people, and particularly students, the planet will eventually be irrevocably b changed or destroyed (Agboola & Emmanuel, 2016). Unfortunately, there is little information available on the level of awareness of students on CC and more research needs to be done on the awareness levels of students on CC (Barreda, 2018). It is unclear whether students at tertiary institutions are aware of CC.

1.3 Research aim and objectives

The aim of the research is to explore the level of climate change awareness of tertiary students at a selected University of Technology (UoT) in South Africa.

The following are the objectives of the research:

Objective 1: To determine the climate change perceptions of students

Objective 2: To assess the different levels of climate change awareness of students

Objective 3: To examine the factors that affect the climate change awareness levels of students

Objective 4: To identify and recommend a climate change awareness communication model to use for students

The objectives are aligned with the hypothesis postulated in Chapter 3 , section 6.3.2

1.4 Research questions

presents the research problem, primary research question, sub-research questions, the research methodology and the objective of each question.

Table 1.1: Research problem, research question, research sub-questions, methods, and objectives

Research problem	It is unclear whether students at tertiary institutions are aware of climate change.	
Primary Research question (PRQ)	What is the level of climate change awareness of students at a selected University of Technology in South Africa?	
Sub-Research Questions (SRQs)	**Research method(s)**	**Objectives**

SRQ1: What are students' perceptions of climate change?	Survey	To determine the climate change perceptions of students
SRQ2: What are the differences in the climate change awareness levels of students?	Survey	To assess the different levels of climate change awareness of students
SRQ3: What are the factors affecting the climate change awareness levels of students?	Survey	To examine the factors that affect the climate change awareness levels of students
SRQ4: What channel of communication do students perceive as important to improve their awareness of climate change?	Survey	To identify and recommend a climate change awareness communication model to use for students.

1.5 Research methodology

Wong (2016) regards research methodology as important because it shows the plan on how the research problem will be addresses. It describes the action required to complete the study. It includes the research paradigm or philosophy, research strategy, research design, research methods, data collection and data analysis.

1.5.1 Research philosophy

1.5.1.1 Ontology

Al-Saadi (2014:1, citing Crotty, 1998) defines ontology as "the study of 'being' and is concerned with 'what is', i.e., the nature of existence and structure of reality as such". Objectivism has been selected. Ratner (2012: online) defines objectivism as "a view that an objective reality exists and can be known more through the gathering of more information. It is more practical and focuses more on facts from individually participants". For this reason this research is done from an objectivist perspective.

1.5.1.2 Epistemology

A positivist approach was followed. Positivism is regarded as a philosophical approach only recognising that which is verified scientifically. It posits that a scientific approach is the only way to establish truth (Kawulich, 2012).

1.5.2 Research approach

Saunders et al. (2009) define an inductive approach as the researcher gathering and analysing data and then, from the analysis, formulating a theory. According to Creswell and Plano Clark (2007:23), deductive researchers "work from the top down, from a theory to hypotheses to evidence to support or refute the theory". According to Saunders et al. (2009), a deductive approach is more focused on testing a hypothesis and is therefore better suited to dealing with quantitative data. For this study a deductive approach was followed. The results cannot be generalised; it can only be applied to the University of Technology (UoT) studied.

1.5.3 Research design

According to Creswell (2014:113), research design is “an outline that has been formed to find answers to the research questions”. It includes processes used for the collection and analysis of data. Quantitative research was adopted for this study. It emphasises collecting numerical data to explain a specific phenomenon. Quantitative methods focus on objective measurements using statistical and numerical analyses of collected data through surveys and questionnaires (Creswell, 2014).

1.5.4 Research strategy

The research strategy followed was that of a survey. Kendall (2011:31) argues that “a research survey is a tool in which the investigator gathers facts or attempts to determine the connection among facts”. A survey is commonly used method, making it possible to study things that are not seen, such as the beliefs or attitudes of people. The unit of analysis was the students of a selected UoT in South Africa. The survey was structured to gained insight into the answers of the students on the research question and sub-research questions posed to them.

1.5.5 Research methodology/processes

The population is defined as the students of the District 6, Mowbrey, Athlone, and Bellville campuses of the selected UoT. The unit of analysis (UoA) was randomly selected (all students has an equal chance to be selected) (Saunders et al., 2019). Selected students on the campuses were approached to complete the questionnaire. Furthermore 1st, 2nd, 3rd and 4th year students were sampled. In total, 603 students participated in the study; 127 were 1st year, 157 were 2nd year, 152 were 3rd year, and 168 were 4th year students. The data collection and analysis were done under the supervision of the research supervisor.

1.6 Data collection

The survey questionnaire was used as a tool to collect data (Appendix C). The questionnaire was given to two experienced researchers, and after the inputs of the researchers have been incorporated, the questionnaire was piloted with students in the different sample clusters.

1.6.1 Data collection/fieldwork

In order to obtain the required number of questionnaires, fieldworkers were recruited. A workshop was held to train the field workers. They worked on voluntary basis and no one was remunerated in any way. After each session of data collection, the field workers were debriefed to maintain the same standard of data collection and on what was needed to improve the clarity of the questionnaire.

1.7 Data analysis

The collected data were captured to an Excel spreadsheet. SPSS and Microsoft Excel were used to analyse data.

1.8 Ethical considerations

Gajjar (2013) suggests that ethical standards stimulate the ideals crucial to cooperative work, such as accountability, shared respect, trust, and fairness. The researcher is alerted to the need for ethical consideration as it is a requirement enforced by the Cape Peninsula University of Technology Research Ethics Committee. The participants were informed about the purpose of the study and their rights to privacy (Leedy & Ormrod, 2001). The rights and confidentiality of all participants involved in the study were respected. The researcher did not ask culturally sensitive questions, and participants were given the option to decline answering questions. They were also given the right to withdraw from the study if they felt so. No minor was interviewed.

The sources used are acknowledged and recognised as it is a required standard for all professionals. A consent letter was obtained from the UoT to do the research on campus (Appendix A). The UoT's Memorandum of Understanding as well as the Research Ethics Committee documents were signed and adhered to (Appendix B).

1.9 Demarcation

Simon (2011:2) describes delimitations as "those features that control the scope and define the limits of the study". The study focused on tertiary education students. Only one university was selected as a case. Although it is acknowledged that there are many factors affecting CC, only the level of awareness of students at a specific university was studied. Schools and other tertiary institutions such as TVETs were excluded.

1.10 Limitations of the research

The questionnaires used for data collection was prepared in English and this may have been a problem for some students as English is generally a second, or even a fourth language to them (Appendix C). Only students were interviewed. Only one UoT was used.

1.11 Main findings

Based on the analysis of questionnaire responses gathered during the research process, 42 findings were formulated in Chapter Four. Five (5) headline findings emerged from these findings.

Finding 1: The majority of students are aware of climate change

Finding 2: Students acknowledge that climate change is the world's biggest problem

Finding 3: Large countries, governments, large corporates, businesses and individuals are seen as the major causes of climate change

Finding 4: The rise in the planet's temperature is a major challenge created by climate change

Finding 5: Most respondents became aware of climate change through TV

1.12 Conclusion

CC is one of the environmental challenges that are currently central to the global debate because of its threat to the lives and livelihoods throughout the world. Students and young people at large should be hands on in managing the impact of CC as they are the ones who have an appointment with the future.

1.13 Contribution of study

The research may make students more aware of climate change through the distributed questionnaires. It may also improve students' understanding and awareness of climate change. It may also influence the people in authority positions and decision makers to have an informed method of handling the climate change challenge.

1.14 Chapter summary

The chapter introduced the research topic, focusing on tertiary students' awareness of CC. It provided a background on CC as an environmental challenge currently facing the globe. The different levels of understanding from different researchers about the topic were given. The chapter also indicated the reasons for the research and the research objectives. The significance and limitations of the study were outlined.

A broader view of the problem statement was provided, namely, "it is unclear if students at tertiary institutions are aware of CC and how they can impact the negative effects of CC". This was followed by the main research question, "What is the level of climate change awareness of students at a selected University of Technology in South Africa?" The research methodology was chosen to respond to the research sub-questions. Quantitative research methodology with the deductive approach was adopted for this research. The data collection was done using a questionnaire, followed by the data analysis using Microsoft Excel and SPSS. Ethical clearance of the study was provided to ensure the credibility of the study. The conclusion, contribution and headline findings of the study were stated.

1.15 Outline of thesis structure

Chapter One outlines the introduction of the research, which includes problem statement, research objectives, research questions, significant of the study, brief methodology and ethical considerations.

Chapter Two covers the literature review, which includes the impact of CC on the world, Africa, sub-Saharan Africa and South Africa. Furthermore, the role of humans with regard to climate change and the human behaviour theory are also covered.

Chapter Three covers the research methodology, research philosophy, research approach, the research strategy, data collection, data analysis and ethical considerations.

Chapter Four outlines the results and findings of the study.

Chapter Five outlines the thesis in relation to the research questions in detail.

Chapter Six covers the study's conclusion and recommendations.

The next chapter is a literature review, discussing the concepts of CC more in-depth.

CHAPTER TWO: LITERATURE REVIEW

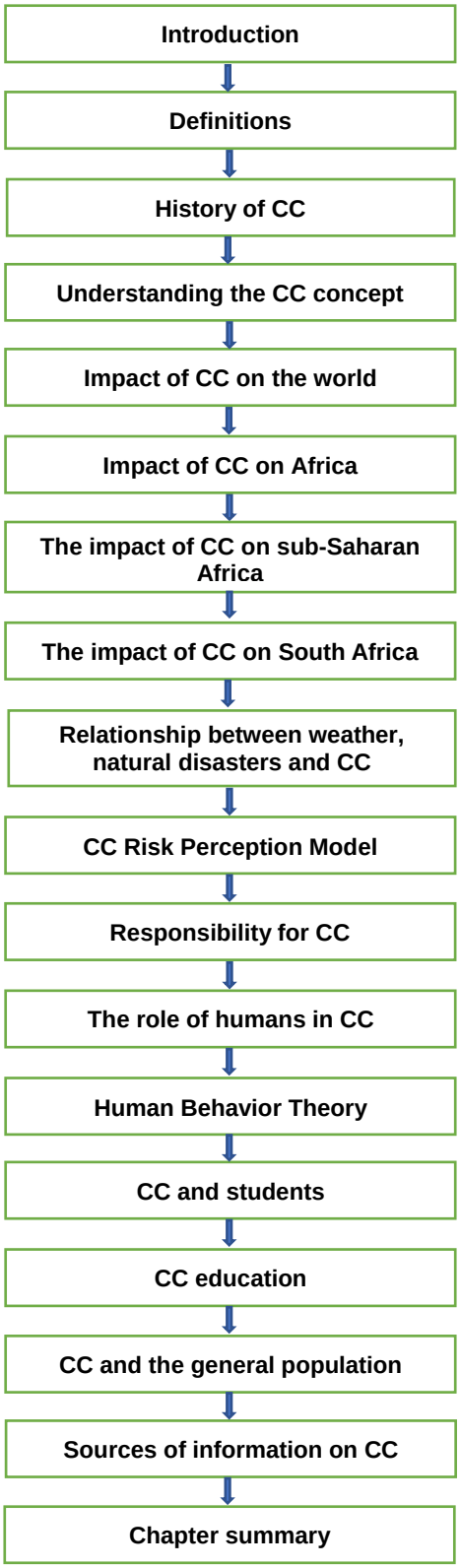


Figure 2.1: Chapter Two layout

2.1 Introduction

CC affects the everyday life of all the people on the planet. There is a need for a deep understanding of the CC problem and for understanding the human and its relationship with the planet at large. The people of the world need to be involved in the management of CC. In this research, students' levels of CC awareness are explored. To do this, a literature review was done using keywords identified from the title, problem statement, research questions and aim of the study.

Online library databases of the Cape Peninsula University of Technology, including Google Scholar, Scopus and Emerald, were consulted to review the literature. Chapter Two is presented as follows: i) definitions; ii) history of CC; iii) the impact of CC on the world; iv) the impact of CC on Africa and sub-Saharan Africa; v) the impact of CC on South Africa; vi) relationship between weather, natural disasters and CC; vii) CC responsibility; viii) the role of humans with regard to CC; ix) human behaviour theory; x) CC and students; xi) CC education; xii) CC and the general population; xiii) sources of CC information; xiv) and a summary.

2.2 Definitions

2.2.1 Climate change

According to Weber (2010:332), CC has been defined as "systematic changes in average conditions of weather over time". Vijaya et al. (2012) posit that global CC can be characterised as an alteration in long-term weather patterns that describes the different areas of the world. CC is also defined as, "the variability of the atmospheric climate system, the biogeochemical cycles of the planet Earth (carbon cycle, nitrogen cycle and hydrological cycle), the surface of the soil, ice and biotic and abiotic components" (Ahmed, 2020:1).

Lorenzoni et al. (2007) argue that CC is caused mostly by anthropogenic and natural causes and these have an impact on the entire world. Zobeidi et al. (2020) agree as they suggest that CC cases have increased due to the greater effect of greenhouse emissions caused by human activities and lifestyle. The impact of these contributing factors is felt across the globe.

2.2.2 Global warming

Gadea Rivas and Gonzalo (2020:153) define global warming as "an increasing drift in certain features of global temperatures than the average temperature value". In the past few decades, due to the positive irradiative imbalances caused by greenhouse gas emissions from human activities, the earth has entered a new age of rapid and potentially irreversible global warming (Albouy et al., 2020).

According to Shahzad (2015), the planet's continuous rise in temperature is truly upsetting. This is caused by global warming. Global warming begins with sunbeams travelling to Earth. The clouds, dust particles, reflective land surfaces and ocean surface then send out nearly 30% of sunlight into space, while the remainder is absorbed by the sea, soil and air.

2.2.3 Global climate change

A report of the National Aeronautics and Space Administration (NASA Global Climate Change, 2018) suggests that global CC comprises a wide range of global phenomena generated primarily by burning fossil fuels, thereby adding heat-trapping gases to the Earth's atmosphere.

2.2.4 Extreme weather events

With the combination of CC and anthropogenic behaviour, extreme weather events are on the rise (Hassan et al., 2020). CC results include unforeseen, irregular, intense, or unseasonal weather, and weather at the extremes of a historical distribution range (IPCC, 2005). Globally, severe weather events are expected to rise (Powell & Reinhard, 2016). According to Sharma and Veeramani (2011), it should be known that extreme weather events are also of natural or anthropogenic origin, and are common, largely due to their increasing damaging effects. The consistency of surface air, which has become a significant environmental factor, may be highly affected by extreme weather events (Zhang et al., 2017). Painter et al. (2020) suggest that CC is the main influencer of extreme weather events.

2.2.5 Vulnerable countries

Vulnerability to CC will be faced by all nations. According to Scott et al. (2019), Western and Northern Europe, Central Asia, Canada and New Zealand have the lowest vulnerability to CC. Africa, the Middle East, South Asia and the Small Island Developing States are found to be highly vulnerable countries (Schilling et al., 2020). Algeria is most vulnerable to CC, mainly because of the region. CC is likely to intensify the danger, making it even more vulnerable for farmers in Afghanistan, for example (Omerkhil et al., 2020:1).

2.2.6 Anthropogenic processes

Gill and Malamud (2017:247) define anthropogenic processes as "deliberate, non-malicious human activities". Leading scientists around the world are of the opinion that beyond reasonable doubt, anthropogenic processes caused CC (Rousell & Cutter-Mackenzie-Knowles, 2019). As part of a centennial warming trend, warm-season days have increased in temperature by more or less 1.4 °C since the early 1970s and resulted in the rising of the atmospheric vapour pressure deficit (VPD). These developments are in line with anthropogenic patterns simulated by climate models (Williams et al., 2019; Abatzoglou & Williams, 2016).

2.2.7 Greenhouse emissions

Greenhouse emissions are known as a gas that absorbs and emits radiant energy within the thermal infrared range, resulting in the greenhouse effect (IPCC, 1996). Anthropogenic greenhouse gases (GHGs) are emitted predominantly during the combustion processes of fossil fuels (coal, oil and natural gas) and industrial activity. These are considered major contributors to global CC and one of the most serious problems facing sustainable growth (Liu et al., 2016). "During 1990–2017, G7 countries per capita greenhouse gas emissions have decreased and highly increased in BRICS nations" (Zheng et al., 2019:1113). Increases in anthropogenic greenhouse gas emissions have been caused by major changes in human history, the Industrial Revolution, advances in science and technology, and an increase in the world population (Şahin, Onat & Ayvaz, 2019). Fawzy et al. (2020:2069) argue that CC is characterised as "a shift in climate patterns, mainly due to natural systems and human activities emitting greenhouse gases". Anthropogenic activities have so far caused an approximate 1.0 °C increase in global warming above what was contributed by the pre-industrial era, and if the current emission rates continue, are expected to exceed 1.5 °C between 2030 and 2052.

2.3 History of climate change

The science of CC has a relatively long history (Bhandari, 2018). Hamza et al. (2020) argue that there is sufficient historical proof to back the theory that CC is a natural occurrence. The term 'climate' is derived from the Greek word *Klima*, which means "inclination, the earth's expected slope toward the pole". Black (2013:1) argues that, "when it comes to CC science, the research underlying this perception has accumulated steadily over decades, similar to other major paradigm shifts". The first scientific observation related to this subject can be traced back to the French physicist Joseph Fourier, who discovered the natural greenhouse effect of the Earth in 1824.

Vlassopoulos (2012) argued that the topic of CC was addressed mainly within the scientific community from the beginning of the 19th century until the late 20th century. Meanwhile, Rahman (2013) suggests that without hesitation, CC has been the most illustrious environmental concern since the late 20th century. However, the discourse was neither emerging during this period nor was it problematised in the same way after its inception. Stanhill (2001) found that with an 11-year doubling duration from 1951 to 1997, CC research literature grew approximately exponentially. Figure 2.2 shows the increase in CC documents produced since 1910.

The scientific opinion that carbon emissions would warm the atmosphere by the late 1980s was sufficient to become a major issue. This led to the *1992 United Nations Framework Convention on Climate Change*, which was dedicated to stabilising atmospheric greenhouse

gas concentrations against harmful anthropogenic interference with the climate system (Oppenheimer & Anttila-Hughes, 2016).

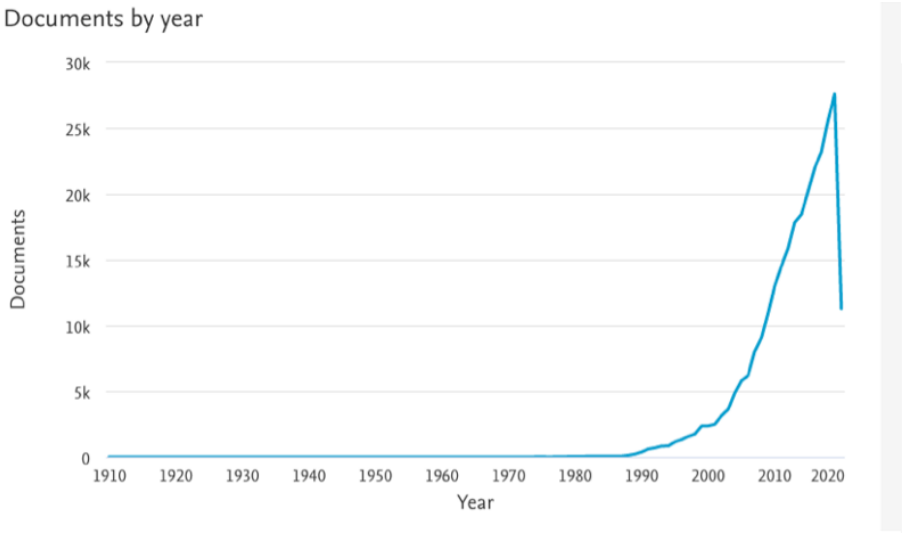


Figure 2.2: Scopus distribution of articles on CC
(Scopus, 2021)

Seacrest et al. (2000) suggested that CC first appeared on the public agenda in the mid- to late-1980s. CC has been a topic since then, and many scholars have seen it as a reality that affects our everyday lives throughout the global community. Although there seems to be varying opinions on the specific past of CC, experts tend to accept that the issue has been around for many years and will continue to be around for many years (Jorge et al., 2019).

Haunschild et al. (2016:2) state that even "though the history of CC in environmental science can be traced back from 19th century during the times of the 'Ice Age' and the 'Greenhouse Effect' … the CC subject started to emerge as the new research field around 1980s". As per Sharifi et al. (2020:1079), there have been a vast number of publications in the body of research on the CC topic and the subject has been growing since 1990s until now. According to Das (2018:1), despite the long history of CC, it remains a global environmental phenomenon. CC and its effects continue to be the focus of many on-going research projects even today (Zhou et al., 2020).

2.4 Understanding the climate change concept

Many different schools of thought believe that CC is caused dominantly by anthropogenic and natural events (Jehanzaib et al., 2020). The CC subject remains a complex issue, which is differently defined. According to Hoogendoorn et al. (2020:1577), CC "is a combination of both natural events and human activities". Climate is a forced, dissipative, nonlinear, complicated, and heterogeneous system that is out of thermodynamic balance in the environment. On several scales of motion, in time and space, the system shows natural

variability and is subject to different external forces, both natural and anthropogenic (Ghil & Lucarini, 2020).

2.5 Impact of climate change on the world

There is no doubt that the planet's climate is changing and has been changing for thousands of years (Verichev et al., 2020; Kotir, 2010). According to Adil and Chohan (2020) as well as Dawson and Carson (2018), people worldwide are facing an uncertain future because of environmental issues that present a multitude of challenges, including human diseases, sea levels rising, economic impacts, ocean oxygen depletion and acidification, droughts, extreme weather events, arctic ice melting, and loss in biodiversity. At government level worldwide, CC is one of the most important problems affecting the global economy and the very life on earth (Kurup et al., 2021). CC is expected to have a negative effect on the economic growth of continents (Baarsch et al., 2020). Etwire (2020) indicates that agriculture worldwide has been affected directly by CC, and that CC is the most pressing universal challenge of this century. There is a collective understanding that CC spans across geo-political borders and affects the entire global population (Sharma & Chowhan, 2020).

Many nations are ranked as the most vulnerable countries because of CC (Trigoso, 2008). Hossain (2019:2) states that "universally nearly 600 million people abide in low lying coastal areas and can shortly be victims of an aggressive response of nature because of CC causing sea levels to rise".

Falkland and White (2020) mention that the *2014 Samoa UN Conference* reaffirmed the vulnerability of Small Island Developing States due to global CC and extreme weather events. CC is a global phenomenon with negative impacts that are severely felt by poor people in developing countries (Djikeng et al., 2014). Engle et al. (2019) posit that the world's climate is changing, and that uncertainty about the path and human and economic consequences remain an issue. Climate models worldwide anticipate CC to have an undesirable effect on global land and the financial value thereof (Hossain et al., 2020).

According to a World Bank (2014:17) report, carbon dioxide equivalent (CO2e) releases are now 60% higher than the levels in 1990 and mounting to about 2.5% per annum. Without interventions, CO_2 emissions will continue to increase and negatively affect the planet. Hossain et al. (2020) believe that CC is one of the greatest puzzling scientific and political subjects of our time. According to Ibeabuchi et al. (2017), there is scientific consensus that CC has a huge impact on the globe, and Africa is not immune to CC as it is part of the global community. Conversi (2020) agrees that CC is non-geographic, uncontainable, boundless, and affects everyone in the world.

2.6 Impact of climate change in Africa

Africa has been identified as one region of the world most vulnerable to the impacts of CC (Edenhofer, 2014). The United Nations Environment Programme (2012) report suggests that numerous issues should be considered when relating the series of impacts and the underlying vulnerability of Africa to CC. Oduniyi (2013) states that the impact of CC on Africa is real and severe because of its high agricultural dependency and limited capacity to adapt. Baarsch et al. (2020) debate that CC is anticipated to have a harmfully effect on the African nations' economic development and that their income inequalities will subsequently continue to be the highest on the globe.

It is understood that Africa is vulnerable to CC, not only because of its exposure to CC, but also because many African communities lack the capacity to adapt or respond to the effects of CC (Pereira, 2017). Africa is considered the most vulnerable region to CC in the world (Awojobi & Tetteh, 2017). CC has been categorised as the largest and most crucial global issue facing humanity today, yet empirically, the debate remains largely feeble in sub-Saharan Africa, where the impact of warming universal temperatures are projected to have the highest impact (Alagidede & Adu, 2014).

The effects of CC on the African continent are so worrying that scholars consider the region to be the most vulnerable on the entire globe (Awojobi & Tetteh, 2017). For example, Africa has been categorised as one of the areas that is most vulnerable to the effects of CC due to its exposure and lower adaptive ability (Niang et al., 2014). Land degradation, high temperatures, strange rainfall patterns and desertification caused by CC are expected to affect African nations (Hummel, 2015). Sidibe et al. (2020) argue that CC is anticipated to threateningly influence the accessibility of water resources in West and Central Africa because of changes in rainfall, evapotranspiration and temperature. The 2007 IPCC report on regional climate projections indicated that by 2050, the average temperatures in Africa are projected to increase by 1.5 ^{o}C – 3 °C and the warming of the continent is highly likely to be higher than the rest of the world (Gemeda & Sima, 2015).

The direct effects of CC will differ across the continent, with Eastern Africa anticipated to become wetter, but much of Southern Africa becoming hotter and drier (Collier et al., 2008). According to the Centre for International Governance Innovation (2009) report, there are long and intense droughts in Eastern Africa, unusual floods in Western Africa, the lessening of rain forests in Equatorial Africa and a rise in ocean acidity around the Southern Coast of Africa. Coulibaly et al. (2020) report that CC and natural disasters are regarded a main risk for many activities in Africa, including agricultural production.

2.7 The impact of climate change in sub-Saharan Africa

Zewdie (2014) suggests that sub-Saharan Africa is more vulnerable to the effects of CC than any developing region in world. Southern Africa is a fast-emerging region of great climatic, ecological, and cultural variety (Network of African Science Academies, 2015). In sub-Saharan Africa, the consequences of CC will be felt in many ways throughout human and natural systems.

The climate of the Southern African region is typified by changes in the severity, frequency, and length of weather extremes, causing recurring droughts, floods, and tropical cyclones in southern Africa (Kusangaya et al., 2021). It is influenced largely by tropical, subtropical and mid-latitude changes with most of its rainfall happening during the summer period (Landman et al., 2001). The area could also experience a sea-level rise of one meter by the end of the century (Serdeczny et al., 2016). Engelbrecht et al. (2015) report that temperatures within most of the Southern African countries are predicted to rise between 4 °C and 6 °C by the end of the current century, much higher than projected by the IPCC. Despite this prediction, sub-Saharan Africa has contributed the least of any global region to the world increase of greenhouse gas emissions. However, this region will possibly be more vulnerable to the impacts of CC than any other region (Kula et al., 2013).

Serdeczny et al. (2016) suggest that the consequences of CC will be felt in different ways in sub-Saharan Africa, both naturally and in human systems. According to Pereira (2017), sub-Saharan Southern and Northern Africa have seen temperature rises at a pace twice than that of the rest of the world, with the most extreme warming in Southern Africa, especially over the last two decades. The unchanging upward trend of yearly temperatures have been reported for the Southern African region, with higher increased rates noted in Angola and Namibia for the period of 1979 to 2007 (Morishima & Akasaka, 2010).

Sub-Saharan Africa has been described as the most vulnerable region to the effects of CC (Kotir, 2010) because of its dependence on agriculture, which is more sensitive to weather and climate changes such as precipitation, temperature and low capacity for adaptation. This is despite the fact that agriculture continues to dominate sub-Saharan Africa's GDP and employment opportunities (Alagidede & Adu, 2014). CC has harshly impacted on the sub-Saharan African plants over the past decades. Recent research has shown that minimising the global warming level to below 2 °C above the required pre-industrial level may help reduce the catastrophic effects of anthropogenic CC in the region (Lawal et al., 2019). South Africa, which is among the countries in the region, is also not immune to these challenges.

2.8 The impact of climate change in South Africa

Ziervogel et al. (2014) state that CC is a key concern for South Africa where yearly temperatures over the past five decades raised with 1.5 times the perceived universal average of 0.65 °C. Extreme precipitation events have also risen frequently. The Department of Environmental Affairs (2017/2018) Report on National Environmental Compliance and Enforcement also suggests that South Africa has an observed warming rate of 2 °C per century, more than twice the global rate of temperature increase for the Western and Northern parts (South African Department of Forestry, Fisheries and the Environment. 2017).

The South African rainfall patterns demonstrate high inter-annual changes and decreasing trends, even though CC as the cause is not statistically supported (Dube & Nhamo, 2019). The studies also indicate that the changing climate has forced considerable expenses on wildlife, the environment and the country's national budget. Extreme weather events have disrupted tourism activities in the country. The 2016 drought that affected parts of South Africa is assumed to be the result of recently noticed CC (Masipa, 2017).

There is evidence that extreme weather events in South Africa are growing, with heat wave conditions, dry spell durations and rainfall intensity increasing. According to Leck and Simon (2018), with the multiple CC threats facing several parts of the country, including sea-level rises, flooding and drought especially in the Western Cape, the South African national government developed a roadmap action to deal with climate change. The Western Cape, a province of South Africa, recently experienced one of the most severe droughts in the country's history (Naik & Abiodun, 2019). South Africa's Southern Cape district is extremely vulnerable to CC and is affected by extreme temperatures and tropical atmospheric and oceanic rotation dynamics (Chase et al., 2020).

Potential implications of CC and environmental-related issues will derail South Africa's development of social and economic activities (Long & Ziervoge, 2020). South Africa is confronted with a population growth and CC-related challenges such as high temperatures, drought, and floods (Jude et al., 2019).

2.9 Relationship between weather, natural disasters and climate change

2.9.1 Weather

The United States Environmental Protection Agency (2018:16) report indicates that "weather is a condition that is normal but when its average pattern changes over time it could be an indication of CC". The Climate Council of Australia (2017) report suggests that heavy rain events, flooding, rising sea-levels, heat waves and bushfires are proof that relates weather to CC. While the connection between extreme events, CC beliefs, and risk perceptions may be unanswered in the literature, grasping this connection holds vital practical consequences for

the CC message. CC comprises not only of alterations in average climate but also in most weather extremes (Fischer & Knutti, 2015). For prominent heat waves and heavy rain events, human involvement in their existence has been proven (Davis & Hanna, 2020).

CC investigations confirm anthropogenic environmental change in an increasingly varied array of climatological and hydrological occurrences around the globe (Mann & Gleick, 2015), ranging from extreme temperatures to coastal damage during extreme waves and storms, flooding from intense rainfall events, and severe droughts.

Cheeseman (2016) indicates that universal CC, including rising temperatures, severe droughts and more extreme weather changes, is seriously challenging the development and survival of the globe at large. Weather extremes such as heat waves, drought, rising sea levels and flooding are among the extreme weather events that have been proven since the beginning of CC, and these conditions have impacted both human activities and the environment (Ohba & Sugimoto, 2018). Average land and ocean temperature acceleration, rising sea-levels, regular extreme weather events, and ocean acidification mean that CC is a pressing contemporary problem facing the planet (Mohamed Ali Khan et al., 2020).

2.9.2 Disasters

Several research studies shed more light on the link between CC and disasters (Neumayer & Barthel, 2011). Media and the public recently drew connections between CC and disasters. Among recent global environmental changes, CC is probably the most-widely debated concern, and research studies show that it is linked to natural disasters that affect the social and economic well-being of populations (Kabir et al., 2016). In the past two decades, CC-related natural disasters such as floods, hurricanes, and droughts have illustrated these links (Chen et al., 2020). As a result of CC, the United States of America (USA) is witnessing an increase in the frequency and severity of natural disasters (Benevolenza & DeRigne, 2018). According to Dixon et al. (2018), during 2017, various natural disasters in the USA (hurricanes, wildfires, and blizzards) resulted in severe loss of life and property. Emphasising the role of CC in these events, particularly with sceptical audiences, might offer an effective tool for engagement.

These links or connections seem reasonable, since weather events are mostly the drivers of CC (Collins et al., 2013). There is significant evidence that global CC contributes largely to many types of natural disasters (Visconti & Young, 2019). For example, CC-related natural disasters have recently manifested in Southern Africa through cyclones that have wreaked havoc and displaced a large number of individuals and households, destroying their long-term ambitions and aspirations (Chapungu, 2020). The recent cyclones were Dineo in 2017 and Cyclone Idai in 2019 (Mavhura, 2020).

Kuang et al. (2020) are of the view that many natural disasters occur alongside CC and have serious effects on human lives. As CC consequences are increasingly being recognised, concerns about the intensity and occurrences of natural disasters are also rising (Visconti & Young, 2019). Visser et al. (2014) state that CC might influence weather-linked disasters such as floods, storms, rising of sea-levels, heat waves and droughts. Berlemann and Steinhardt (2017) as well as Visconti and Young (2019) posit that CC influences the likelihood of natural disasters such as floods, storms and droughts.

2.9.3 Heat waves

Environmental analysis and climate experts agree that the regularity, strength, and duration of heat waves will increase as the earth's temperature rises (Raghavendra et al., 2018). Many study experts agree that the rise in temperature in the 20th century is closely related to CC (Loo et al., 2015). Future estimates point to a steady spike in temperature and mean sea-level rise due to CC until the end of the 21st century (Tang, 2019). Many agricultural operations will be affected as a result of continuous rising temperatures related to CC (Praveen & Sharma, 2019).

D'Amato and Akdis (2020) argue that due to increasing anthropogenic greenhouse gases in the atmosphere, especially carbon dioxide (CO_2), the average global temperature of our planet is on the increase. Christidis et al. (2015) agree that there have been extreme global hot weather events in past decade. Throughout the world, both the climate response and the alterations in extreme temperature events have been proven to be related to CC (Mitchell et al., 2016).

Vardoulakis et al. (2014) opine that high and low temperatures are related to a rise in mortality in extreme and subtropical climates. Temperature-connected mortality events are likely to change all through this century because of CC. Otto et al. (2019) predict that CC is expected to rise frequently and rigorously during periods of high heat pressure. Rojo et al. (2021) agree that in some communities, CC has been characterised by rising temperatures.

2.9.4 Rainfall

With the rise in temperature the overall water cycle will become intensified, with the global rainfall predicted to rise with approximately 1% to 3% per °C (Collins et al., 2013). Kent et al. (2015) anticipate changes in global seasonal rainfall due to CC. Ohba and Sugimoto (2018) indicate that heavy rainfall is among the most devastating extreme weather events occurring because of CC. Tietjen et al. (2017) add to the debate, stating that extreme temperatures and heavy rainfall due to CC have a harmful effect on the planet.

2.9.5 Drought

Carlton et al. (2015) posits that the drought of 2012 in the USA is widely known to be a major natural disaster. As a consequence of this drought, the world began to realise the impact of CC. Drought affects people, economies, communities, societies and the environment in all corners of the world (Nam et al., 2015). The impact becomes increasingly evident given the context of CC, characterised by rising temperature. Schlaepfer et al. (2017) explain that most of the existing evaluations of CC highlight its impact on dry land, soil moisture and environmental drought. As an example, Anderegg et al. (2019) argue that drought-induced tree mortality is likely to rise due to CC, which will have multiple environmental and societal effects, including the possibility of deteriorating or reversing the earth's carbon sink.

However, despite the abundance of literature linking CC and drought, several researchers produced conflicting results on how drought is altering as a result of CC (Dai, 2014). This is an issue that deserves serious research attention going forward.

2.9.6 Sea-level rise

Sea-level rise and its effect on coastal zones have become a question of mounting interest in the scientific society and public discourse (Cazenave et al., 2018; Ellison, 2014; Mimura, 2013). Worldwide, the mean sea-level is anticipated to rise a few decimetres to above a meter by the year 2100 (Hallmann et al., 2018). Sea-level rise has severe effects on coastal environments, water supplies, closely occupied coastal areas, and low-lying areas. These are commonly considered as vulnerable global regions in terms of rising sea-levels. Schuerch et al. (2018) maintain that the reaction of coastal wetlands to rising sea-levels throughout the 21st century remains ambiguous. This supports Osland et al.'s (2015) opinion that, for example, coastal wetlands at the edge of the sea are exposed to many CC traits.

Clark et al. (2016) state that policy debates on the activities required to adapt and mitigate anthropogenic CC, have been outlined by observations of the previous 150 years as well as climate and sea-level predictions for the 21st century. Reager et al. (2016) highlight the prominence of climate-driven changes in the environment by acknowledging decadal alterations in sea-level.

Sea-level rise is the most complex index of CC, as it amalgamates the effects of ocean warming and ice mass loss (Legeais et al., 2018). CC-linked sea-level rise is likely to deeply affect coastal zones, thus influencing many species (Varela et al., 2018). As a result, Mukul et al. (2019) explain that the combined effect of CC and sea-level rise will negatively impact on the ecosystems of many animals.

2.9.7 Desertification

D'Odorico et al. (2013:326-344) define desertification as "a change in soil properties, vegetation, environment or climate, which results in stubborn loss of ecology services that are central to sustaining life". Feng et al. (2015) suggest that desertification is the consequence of complex connections between different factors, which include CC and human activities. According to Karavitis et al. (2020), desertification has continually and diachronically displayed itself as one of the most vital environmental issues to be confronted and alleviated by humanity. Huang et al. (2020:1380) state that desertification is "the failure of waterless, semiarid, and some sub-humid ecology". The valuation of universal measure desertification vulnerability to CC and human activity is vital to help decision makers articulate the best policies for land recovery and fight global desertification in sensitive zones. Benjaminsen and Hiernaux (2019) posit that during the past decades, desertification has become a universal environmental issue. The changes in rainfall, wind speed, temperature, and moisture because of CC can cause profound desertification and dust storms, thereby increase the intensity of desertification (Zhang, Gao et al., 2020). Desertification areas across the globe have always suffered times of degradation due to natural fluctuation in climate (Eskandari et al., 2016).

2.9.8 Coastal erosion

According to Zhang et al. (2004), one of the most certain significances of CC and global warming is an increase in sea-levels global. Scientific agreement exists about the major impact of global CC on coastal areas (Buitrago et al., 2020). Local anthropogenic and CC activities such as river rule and urban development are escalating risk levels in coastal zones hotspots (Grases et al., 2020).

2.10 Climate Change Risk Perception Model

According to van der Linden (2015:1), a CC Risk Perception Model (RPM) can be defined by two key aspects, namely personal and social risk assessments, and both these dimensions have different psychological backgrounds. The CC RPM incorporates and integrates: i) socio-demographic characteristics; ii) cognitive dimensions; ii) processes of experiential memory; iii) experiential processing dimensions; and iv) socio-cultural factors (Van Eck et al., 2020; Hornsey et al., 2016; McDonald et al., 2015; Persson et al., 2015), which are described as follows:

i) Socio-demographic characteristics – this dimension includes gender, education, age, income, religion, and political party affiliation (Bradley et al., 2020).

ii) Cognitive dimension – "This dimension includes information about the causes, impacts and responses to CC management. Studies typically show that this factor is an optimistic and important indicator of the expectations of CC risk if 'accurate' information about CC is assessed" (Hornsey et al., 2016:622).

iii) Experiential processing dimensions – this includes effects and individual encounters of severe weather events (McDonald et al., 2015)

iv) Socio-cultural factors – this dimension Includes cultural norms and orientations of value (Persson et al., 2015).

A broad range of cognitive, experiential, socio-cultural and demographic features have been shown to be relevant (Van der Linden, 2017). Research suggests that 19.2% of the variation in risk perception can be clarified by CC variables. Impact and personal experience are regarded the best predictors of CC risk perception, while the worst predictors are socio-cultural variables (value orientations) (Elshirbiny & Abrahamse, 2020). According to Aksit et al. (2017), to attempt lowering risk, student courses with embedded climate-related activities may offer opportunities for potential decision makers to improve both climate science awareness and risk perceptions.

2.11 Climate change responsibility

The debate about who is responsible for CC has taken a central position on most global platforms, including the United Nations Framework Convention on CC. Some groups argue that large and industrialised countries must take full responsibility as they have a history of contributing to the highest proportion of emissions leading to CC (Frumhoff et al., 2015). Figure 2.3 shows the CC contribution of countries.

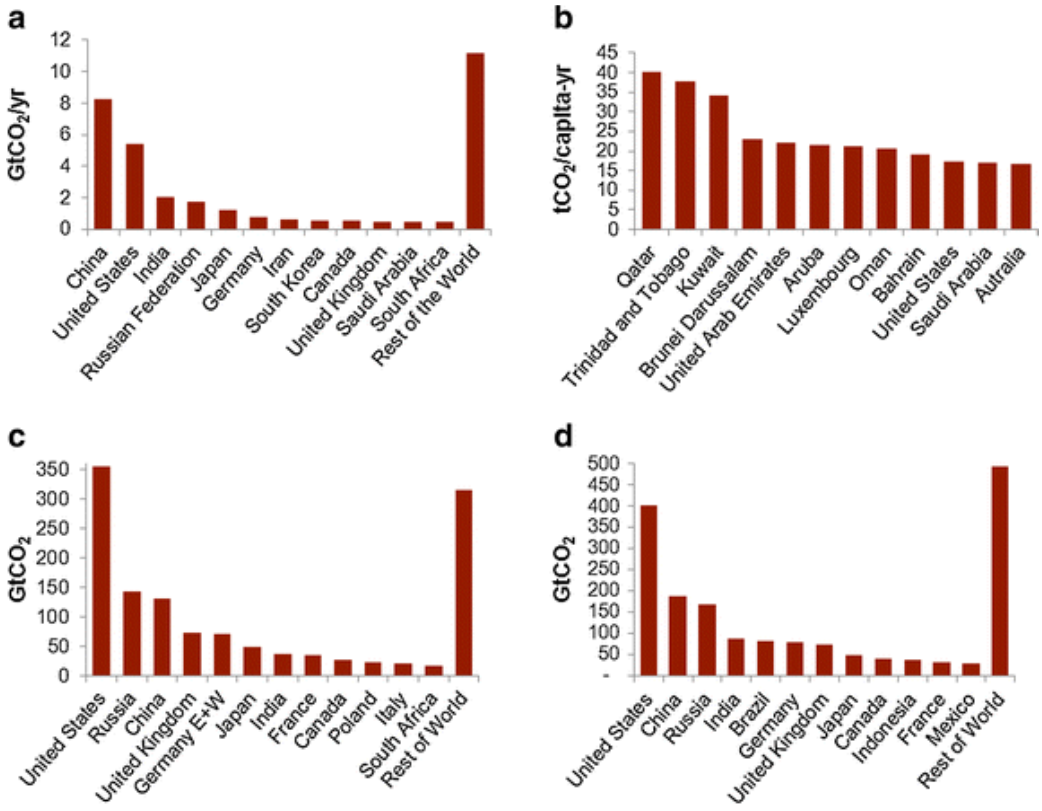


Figure 2.3: Industrial carbon producers
(Source: Frumhoff et al., 2015:159)

Liu et al. (2019) agree that large countries, which include developed and developing countries, are major drivers of greenhouse gas (GHG) emissions, leading to changes in climate. Trenberth (2018) states that it is commonly understood by many researchers that individual activities are major causes of CC and global warming. Griffin (2017), in the CDP Carbon Majors Report, argues that more or less 100 large companies are responsible for 71% of the world emissions. Based on their emission patterns over the 1991-2015 period, China, the USA, India, Russia, Japan, Germany, South Korea, Iran, Saudi Arabia and Indonesia are the major contributing countries (Dong et al., 2018a; Tavakoli, 2018).

Shue (2017) argues that governments are responsible for carbon emissions, causing CC through their state-owned entities. Mayer and Rajavuori (2017) posit that state-owned companies (SOEs) and dominating industries are critical to carbon emission pollution, particularly in emerging economies. More or less a quarter of existing greenhouse gas emissions can be traced to fossil fuels produced by only 12 SOEs. Ganguly et al. (2018) claim that companies are the 'right' ones to take responsibility for CC, and that enterprises in the oil, transport, agriculture and other manufacturing sectors such as cement, through their carbon-emitting activities, have a collective responsibility for CC. The CC discussion also focuses on the exposure of businesses to global warming, which contributes to a rise in the value of carbon disclosure by companies (Hahn et al., 2015).

2.12 The role of humans in climate change

It is suggested that since the mid-19th century, human activities have largely increased greenhouse gases such as methane, carbon dioxide, and nitrous oxide, which resulted in CC (Rossati, 2017). Many climate ethicists argue that the conscience about climate-related matters requires basic morals and understanding of individually responsibility (Lahikainen, 2018). Banks (2013:114) states that as "we become more conscious of the causes and consequences of these climate changes we are left pondering with questions like: who is responsible?" CC has the potential to harm the world, and it is argued that human beings are at the centre of causing these changes. One explanation why CC remains so common and sometimes contentious is that many people agree CC is primarily attributed to human activity, including industrialisation, fossil fuel burning and deforestation, and that this causes increased concern among people globally (Hamza et al., 2020). Ahima (2020), Williams and Bond (2020), Hornsey and Fielding (2019), Akintunde (2017), Cook et al. (2016) and Galvani et al. (2016) state that there is an overwhelmingly consensus among researchers that humans are the reasons for CC. The position is expressed by the Intergovernmental Panel on Climate Change (IPCC) reports, which posit that mankind has been the central cause of the latest changes since the mid-20th century (Qin et al., 2014).

Natural events are a problem, but are too minor and slow to have an influence on CC in comparison to human influence (Houghton et al., 2001). Volcanoes produce a yearly average of between 130 and 230 million loads of carbon dioxide while human activities cause annual emissions of about to 26 billion tons of carbon dioxide, which is 100 times more than volcanoes (Riebeek, 2005). Urbanc and Martinez (2021) debate that individual culture and history shape local and regional reactions to climate change. Personal background and family influence conscience about climate change. Influential debates with family may one day help build CC concern among incoming generations (Stevenson et al., 2016).

2.13 Human Behaviour Theory

Swim et al. (2011) suggest that the reason for fast changes in global climate is attributed to human behaviour and the manner in which individuals think and reason. The nature of the ecosystem strongly depends on the patterns of human behaviour (Shafiei & Maleksaeidi, 2020). According to Schwarzer and Frensch (2010:6), behavioural theory, also known as behaviourism, is “a theory of knowledge based on the idea that all people’s behaviours are acquired based on conditions”. Human behaviour is an inherently difficult subject matter, which relates to the manner and motives behind people’s actions (Guilbeault, 2019). According to Akintunde (2017), understanding human behaviour can help to find long-lasting solutions to CC problems that are created by the behaviour of humans.

For years, there has been an agreement among the experts that CC is a reality and human behaviour is among the causes (Van Lange et al., 2018). Evans (2019:449) suggests that “environmental changes such as temperature rises, extreme weather events, and increased air pollution are expected to have behavioural consequences as a result of global climate change”. The IPCC Fifth Assessment Report highlights human behaviour, lifestyle and changes in culture to have high potential of mitigating CC (Edenhofer et al., 2014).

As per Clayton et al. (2015), human behaviour is not only responding and adapting to climate changes but also causing it. A victory against climate change will require profound paradigm shifts, lifestyle changes, international cooperation and changes in human behaviours at an unprecedented pace (Gowdy, 2008). Extensive evidence from different scholars suggests that human behaviours are the root cause of many environmental problems (refer to section 2.12) (Mohammadi-Mehr et al., 2018). Individuals with a substantial level of CC expertise will change their environmental actions (Wi & Chang, 2018). To combat climate change, a behavioural change model inspired by CC education is needed (Stevenson et al., 2018).

2.14 Climate change and students

Pitpitunge (2013) suggests that students have a poor understanding and knowledge of CC. CC awareness by students is a necessary ingredient for a successful execution of CC laws

(Oruonye, 2011). CC concerns of students and young people seem to be less important (Lawson et al., 2019). Given sufficient education on CC, it may inspire students as adults to be more informed. According to Mercer (2019), institutions such as the International Federation of Medical Students' Associations are already advocating for the universal inclusion of CC into the core curriculum by 2020 to spread CC awareness.

CC is a perplexing marvel and is contended in various ways in the public field (Ng, 2018). For students and youth to comprehend CC and the expected consequences, they need to be educated in CC. Dawson and Carson (2018) state that by improving the capacity of young people to make sound arguments about CC, is a desired outcome of CC education. CC is an extremely prominent issue facing the world and CC-related education is emerging as a reaction (Drewes et al., 2017). However, students proved to be a limited, though non-important gain on mitigating the expected impact of CC. Vinues et al. (2019) show that university students are a segment of the populace that will play a central role in future societies. Therefore, CC-related education must be invested now in them. Aksit et al. (2017) believe that teaching students about CC is vital to guarantee students' capability to making effective climate-friendly decisions both socially and politically in the future.

Senbel et al. (2014) opine that the youth is less represented in most arrangements of joint deliberation on CC, and that is not good. Because students and youth will be extremely affected by upcoming CC events, their underrepresentation in CC dialogues is particularly worrying. Christensen and Knezek (2018) advise that student-centred CC education is presented as the best method to increase long-term awareness of CC.

According to Mugambiwa and Dzomonda (2018) as well as Rosidin and Suyatna (2017), it is alarming to note that students have little knowledge of CC problems. However, Dawson and Carson (2018) suggest that students made vast improvements in strengthening their awareness of CC. Ramkumar et al. (2021) agree that students have increased their awareness and knowledge of CC, especially in terms of health impacts. However, Oğuz et al. (2010) argue that CC knowledge does not always influence students' awareness and their behaviour towards the environment. Rosidin and Suyatna (2017) are of the opinion that the educational levels are an important factor to students' climate and global warming knowledge. Higher level students have more knowledge and experience of CC relative to the lower-level students.

CC and youth engagement are emerging today as critical clarion call across the globe. COVID-19, jobs, and CC are currently some of the biggest social problems facing South African youth. These problems require the active involvement of young people, known locally as "born frees" (Nkrumah, 2021). A crowd of school students and their followers filled the

streets of Hobart, the southernmost capital city of Australia, on 20 September 2019, requesting world leaders to take action against CC (Jones & Davison, 2021). Even though students in the world continue to politically mobilise themselves, it is still not clear what the younger generation's awareness is of this complex environmental issue, and it warrants more research (O'Brien et al., 2018).

2.15 Climate change education

The United Nations Environment Scientific, Cultural Organisation (2013) perceives CC education as a largely unused strategic resource for constructing resilience and sustainable communities. It has raised many agreements and declarations from the organisation. Mochizuki and Bryan (2015) agree that CC education is vital and should be part of an international response in dealing with these complex challenges.

According to Mochizuki and Bryan (2015), even though the role of education in addressing the severe challenges of CC is largely recognised, the educational sector continues to be less utilised as a strategic resource to deal with CC issues. Deisenrieder et al. (2020) share the same sentiments, stating that formal education often lacks effective CC education. While CC in present-day cultures has become a natural part of school educational plans in recent years (Sezen-Barrie et al., 2019), the span and nature of this instruction has been conflicting (Monroe et al., 2017). The world agrees that CC is a major threat and poses unprecedented problems to many individuals. Jamieson (2014) suggests that little is known about the ways in which CC curriculum can be structured to prepare students for dealing with CC challenges. Eilam et al. (2020) agrees that little is known about how school curricula discuss the need to understand this crisis. To address and integrate CC as cohesive knowledge, curriculum reforms are required. Becker (2018) believes that it will be very hard and impossible to reach the target of adaptation and mitigation, which is vital for humanity, without largely relying on systematic CC educational measures to shape the attitudes and behaviour of all people. Global warming and CC are currently significant problems facing humanity, and the curriculum needs to concentrate on the inclusion of educated decisions in classroom activities (Kurup et al., 2021).

The Organisation for Economic Co-operation and Development (OECD, 2019), in its report, *"Trends shaping education 2019",* emphasises the value of CC education and highlights its dual position in equipping students with the skills needed to succeed in a globally changing environment and as a means of fighting CC. The Lima Ministerial Resolution on Education and Sensitisation adopted at their COP 20, calls for CC education to be included in curricula and student growth plans (United Nations Environment Scientific, Cultural Organisation, 2014).

Franco et al. (2019) indicate that it is increasingly accepted that educational stakeholders, especially educators and students, are facing enormous challenges in turning climate education into meaningful action. Feinstein and Mach (2019) suggest that correctly formulated education can be a powerful tool for effective CC adaptation.

A number of studies have shown that young people's views of CC are predominantly constrained, inaccurate, and highly influenced by mass media. Other studies confirmed that didactic approaches to CC education have largely failed to influence students' attitudes and behaviours Rousell & Cutter-Mackenzie-Knowles, 2018). Leal Filho et al. (2018) show that several universities around the world have become involved and established study centres for CC. According to Badau (2016), CC education is the only proposed tool for a sustainable climate. Mochizuki and Bryan (2015) argue that there is an urgent need for government and policymakers to better understand the effects of CC to significantly improve climate responses through education. Becker (2018) agrees that there is now general agreement that global CC can only be controlled and managed through a rapid worldwide transformation that involves politics, civil society and education. People's social attitudes and world views on CC will challenge resilience in conceptualising relationships and education on CC (Lawless, 2018).

Finally, effective CC education experience has continued meaning for students as they attempt to make life decisions in the shadow of a terrifying future (Jones & Davison, 2021). CC is complicated and contentious in nature, but educators and politicians perceive it as a significant subject to be taught by the education sector (Nation & Feldman, 2021). Education on CC is also important for informing people on the destructive impact of their actions on the climate (Mohamed Ali Khan et al., 2020).

2.16 Climate change and the general population

Ajuang et al. (2016) suggest that the general public is conscious of global CC. Knight (2016) indicates that an increase in CC knowledge and perception among the general public could boost an understanding of CC and reduce the challenges of formulating international climate policies that are politically viable and effective. Only with the general public's broad acceptance and involvement, will the optimistic aims of reducing CC be accomplished (Schwirplies, 2018).

2.17 Sources of information on climate change

CC information is a vital driver for people to take personal or collective action to mitigate climate issues (Dong et al., 2018b). It is therefore of the utmost importance to choose the right communication channel when communicating CC issues. For example, Veltri and Atanasova (2015) suggest that an emotional text about CC is more likely to capture the

attention of people than corporate media. Mavrodieva et al. (2019) agree that social networking outlets such as Instagram, Twitter, and Facebook have given the general public the ability to express views and participate in the CC debate as never before.

In a student context, Scott-Parker et al. (2016:1005) argue that students receive knowledge in CC from different sources, including media such as television, radio, and newspapers; the environment (usually through their village, church, and extended family); the university, friends, and international agencies. Mass media does not always succeed in telling people what to do, but they are effective in telling readers what to think (Bakaki & Bernauer, 2016:1). Junsheng et al. (2019:1) Television and mass media are preferred source of information that may help raising awareness of the impact of CC at all levels (La Torre et al., 2020). TV is the key source of information for students.

2.18 Chapter summary

CC is affecting all corners of the world, including Africa, Southern Africa and South Africa. Different weather patterns and natural disasters are seen as examples that display the dangers of CC. There is currently a debate across almost all global platforms about who is responsible for CC, some arguing that large and industrialised countries should bear the responsibility as they carry a burden of huge industrial carbon emissions. It is argued that human activities are at the centre of these changes, and that the behaviour of individuals contributes towards CC. Students also feature in the CC debate as they are perceived as the future and therefore better positioned to deal with the legacy of these changes.

Different opinions are expressed by different authors on the role of education in dealing with CC. Some authors argue that there is no coordinated curriculum on CC since the dawn of this subject. Sources of communication on CC are critical as they carry the credibility of a subject that is debated across the globe.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

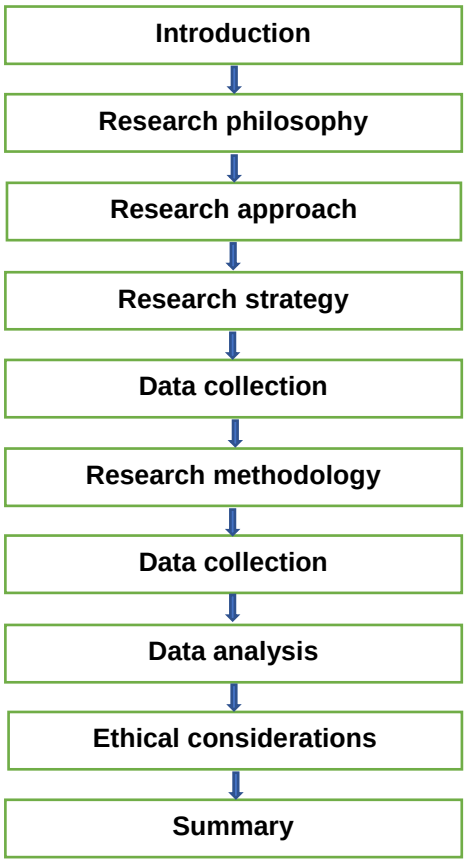


Figure 3.1: Chapter Three layout

3.1 Introduction

This chapter presents the methodology of the research adopted for the study. It commences with outlining the philosophy that underpins the method selected for the research, deliberating on the research ontology and epistemology. Next, the research approach chosen to direct the route of the research is discussed. This is followed by the rationale for selecting the research strategy, outlining the unit of analysis, sampling of the data, and the explaining of the logic of adopting the survey research method. The chapter also discusses the data collection method used in the study, as well as the tools used to analyse the collected data. The chapter closes with a section on the ethical considerations of the study, followed by the summary.

3.2 Research philosophy

Wilson (2010) claims that research is an enquiry and investigation process; it is systematic, methodical and knowledge-enhancing. The choice of research philosophy depends on the essence of the problem of research (Noor, 2008). A research philosophy can be referred to as “a set of principles which are particularly concerned with the nature in which the reality is being investigated” (Bryman, 2012:29). It is also described as “the creation of research assumptions, information and nature”. (Žukauskas et al., 2018:123). Saunders et al. (2019:130) refers to “a system of beliefs and assumptions concerning the creation of knowledge” as research philosophy.

According to Saunders el al. (2009:107), research is “bound by specific philosophical assumptions which demonstrate a definite method in which the surrounding is viewed and understood”. There are three different forms of research philosophy, namely: i) ontology; ii) epistemology; and the iii) combination of the two (Mkansi & Acheampong, 2012). These concepts are discussed in section 3.2.1.

3.2.1 Ontology

“Ontology is regarded as the study of being” (Crotty, 1998:9-10). According to Bryman (2012), ontology can be best described as a theory of the existence of social entities. Ontology can best be defined as “assumptions about the nature of reality. It determines how one sees the world of business and management”, henceforth the choice of what one research for his project (Saunders et al., 2019:133). According to Neuman (2011:107-108), ontology is more concerned with the clarification of the nature of reality. There are two concepts that influence an ontological stance of research namely: objectivism and subjectivism.

3.2.1.1 Subjectivism

Subjectivism is the idea that “language, gender, social status, race, and ethnicity are all viewed through the lenses of experience” (Denzin & Lincoln, 2005:21). It includes the assumptions of the social sciences and humanities disciplines, arguing that the perspectives and consequent actions of social actors create social reality (Saunders et al., 2019). This technique dominates certain ways of subjectivity conceptualisation, and it uses qualitative methods.

3.2.1.2 Objectivism

Ratner (2012:2) defines objectivism as “a view that an objective reality exists and can be known more through the gathering of more information”. Objectivism assumes the independence of the topic of the study (Remenyi et al., 1998). Ontologically speaking, this research adopted objectivism as its ontological stance, thereby affirming that social phenomena and their significance have an existence independent of social actors (Bryman, 2012).

3.2.2 Epistemology

Epistemology is concerned with the existence, validity and limitations of the inquiry and focuses on the investigator’s worldview of the interpretation, generation, and usage of knowledge considered to be standard and valid (Hughes & Sharrock, 1997; Rosenau, 1992). Two epistemological stances that exist is discussed for this research: i) interpretivism; ii) positivism (Wahyuni, 2012).

3.2.2.1 Interpretivism

Interpretivism argues that natural and social reality (and the laws of science) are distinct and thus involve separate approaches (Gray, 2018). It focuses on ideas of how we can acquire world knowledge, which are partially based on the perception or comprehension of the meanings that people attach to their actions. Interpretivism seeks “culturally derived and historically positioned perceptions of social life-world interpretations” (Crotty, 1998:67).

3.2.2.2 Positivism

The positivist approach was followed as it only recognises what has been proven scientifically in relation to the climate change awareness of tertiary students. Positivism suggest that reality is indeed stable and it can be perceived and defined from an objective viewpoint without meddling with the phenomenon under research (Brewster & O’Hara, 2007). Essential in this overall method to research is the understanding that it is likely to measure social conduct independent of context and that social phenomena can be viewed objectively (Hughes & Sharrock, 1997). However, research based on positivism tends to be based on deductive hypothesising, where a number of proposals are produced for testing, and with

empirical evidence required (Babbie, 2005). The positivist researcher upholds that a distant, detached, neutral and non-interactive stance can be adopted (Morris, 2006).

3.3 Research approach

According to Saunders et al. (2009), the two research approaches guiding the research route are i) inductive and ii) deductive.

3.3.1 Inductive approach

Inductive approach commences with an observation and works its approach towards a theory by scrutinising the related issues (Zikmund et al., 2010). Saunders et al. (2009) state that the inductive approach attempts to develop a theory from the outcomes of the analysed data gained. An inductive approach also focuses on collecting realistic evidence and structuring a theory from the results (Creswell, 2009). Saunders et al. (2009:124) define an inductive approach as involving "the researcher collecting data and formulate a theory through data analysis".

3.3.2 Deductive approach

For this study, a deductive methodology was followed to empower the analyst to set up speculation utilising hypotheses. This methodology is appropriate for an exploration project that is concerned with a similar outcome as a past research (Wiles et al., 2011). A deductive approach is characterised by Saunders et al. (2019:153) as a "variety of information and data that is gathered to help the researcher refute or validate the hypotheses to solve the problem". It can also be categorised by establishing a general theory and then test the knowledge gained from the study against the theory (Kothari, 2004).

Snieder and Larner (2009) posit that a deductive methodology may be chosen for the positivist methodology, as it enables the arrangement of theories and the measurable examination of expected likelihood results. By using a research strategy explicitly developed for the purpose of theory testing, the deductive methodology concentrates on the use of literature to classify hypotheses and proposals (AlKindy et al., 2016).

3.4 Research strategy

The exploration procedure essentially centers on how the specialist completes the investigation (Saunders et al., 2009). Saunders et al. (2009:141) identified that the main research strategies are "interviews, survey, case study and experiments".

3.4.1 Quantitative approach

Quantitative research is defined by Punch (2005:3) as "empirical research where data is used in the form of numbers and numerical data". Creswell (2003:52) clarifies that a researcher primarily uses a quantitative approach for post-positivist statements to develop

knowledge. Maree (2012) recognises quantitative analysis as a methodological and objective way of using statistical data from a population sample to generalise the findings of the population being studied. In the opinion of Kumar (2011), the quantitative approach is highly formalised and more clearly regulated than the qualitative approach, with a spectrum that is more specifically defined and relatively similar to social science. Quantitative research makes use of different tools such as questionnaires, surveys and experiments to gather information, and permits the data to be considered for statistical analysis (McNabb, 2013). The research strategy followed in this study was a survey. This was done because of the attempt to generalise the findings and to asked a representative sample of the students on the different campuses. The aim was to statistically and objectively analysis the data.

3.4.2 Survey

Kendall (2011:31) argues that a research survey is “a tool in which the investigator gathers facts or attempts to determine the connection among facts”. A survey is described by Pinsonneault and Kraemer (1993) as a tool for gathering information about the features, behaviour, views or opinions of a large group of people, while it is also described by Mathers et al. (2007) as a versatile form of study used to investigate a broad range of subjects. Surveys are frequently used research methods as they make it easy to research aspects that cannot be seen easily, for example, people’s beliefs and attitude. For surveys, questionnaires are used as an instrument for data collection (Mathers et al., 2007). Grace (2001:3) states that questionnaires are “one of the simplest methods of data collection”. According to Wiid and Diggines (2013), a questionnaire consists of a written list of questions, where the responses are recorded by research participants.

The study used structured questionnaires (Appendix C) serving as data collection instrument.

3.4.3 Questionnaire

According to Leedy and Ormrod (2001), a questionnaire is an effective method to collect research data. The study used questionnaire to collect data, even though Maree and Pietersen (2007) believe that it has advantages and disadvantages, but for this research a survey was chosen because it is easy to manage, it is accurate, and it is less cost intensive.

A well-structured questionnaire for the target audience of a UoT was created (Appendix C). The questionnaire comprised eleven questions and this produced sufficient data to address the phenomenon at hand. The structure of the questionnaire and type of questions asked is attached as Appendix C. Before using the method, the questionnaire was piloted to eliminate any ambiguous questions or any other issues that may affect the quality of the research findings. Once this was done, the questionnaire was used to collect data.

3.4.4 Unit of analysis

Mitchell (2007) clarifies that the unit of analysis (UoA) is the key entity under examination in a research study. In survey research, the unit of analysis refers to the population, people or respondents of the study (Bhattacherjee, 2012). Monette et al. (2014) emphasise that a significant element in the research method is the choice of the unit of analysis to be studied. The unit of analysis is further described by Monette et al. (2014:85) as "unique objects or elements from which we hope to identify or explain the characteristics of and collect information".

Normally, the whole population does not partake in the research; rather, the outcomes acquired are generalised from a sample to the whole population (Gravetter & Forzano, 2009). The unit of analysis is specified by Bengtsson (2016) as the sample used for the research and what the researcher is attempting to explain with the study. For this particular research, the unit of analysis was students at a selected University of Technology. The survey was structured in way that to directly gain insights into the research question and sub-research questions. The survey allowed for anonymity. The intent of the study was to generalise what the students think and know about CC and therefore the survey strategy was deemed best.

3.4.5 Sampling

Durrheim and Painter (2006:47) define sampling as "participants that are chosen from the population to answer the questions of the study". A sample is the section of the population that is selected for research investigation (Bryman, 2012). In quantitative examination, the size of the example and the strategy chosen can be used to decide the dependability of the results of the investigation. According to Quinlan (2011), the population of the research may be too large to work with and is consequently beyond the scope of the study. According to Scientifically extracting a sub-section from a population is called a sample, and it needs to be representative of the population. The sample for this study comprised students from a selected UoT (Sadler et al., 2010).

The population is defined as the students from different campuses of the UoT. The UoA was non-randomly and conveniently selected (Saunders et al., 2019). Randomly selected students from six campuses were approached to complete the questionnaire. Students were visited at their respective faculties, where they were asked to what the faculty of study they belong and the year of study, as specified on the questionnaire.

Samples were obtained from students of different faculties of the institution. Furthermore, 1st, 2nd, 3rd and 4th years students were sampled. The targeted total of students for each

faculty was 120 x 6 = 720, and the total number of students divide by the number of the years of study from 1st year to 4th year was 720/4 = 180, as shown in Table 3.2.

Table 3.1: Number of students per study year level

Year of study (level)	1st year	2nd year	3rd year	4th year
Targeted audience	180	180	180	180
Number of students per year	127	157	152	168
%	21%	26%	25%	28%

The total number of respondents was 603. The statistical data collection, number of students and analysis were done under the supervision of a qualified supervisor.

3.5 Data collection

Permission to collect data was granted by the UoT (Appendix A). The method of gathering research information for relevant variables can be better characterised as data collection; and the data can be categories as primary and/or secondary data (Yin, 2011).

For this research, a structured questionnaire (Appendix C) as tool to collect data from randomly selected students of the UoT on all campuses was used. A questionnaire is considered by Harris et al. (2009) to be a collection of thoughtful and well-structured questions to obtain accurate answers to research questions. Through the use of fieldworkers, a large number of students were reached, and countable responses for the research were obtained and analysed (Appendix D). In total, 603 students completed the questionnaire (Appendix C). To obtain the required number of questionnaires, fieldworkers were recruited. A workshop where the field workers were trained was organised. The field workers were voluntary and no one was remunerated in any way. After each session of data collection, the fieldworkers were debriefed to maintain the same standard of data collection, and where needed, to improve the clarity of the questionnaire.

3.6 Data analysis

Data analysis is characterised by Moore and McCabe (2005) as categorising data collected into workable knowledge. According to Wahyuni (2012), data analysis may be recognised as the gathering of raw data for the study conclusion. There is no single exact process of analysis and the method can be personalised and reviewed depending on each study (Creswell & Creswell, 2017). The study used SPSS and Microsoft Excel's analysis ToolPak instruments because of their effectiveness to analyse quantitative-based research. All questionnaires were hard copies. After the data were collected, it was entered and captured into Excel (Appendix D) before it was transformed and converted into tables and graphs for ease of reading and analysis of the results.

3.6.1 Exploratory factor analysis (EFA)

Exploratory factor analysis (EFA) is a statistical method used to find "hidden meaning" in quantitative data. It does so by reducing many variables into fewer, but not necessarily, three groupings called "factors" based on correlation and communality tables generated from the data (Appendix E). The actual analysis is relatively complex, requiring numerous steps to complete. Each of these steps can utilise any of several methods. Fortunately, statistical analysis software such as IBM's SPSS makes this process easier, and this was used for this study. Similarly, for simple studies such as this one, the same options tend be used time and time again.

DATA Requirements for EFA appropriateness:

i) To conduct a factor analysis, "normality within the data must be univariate and multivariate" (Child, 2006;42).
ii) Reliability or commonality.
iii) Items per factor.
iv) The recommended sample size is 300 participants or more (Comrey & Lee, 1992).
v) The lack of univariate and multivariate outliers is also significant (Field, 2009).

The following options were selected in SPSS for this analysis:

i) Extraction method: **Principal Component Analysis (PCA)**. This is the most commonly used extraction method, and fitted the study well.
ii) Rotation: **Varimax**. As above, this is the most commonly used extraction method and was well suited for the study.
iii) The variables analysed were (as annotated in the questionnaire): "Year of study", IQ1.1.1, IQ1.1.2, IQ1.2.1, IQ1.2.2, IQ1.3.1, IQ1.3.2, and IQ1.3.3. The other variables, being either multiple choice or multiple answer questions, were deemed unsuitable for this analysis.

In this questionnaire, many/most of the questions were dependent on IQ1.1.1 – "Do you think climate exists?" (See further description of this problem in section 4.9.) Thus, the EFA was done using a selection variable of IQ1.1.1 = "Yes" (or, as coded, = "1").

3.6.2 Hypotheses

Seven hypotheses were posed to answer the research questions. The research hypotheses are:

- **H_1:** Students aware of climate change are more likely to study in some faculties rather than others

- **H_2:** The number of students who believe in climate change is to increase as they progress through university
- **H_3:** The level of acceptance of the existence of climate change are different in the faculties
- **H_4:** Students are not concerned about climate change
- **H_5:** Students are more concerned about certain climate change effects than others
- **H_6:** Students feel that certain sectors of the public are more responsible for climate change than others

3.7 Ethical considerations

Bengtsson (2016) posits that from the beginning to the end of the exploration term, morals should consistently be the focal point. Ethical considerations are a central part of every research method and require to be dealt with through the entire life of the study (Clandinin & Connelly, 2000). Resnik (2015) recognises ethics as moral norms that distinguish between acceptable and inappropriate behaviour. Gajjar (2013:8) suggest that "ethical standards stimulate the ideals that are very crucial to cooperative work, such as accountability, shared respect, trust and fairness".

There are three important ethical requirements for researchers, namely: i) confidentiality (Bhattacherjee, 2012); ii) openness; and iii) honesty (Brynard & Hanekom, 2005), and these important requirements were upheld throughout the study. In terms of science ethics, Mouton (2001:238) believes that science ethics is concerned with what is wrong and what is right while conducting research.

In this research, the following ethical aspects were adhered to:

- A letter of consent was requested and granted from the UoT authority (Appendix A)
- Research ethical clearance was also acquired from the Research Ethics Committee (Appendix B) of the UoT before the research commenced
- A Memorandum of Agreement was signed between the student and supervisor
- The researcher was open and honest about the purpose of the research and declared that all information collected would be used for the purpose of the study only
- Participants were informed of their right to privacy and confidentiality as well as their right to respond or not if they choose so
- All participants participated voluntarily and of their own free will. They were all informed of their right to withdraw if they preferred at any time during the research (Silverman, 2010)
- The research never asked culturally sensitive questions
- No minor was interviewed

- Participants also received the opportunity to be informed and gained knowledge on CC awareness
- The sources used were acknowledged and recognised, as it is important for cooperative work for researchers and it is a required standard for all professionals

3.8 Chapter summary

Research studies need the correct identification of a problem and research tools suitable to gather data to address that problem. Chapter Three focused on the research process followed during the exploration interaction, which incorporated the exploration theory, research approach, research process, information assortment strategies and the investigation of the information. The chapter explained the research philosophy, which includes ontology and epistemology. The study followed an objectivism ontological position and the positivism epistemology philosophy.

The Research followed a deductive approach, which is synonymous to quantitative research. Quantitative research can include the use of a survey with questionnaires as data collection instrument. The data were collected and analysed using SPSS and Excel ToolPak.

The student sample was randomly selected from the broader student community of a University of Technology in the Western Cape Province of South Africa, across all campuses. Study factor analysis was also done. The chapter concluded by outlining the UoT ethical standards that were followed throughout the research process. The required consent letters were requested and granted.

In chapter Four, the analysis and findings of the research are discussed.

CHAPTER FOUR: RESULTS AND FINDINGS

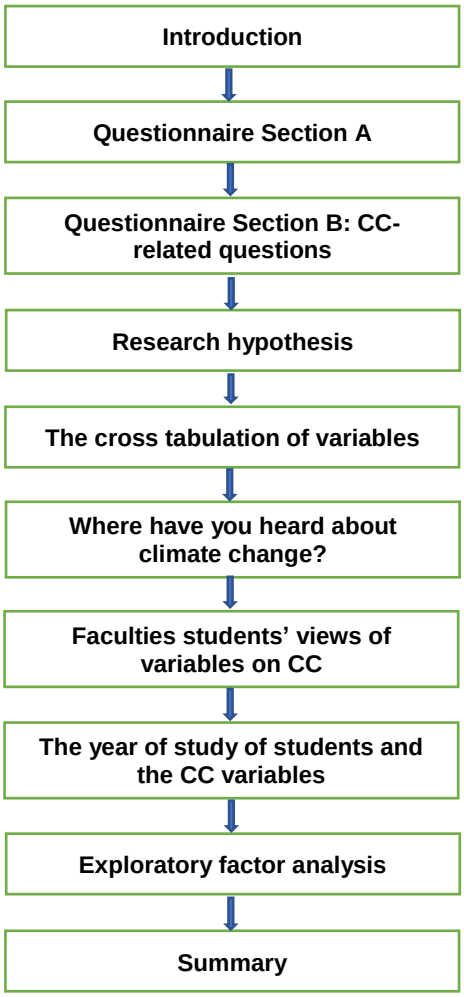


Figure 4.1: Chapter Four layout

4.1 Introduction

This chapter presents the research results from the collected data and discusses the research findings. Marshall and Rossman (1999:150) define data analysis as “a process of adding order, structure and meaning to the mass of data gathered”. The data were collected to explore tertiary students’ awareness of CC. The chapter is divided into section A and section B. Section A presents the contribution figures of all the faculties and levels (from here on forward ‘levels’ and ‘year of study’ are used interchangeably) of studies in the institution. Section B presents CC-related questions and research hypotheses. The data were collected by means of a questionnaire, and then coded and analysed using Microsoft Excel and SPSS.

4.2 Questionnaire – Section A

Section A of the questionnaire was aimed at displaying the student population diversity of the faculties in the University of Technology. It shows the number of students who contributed per **faculty** and **year of study**. The two questions posed to the students were: i) “To which faculty do you belong?” and ii) “What are your current study years of study (level)?” The objective of these questions was to understand the perspectives of the students on the different faculties and year of study. This section presents the number of students i) from various faculties and ii) per study year. At this point it is important to note that the research is not in any way attempting to claim that the sample is a true reflection of the student population of 33,000 students. The sample represents the number of students *per faculty* and **per year of study**.

4.2.1 Faculties

Students have been asked which faculty they represent to support the sampling method do as to ensure that all faculties were included in the survey. A total of 603 students participated in the study – 22% (130) from Business and Management Sciences, 20% (120) from Informatics and Design, 17% (104) from Health and Wellness Sciences, 16% (95) from Education, 13% (81) from Engineering and Built Environment, and 12% (73) from the Faculty of Applied Sciences. Table 4.1 and Figure 4.2 display the numbers of students from the various faculties of the University of Technology.

Table 4.1: Number of students per faculty who completed the survey

Faculty	Business and Management Sciences	Applied Sciences	Informatics and Design	Education	Engineering and Built environment	Health and Wellness Sciences
Number of students (603)	130	73	120	95	81	104
Percentage	22%	12%	20%	16%	13%	17%

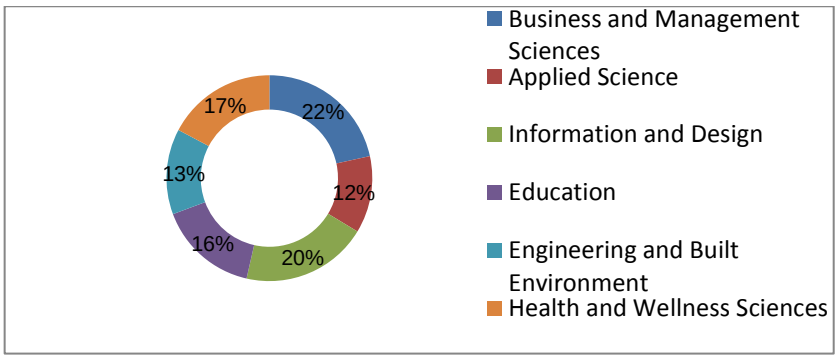


Figure 4.2: Number of students per faculty

4.2.2 Student year of study

The question was asked to ensure that all the years (levels) of study were included in the survey. Students who participated in the study were inclusive of all levels, from 1st year, 2nd year, 3rd year to 4th year. Twenty-one percent (21%) (127) of the students who participated were 1st year, 26% (157) 2nd year, 25% 3rd (152) year and 28% (168) 4th year students. Table 4.2 and Figure 4.3 show the students numbers for each year level of study.

Table 4.2: Number of students per year of study

Year of study (level)	1st year	2nd year	3rd year	4th year
Number of respondents	127	157	152	168
%	21%	26%	25%	28%

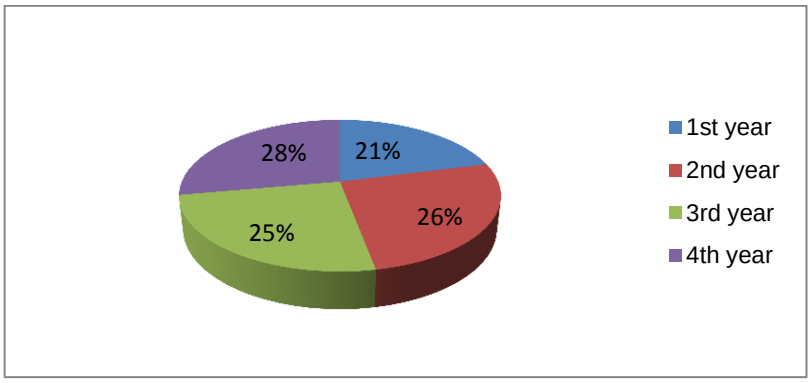


Figure 4.3: Number of students per year of study

4.3 Questionnaire – Section B: Climate change related questions

This section sought to explore the students' awareness of CC and responding to the research questions.

4.3.1 Primary Research Question

PRQ: What is the level of climate change awareness of students at a selected University of Technology in South Africa?

4.3.1.1 SRQ1: What are the students' perceptions of climate change?

Four questions were posed to the students: i) Do you think climate change exists? ii) Do you think climate change is the world's biggest problem? iii) What do you think is the cause of climate change? iv) Which of the following do you perceive happen as a result of climate change?

i) Climate change exists

As a starting point, the question, "Do you think climate change exists?" was asked across faculties and year of study to explore the CC awareness of students. As shown in Table 4.3, 92% of students acknowledged that CC exists, while a minority of 7% did not. The response in Table 4.3 and Figure 4.4 show that the students are aware of the existence of CC.

Table 4.3: Number of students responding to the existence of CC

Response	Yes	No	No response
Number of respondents	555	45	3
%	92%	7%	< 1%

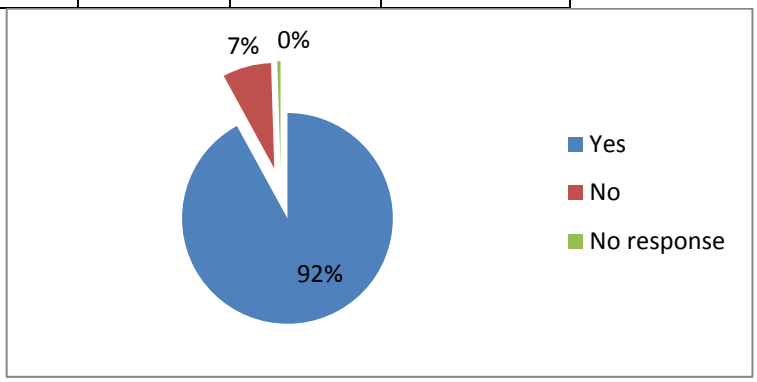


Figure 4.4: Number of students responding to the existence of CC

This may indicate that the students became aware of CC either before entering the university or during their university education. Thus, it could be that students were exposed to the CC concept at university. This will be discussed further in section 4.4. In total, 555 (92%) of the 603 students acknowledged that CC exists, while 45 (7%) were of the opinion that CC does not exists and 3 (<1%) did not answer the question. This shows that the majority of the students are aware of the existence of CC.

Finding 1: The majority of students are aware of climate change

ii) Climate change as a world problem

The question, "Do you think climate change is the world's biggest problem?" aimed to assess the students' understanding of the impact of CC on the world. As reflected in Table 4.4, of the 603 students, 79% (477) suggested that CC is the biggest problem while 21% (126) stated the opposite. This is not surprising, as most students are aware of CC.

Table 4.4: Students' view on CC as the world's biggest problem

Response	Yes	No
Number of respondents	477	126
%	79%	21%

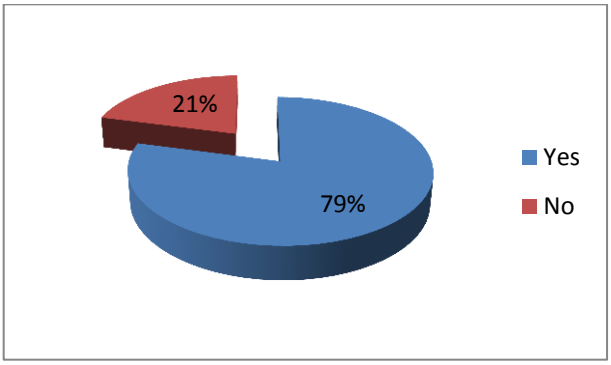


Figure 4.5: Students acknowledge that CC is the world's biggest problem

Finding 2: Students acknowledge that climate change is the world's biggest problem

iii) Causes of climate change

The question, "What do you think is the cause of climate change?" was constructed to verify the students' perceptions of the contributions of countries, governments, corporations, businesses in general, and individuals to the causes of CC. Table 4.5 and Figure 4.6 show that 52% (316) of the students pointed to large countries, governments, large corporates, businesses and individuals as the major sources (causes) of CC. In total, 20% (122) suggested that individuals are responsible, 6% (39) indicated businesses in general, 7% (44) indicated large corporates, 2% (15) pointed to governments, 9% (54) indicated large countries, and 1% (7) opined that large countries and large corporations together are responsible for CC. Thus, all the role players were seen as responsible for CC. This is per se not useful – the question should have been posed differently.

Table 4.5: Role players contributing to CC as indicated by students

Responses	Percentage	No. of respondents
Large countries	9%	54
Large countries, Government, large corporates & Businesses	0%	2
Large countries & large corporates	1%	7
Large countries, large corporates & Businesses	0%	1
Government	2%	15
Government and large corporates	0%	1
Government, large corporates & Businesses	0%	2
large corporates	7%	44
Businesses in general	6%	39
Individuals	20%	122
Large countries, Government, large corporates, Businesses & Individuals	52%	316

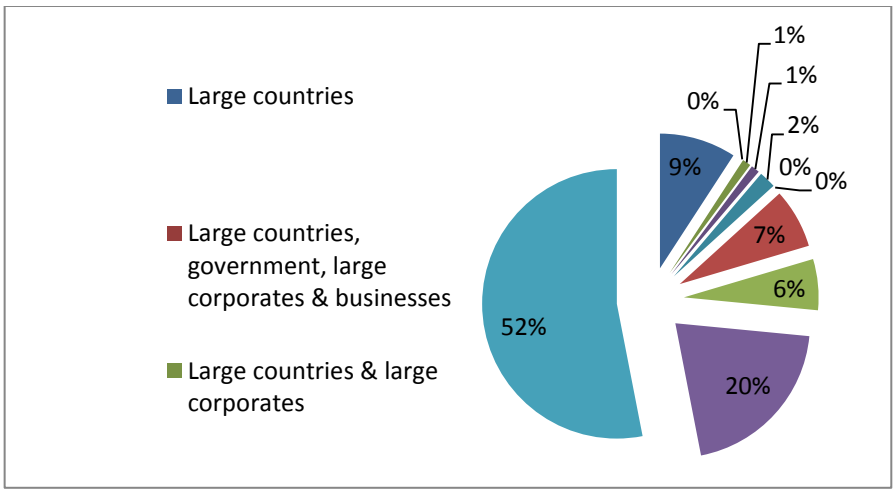


Figure 4.6: Role players contributing to CC as indicated by students

It is evident from the responses that the students place the blame of CC on a range of organisations and individuals. Again, this is to be expected as the students are aware of CC and seemingly realise that everyone, whether organisations or individuals, are responsible for the climate changes.

Finding 3: Large countries, governments, large corporates, businesses and individuals are seen as the major causes of climate change

iv) Climate change consequences

The question, "Which of the following do you perceive happen as a result of climate change?" was asked to assess students' awareness of the different natural disasters and weather events that are happening across the globe. In total, 33% (196) of the students stated that rising temperatures happen because of the changes in climate, 3% (17) said desertification, 2% (13) coastal erosion, 10% (61) sea-level rise, (70) flooding 12%, and 12% (72) drought. Twenty percent (20%) of the students indicated that CC results in drought, flooding, rising temperatures, sea-level rise, coastal erosion and desertification, while 4% (27) pointed to drought, flooding, rising temperatures and sea-level rise. Five percent (5%) (29) stated drought, flooding and rising temperatures (Table 4.6; Figure 4.7).

Table 4.6 and Figure 4.7 clearly show the diverse opinion of the students on the consequences of CC. Many students are of the opinion that the rise in temperature on the planet is the main challenge facing the citizens on earth. Despite the severe drought the Western Cape Province recently experienced three years in a row, only 12% of the students recognised that drought on its own is consequence of CC. When considering that the question includes a combination of factors affecting climate change, drought seems to have increased in importance.

Table 4.6: Students' answers on the effects of CC on the planet

Response	Percentage	No. of respondents
Drought	12%	72
Drought, flooding & rising temperatures	5%	29
Drought, flooding, rising temperatures, sea-level rise, coastal erosion and desertification	20%	118
Drought, flooding, rising temperatures, sea-level rise	4%	27
Flooding	12%	70
Rising temperatures	33%	196
Sea-level rise	10%	61
Coastal erosion	2%	13
Desertification	3%	17

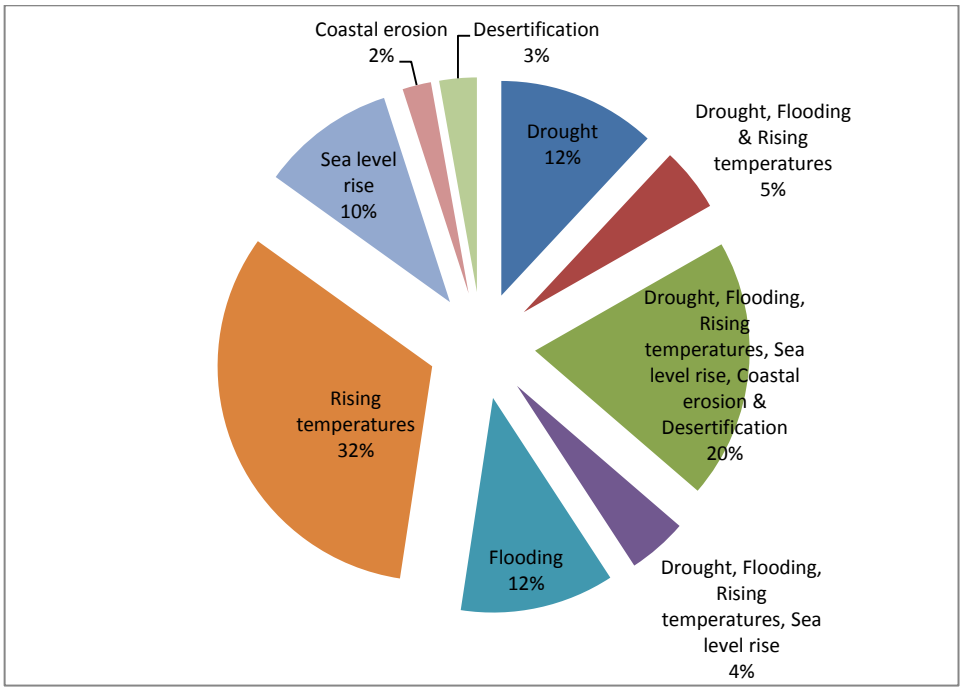


Figure 4.7: Students' answers on the effects of CC on the planet

Finding 4: The rise in the planet's temperature is a major challenge created by climate change

4.3.1.2 SRQ2: What are the differences in the levels of awareness of students on climate change?

i) Students' perceptions on their level of CC awareness

The question, "On a scale of 1 to 5, how would you rate your level of awareness of climate change?" aimed to measure the level at which students perceived their understanding of CC. As seen in Table 4.7 and Figure 4.8, 10% of students rated their level of CC understanding as poorly. Eighteen percent (18%) indicated that they are only a little aware of CC, 30% (179) said they have an idea of CC, 29% (177) stated that they are aware of CC, and 13%

(77) opined that they are very aware of CC. The response to this question is a surprise, especially when considering answers to the previous questions. When students were asked a more general question, e.g. “Do you think climate change exists?” compared to a question on CC awareness with more options, the students were less certain of their level of awareness, ranging from ‘having an idea’ to ‘very aware’.

Table 4.7: Students’ perceived level of CC awareness

Scale	Poor	Little aware	I have an idea	Aware	Very aware
Number of respondents	59	111	179	177	77

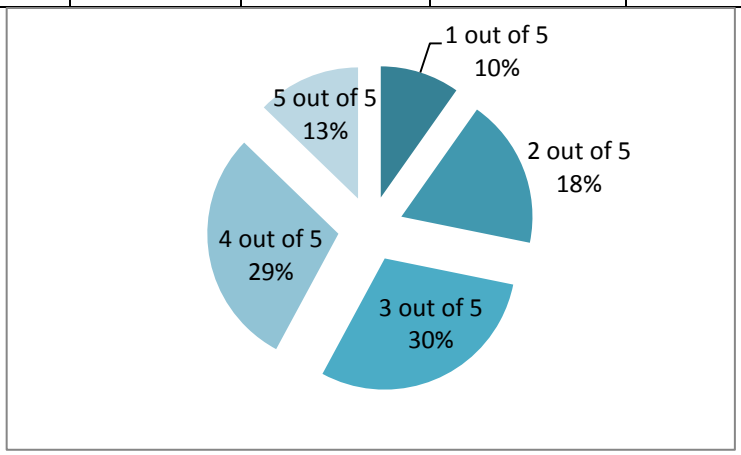


Figure 4.8: Students’ perceived level of CC awareness

Finding 5: Students tend to have an average understanding of climate change

ii) The role students’ level of study plays in understanding climate change

The question, “Does your level of study play any role in how you understand climate change?” was asked to explore the students’ perception of whether the level (year) of study plays a role in the awareness and understanding of CC. As indicated in Table 4.8 and Figure 4.9, 52% (314) of students said they believe that level of education plays a significant role in understanding CC, while 48% (289) suggested the level of study does not really matter. The results surprisingly indicate a level of uncertainty whether education plays an important role in the CC awareness of students.

Table 4.8: Role of the level of education in CC awareness

Response	Yes	No
Number of respondents	314	289
%	52%	48%

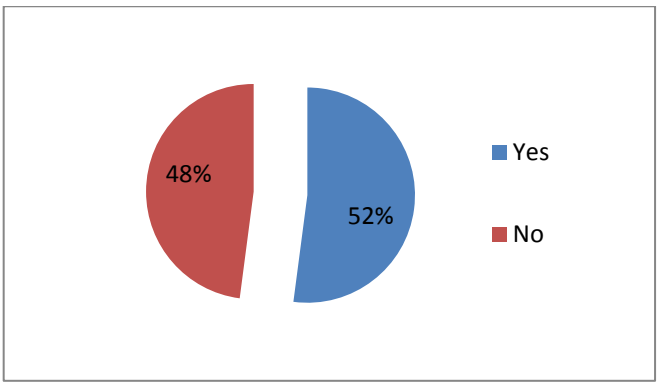


Figure 4.9: Role of the level of education in CC awareness

Finding 6: Students are uncertain whether the level (year) of study plays a significant role in creating climate change awareness

4.3.1.3 SRQ3: What are the factors affecting the climate change awareness levels of students?

i) The influence of students' personal background on climate change awareness

"Do you think your personal background has an influence on the way you understand climate change?" This question was asked to determine students' perceptions on whether their background has any effect on their CC awareness level. As illustrated in Table 4.9 and Figure 4.10, 70% (422) of the students said their personal background does have an effect on their awareness of CC, while 30% (181) felt the opposite. This indicates that the way students are raised may play a role in their awareness of CC.

This is not surprising, as the data show that TV and social media play an important role in creating CC awareness. Considering the socio-economic disparity in South Africa, where for example TV and social media are not freely available to all citizens, it makes sense that the background of the students may greatly vary.

Table 4.9: Personal background influence on CC awareness

Response	Yes	No
Number of respondents	422	181
%	70%	30%

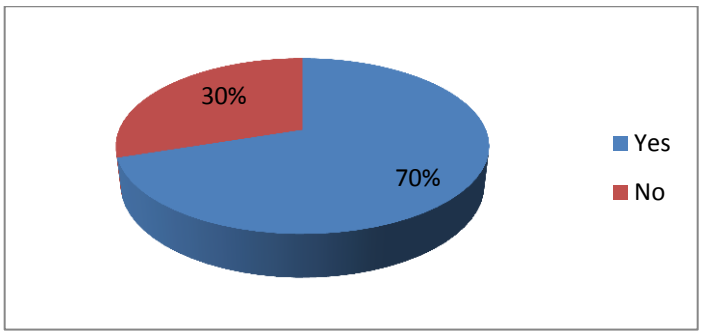


Figure 4.10: Personal background influence on CC awareness

Finding 7: An individual's background contributes towards the awareness of climate change

ii) The lack of education in the awareness of climate change

The statement, "Lack of climate change education is a major contributor to students' awareness of climate change" was posed to determine if the curriculum presented at the University of Technology assists with creating CC awareness within faculties and at different levels of education. Table 4.10 and Figure 4.11 indicate that 47% (285) of the students strongly agreed that the lack of CC education at the university is a major contributor towards the lack of student awareness of CC, while 37% (221) somewhat agreed.

However, 13% (76) somewhat disagreed, while 3% (21) strongly disagreed. This shows that CC-related education is necessary to improve the awareness of students about CC, which is a surprise finding as it is expected that universities in general would teach at least to some degree the importance of CC and the impact on the planet.

Table 4.10: Lack of CC education as major contributor to students' CC awareness

Response	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Number of respondents	285	221	76	21
%	47%	37%	13%	3%

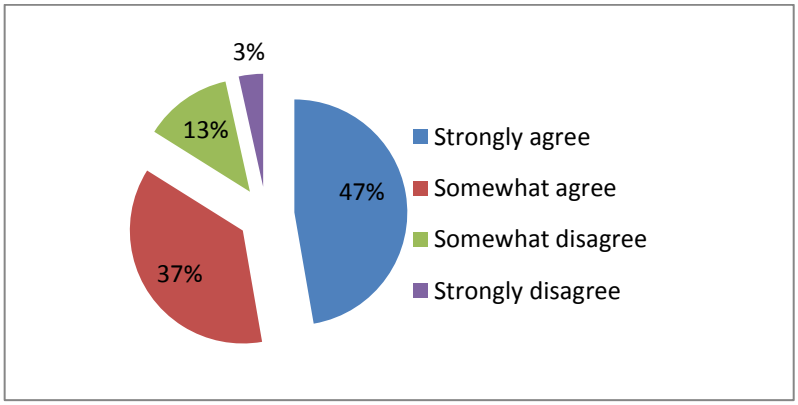


Figure 4.11: Lack of CC education as major contributor to students' CC awareness

Finding 8: Students are of the view that a lack of CC education contributes to low climate change awareness

iii) Human behaviour and climate change

The statement, "Human behaviour is responsible for climate change", has been made to determine the students' views on human behaviour affecting CC. As shown in Table 4.11 and Figure 4.12, 55% (329) of the students strongly agreed that human behaviour is more responsible for changes in the climate, 32% (191) somewhat agreed, 11% (67) somewhat disagreed, and 3% (16) strongly disagreed. The students are aware that human behaviour is contributing towards CC.

Unfortunately, this research did not further explore the matter in terms of determining what type of behaviour is responsible for CC and how this behaviour can be changed. These challenges need further research.

Table 4.11: Students' view on human behaviour affecting CC

Response	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
No. of respondents	329	191	67	16
%	55%	32%	11%	3%

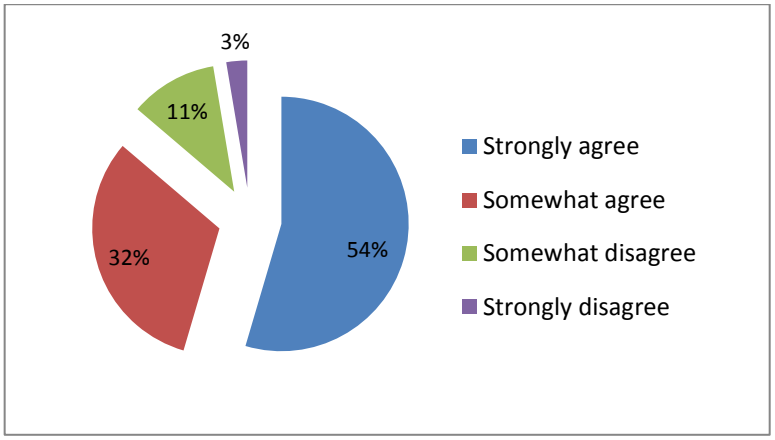


Figure 4.12: Students' view on human behaviour affecting CC

Finding 9: Human behaviour contributes to climate change

4.3.1.4 SRQ4: What channel of communication do students perceive as important to improve their awareness of climate change?

i) Sources of information that contribute to conveying the climate change awareness message to students

The question was asked to determine the sources that effectively contribute in conveying the message (awareness) of CC. Table 4.12 and Figure 4.13 indicate that 35% (214) of the

students heard of CC through television, 10% (59) through radio, 5% (28) through newspapers, 8% (50) through the Internet, 3% (16) through Facebook, 1% (8) through Twitter, 6% (34) from government, and 1% (4) from organisations. Several students became aware of CC through two or more mediums – 3% (16) from TV, school and university; 1% (5) from the Internet, school and university; 13% (80) from school and university; 4% (26) from family and friends; 2% (14) from TV and government; 2% (11) from other sources; and 2% (11) never heard of CC. TV is widely accepted and indicated as the medium that creates CC awareness. Surprisingly, social media is not indicated as significantly important. It must be said that the question was structured in such a way that the answered can be skewed in the sense that the combination of questions made it difficult to be statistically sound. This is a an oversight and needs to be rectified in future research.

Table 4.12: Sources where the students heard of CC

Sources	Number of students	Percentages
TV	214	35%
TV & Internet	5	0%
TV & Facebook	3	0%
TV & twitter	1	0%
TV & Government	14	2%
TV & school or University	16	3%
TV & Family & friends	1	0%
Radio	59	10%
Radio & newspaper	1	0%
Radio & internet	1	0%
Newspapers	28	5%
Newspapers & government	2	0%
Internet	50	8%
Internet & government	1	0%
Internet & School & university	5	1%
Internet & family & friends	1	0%
Never heard of it	11	2%
Facebook	16	3%
Facebook & twitter	2	0%
Facebook, School or university & family & friends	1	0%
Facebook & others	1	0%
Twitter	8	1%
Government	34	6%
Government & schools & universities	3	0%
Government & other	1	0%
School & university	80	13%
School & university & family & friends	2	0%
School & university & other	1	0%
Family & friends	26	4%
Organisations	4	1%

Sources	Number of students	Percentages
Other	11	2%

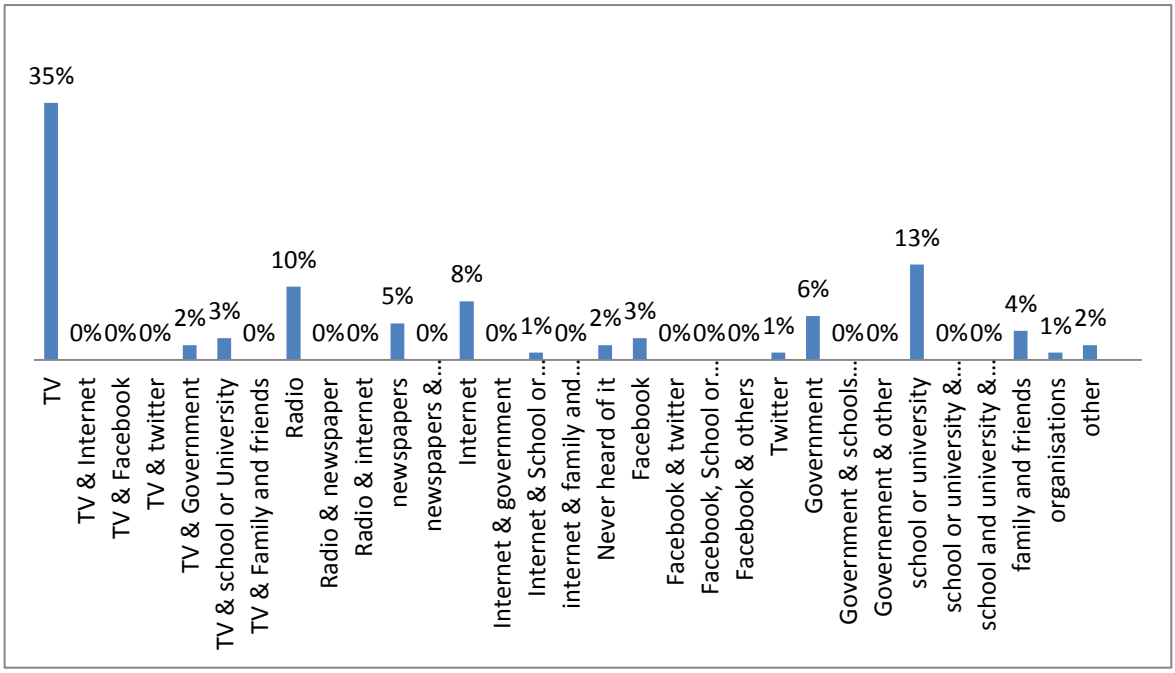


Figure 4.13: Sources where the students heard of CC

Finding 10: Most of the students became aware of climate change through TV

Finding 11: Social media, including the Internet, seems to be less of a climate change information platform for students

Finding 12: Schools and universities are perceived as not creating climate change awareness among students

ii) Preferred sources of information to create climate change awareness

The question, "Which communication model would you prefer to communicate issues of climate change?" was asked to explore which communication medium(s) the students prefer to learn about CC. Table 4.13 shows that 19% (117) of the students prefer TV to make them aware CC, 8% (46) indicated classroom, 7% (44) radio, 6% (36) SMS, 5% (32) Facebook, 5% (30) newspapers, 5% (390) seminars, 4% (24) e-mail, 4% (22) posters, 3% (17) other, and 3% (18) Twitter. The students also stated that awareness can be created through a combination of media – (5%) (31) indicated TV and classroom, 2% (18) TV and radio, 1% (6) TV and seminars, 1% (5) radio and SMS, 1% (4) Facebook and Twitter, 1% (5) classroom and seminars, 1% (7) TV, radio and newspapers, 1% (6) TV, Facebook and Twitter, 1% (6) TV, radio and classroom, 2% (13) TV, radio, newspaper and classroom, 1% (6) TV, radio, Facebook and classroom, 1% (7) TV, Facebook, classroom and seminars, and 1% (6) said TV, radio, newspaper, classroom and seminars. As in the case of section 4.3.1.4 i) where the

question was asked to determine the sources that effectively contribute in conveying the CC message in the opinion of the students, this question about a communication model is also more of a challenge to interpret. However, TV is once again the dominant model.

Table 4.13: Communication models preferred to create CC awareness

Source	Number of respondents	Percentage
TV	117	19%
TV & Radio	10	2%
TV, Radio & newspaper	7	1%
TV, Radio, newspaper & poster	2	0%
TV, Radio, newspaper & other	1	0%
TV, Radio, newspaper & Facebook	2	0%
TV, Radio, newspaper, Facebook & e-mail	1	0%
TV, Radio, Newspaper, Facebook & classroom	1	0%
TV, Radio, Newspaper & classroom	13	2%
TV, Radio, Newspaper, classroom & seminar	6	1%
TV, Radio, posters, Facebook & Twitter	1	0%
TV, Radio, posters & classroom	1	0%
TV, Radio, other, classroom & seminar	1	0%
TV, Radio, other & seminar	1	0%
TV, Radio & Facebook	2	0%
TV, Radio, Facebook & twitter	1	0%
TV, Radio, Facebook & e-mail	1	0%
TV, Radio, Facebook & classroom	6	1%
TV, Radio & SMS	1	0%
TV, Radio, SMS & e-mail	2	0%
TV, Radio & classroom	6	1%
TV, Radio & seminar	1	0%
TV & Newspaper	1	0%
TV, Newspaper & posters	1	0%
TV, Newspaper, posters & classroom	1	0%
TV, Newspaper & Facebook	1	0%
TV, Newspaper, Facebook & e-mail	1	0%
TV, Newspaper, Facebook & classroom	2	0%
TV, Posters & Facebook	1	0%
TV, Posters, Facebook & twitter	2	0%
TV, Posters, Facebook, twitter, classroom & seminar	1	0%
TV, Posters, Facebook & classroom	1	0%
TV, Posters, classroom & seminar	1	0%
TV & Facebook	2	0%
TV, Facebook & Twitter	6	1%
TV, Facebook, Twitter & classroom	1	0%
TV, Facebook & classroom	4	1%
TV, Facebook, classroom & seminar	7	1%
TV, Facebook & seminar	1	0%
TV & Twitter	1	0%
TV & SMS	3	0%
TV, SMS & e-mail	1	0%

TV & e-mail	1	0%
TV, eMail & classroom	1	0%
TV & Classroom	31	5%
TV, Classroom & seminar	8	1%
TV & Seminar	6	1%
Radio	44	7%
Radio, Facebook & Twitter	1	0%
Radio & SMS	5	1%
Radio & classroom	1	0%
Newspaper	30	5%
Newspaper & SMS	2	0%
Newspaper, SMS, classroom & seminar	1	0%
Newspaper & classroom	1	0%
Posters	22	4%
Poster & Facebook	1	0%
Posters, Facebook, Twitter & classroom	1	0%
Posters, Facebook & classroom	1	0%
Posters & SMS	1	0%
Posters, e-mail & classroom	1	0%
Posters, classroom and Seminar	1	0%
Other	17	3%
Other & SMS	2	0%
Facebook	32	5%
Facebook & Twitter	4	1%
Facebook, Twitter & classroom	1	0%
Twitter	18	3%
SMS	36	6%
Twitter & SMS	2	0%
SMS & Classroom	1	0%
SMS & Seminar	1	0%
e-mail	24	4%
e-mail & classroom	1	0%
Classroom	46	8%
Classroom & seminar	5	1%
Seminar	30	5%
Total	**603**	**100%**

Finding 13: TV is the preferred medium of students for creating and communicating climate change awareness

4.3.2 Summary of the findings

Thirteen (13) findings were derived from the responses received (Table 4.14).

Table 4.14: Summary of findings from the questionnaire data – Section B: CC-related questions

PRQ:	**What is the level of climate change awareness of students at a selected University of Technology in South Africa?**	
	Finding No.	**Finding description**

SRQ1:	***What are students' perceptions of climate change?***	
	1	The majority of students are aware of climate change
	2	Students acknowledge that climate change is the world's biggest problem
	3	Large countries, governments, large corporates, businesses and individuals are seen as the major causes of climate change
	4	The rise in the planet's temperature is a major challenge created by climate change
SRQ2:	***What are the differences in the climate change awareness levels of students?***	
	5	Students tend to have an average understanding of climate change
	6	Students are uncertain whether the level (year) of study plays a significant role in creating climate change awareness
SRQ3:	***What are the factors affecting the climate change awareness levels of students?***	
	7	An individual's background contributes towards the awareness of climate change
	8	Students are of the view that a lack of climate change education contributes to low climate change awareness
	9	Human behaviour contributes to climate change
SRQ4:	***What channel of communication do students perceive as important to improve their awareness of climate change?***	
	10	Most of the students became aware of climate change through TV
	11	Social media, including the Internet, seems to be less of a climate change information platform for students
	12	Schools and universities are perceived as not creating climate change awareness among students
	13	TV is the preferred medium of students for creating and communicating climate change awareness

4.4 Research hypotheses

Six hypotheses and a general question were posed to answer the research questions. The research hypotheses are:

- **H_1:** Students aware of climate change are more likely to study in some faculties rather than others
- **H_2:** The number of students who believe in climate change is to increase as they progress through university
- **H_3:** The level of acceptance of the existence of climate change are different in the faculties
- **H_4:** Students are not concerned about climate change
- **H_5:** Students are more concerned about certain climate change effects than others
- **H_6:** Students feel that certain sectors of the public are more responsible for climate change than others

The following statistics have been generated after filtering out the "CC exists = 'N'" records. It was deemed for these particular relationships to include people who do not believe CC exists

in the first place. All tests were assessed at the probability level of 5% (p=0.05) as it is standard for this type of research (Wasserstein et al., 2019). It is the norm for this type of research (Yates, 1934).

4.4.1 H1: Students aware of climate change are more likely to study in some faculties rather than others

The hypotheses assessed whether the students believe in the existence of CC by comparing two variables, 'faculties' and 'CC existence'. It seems that some areas of study are more likely to include CC than others.

Hypothesis tested:

H_1: There is a tendency for students in certain faculties to believe that climate change exists

H_0: Students who believe climate change exists are evenly distributed across faculties

Table 4.15: One-sample Chi-Square test summary for H_1

Total N	557
Test Statistic	18.558[a]
Degree of Freedom	5
Asymptotic Sig. (2-sided test)	.002

[a]There are 0 cells (0%) with expected values less than 5. The minimum expected value is 92.833.

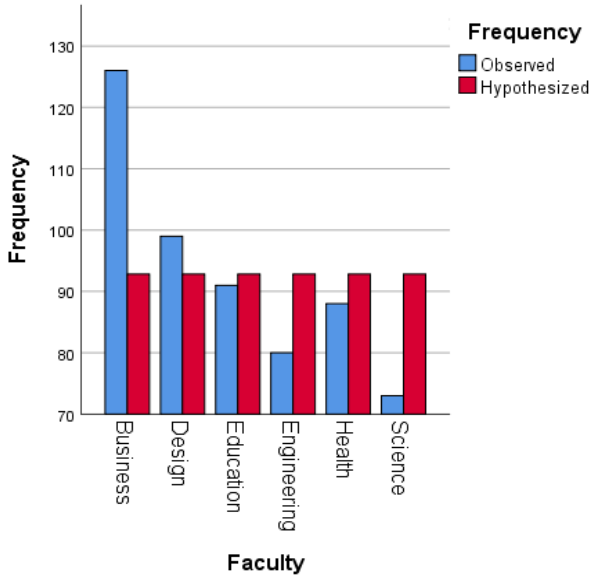


Figure 4.14: One-sample Chi-Square test summary for H_1

The Chi-Square goodness-of-fit test shows that H_0 can be rejected (N=557, DF=5, p=0.002), i.e. the students are not evenly distributed across faculties. As can be seen in Figure 4.14, there is a strong bias towards the Business Faculty for students' awareness of CC. This agrees with Gill (2020) who states that Business schools accept the existence of CC and

have made substantial progress in reducing the environmental impact of CC. However, this is somehow surprising as Business faculties are usually the area with the least amount of CC integration in their curricula (Blackmore et al., 2018). It is furthermore somewhat surprising that the Engineering and Science faculties are the lowest ranking faculties in terms of CC awareness in this research. This may indicate their focus on specific disciplines, whereas the other faculties cover a wider variety of subjects.

In a study that included Delhi University, JNU, CUSAT, Pondicherry University, and Pune University, Ray (2020) reports that other faculties (other than business) offer instruction in all disciplines and use modern innovations to incorporate content related to CC in their classrooms while teaching subjects unique to their disciplines. That is, instead of making CC an independent subject, the course combines climate science with the core undergraduate curriculum.

Finding 14: Business Faculty students are more aware of climate than students of other faculties

Finding 15: There is a lower level of climate change awareness in the other faculties

4.4.2 H2: The number of students who believe in climate change is to increase as they progress through university

This hypothesis aimed to compare the different CC awareness levels of students as they progress with their studies by comparing their 'year of study' and 'CC existence'. It seems reasonable to expect from students to become more aware of CC over time, whether through the curriculum, or because of a general increase in interest in world affairs as they mature. Freije et al. (2017) posit that generally, 4th year students seem to be more aware of environment issues than 1st year students, something that is not clear, whether attributed to CC inclusion in the curriculum or to students' maturity in general. Falaye and Okwilagwe (2016) suggest that the more students mature, the more they become aware of CC.

Hypothesis tested:

H_2: There is a tendency for students' belief in the existence of climate change to increase throughout their years of study

H_0: Students who believe in the existence of climate change are evenly distributed across years of study

Table 4.16: One-sample Chi-Square test summary H_2

Total N	557
Test Statistic	4.113[a]
Degree of Freedom	3

Asymptotic Sig. (2-sided test)	.250
[a]There are 0 cells (0%) with expected values less than 5. The minimum expected value is 139.250.	

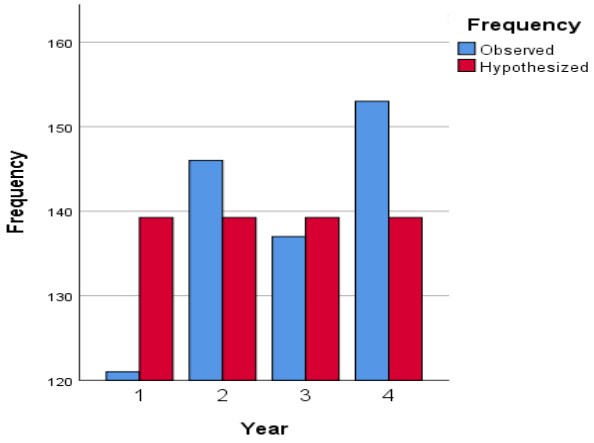


Figure 4.15: One-sample Chi-Square test summary for H_2

The Chi-Square goodness-of-fit test shows that H_0 cannot be rejected (N=557, DF=e, p=0.25), i.e. there is a relationship between students' belief in CC and their year of study (Table 4.16; Figure 4.15). The number of students who are aware of CC as they enter the university is substantially smaller than those in their 2nd , 3rd or 4th year of study. Although it cannot be deduced from this test, it is reasonable to assume that the very fact that they are studying at university increases their belief in CC. While this may be a simple case of increasing maturity or increasing contact with other strata of students than they might have at school, there is a distinct possibility that CC is part of the curricula being taught. Rahman et al. (2014) indicate that the level of the students is one of the most critical factors influencing the level of students' awareness of CC. The level of the maturity of students to grasp and comprehend the breadth of content of CC increases with their level of study. Rahman et al. (2014) further suggest that that a student's level of year study has a substantial effect on their views and the awareness of CC knowledge.

Finding 16: The year of study increases the level of students' climate change awareness

4.4.3 H_3: The level of acceptance of the existence of climate change are different in the faculties

This hypothesis aimed to assess students' CC awareness in different faculties. If CC awareness is being taught in some faculties more than others, there should be a relationship between the variables 'faculty' and 'year of study'.

Hypothesis to be tested:

H_3: There is a relationship between the variables 'faculty' and 'year of study'

H_0: The variables are independent

Table 4.17: Student awareness in different faculties by comparing CC existence and faculties (H_3; Chi-Square test)

Chi-Square test	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	46.279[a]	15	.000
Likelihood Ratio	61.625	15	.000
N of Valid Cases	557		

[a]There are 0 cells (0%) with an expected count less than 5. The minimum expected count is 15.86. Correlation statistics available for numeric data only.

As can be seen in Table 4.17 above and Figure 4.16 below, H_0 is rejected (N=557, DF=15, p>0.001). This indicates that there is a relationship between 'faculty' and 'year of study' for students who believe in CC and are aware that CC exists. It is interesting to note that no 1st year students in the Science Faculty are aware that CC exists. This changes drastically in year two, but remains constant in years three and four. This is most probably due to the inclusion of CC in the curriculum. On the other hand, a large proportion of students entering FID are aware that CC exists, but only half as many students believe the same in their second year. This is very hard to reconcile. The fact that there is a dramatic increase in students' awareness of CC in the fourth year may again implicate that CC is being taught in the third year curriculum.

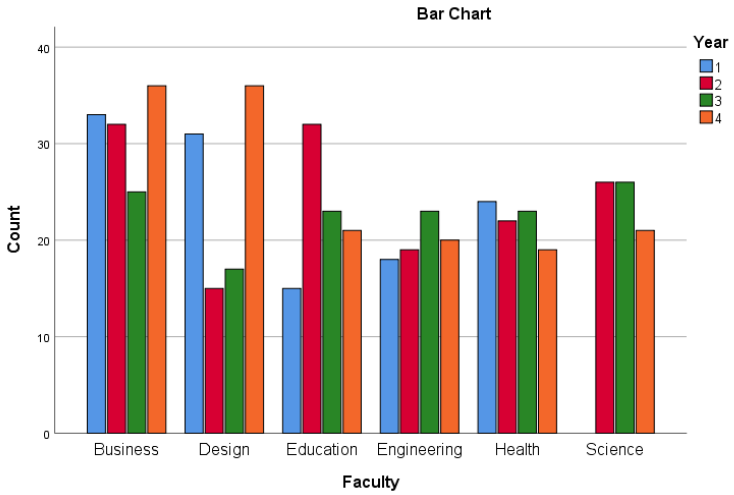


Figure 4.16: Chi-Square test summary for H_3

Further research should be done into CC being included in the curriculum to ascertain when and how and perhaps in which courses of study CC awareness is taught.

Finding 17: Further research is needed as there are no clear findings on students' climate change awareness in different faculties

4.4.4 H_4: Students are not concerned about climate change

This hypothesis aimed to explore if students are concerned about climate change.

H_4: Students are concerned about climate change
H_0: Students are not concerned about climate change

Students have a better understanding of CC concerns, hence they play an important role in educating people on CC in their different localities (Mugambiwa & Dzomonda, 2018). Weber (2010) posits that students gain a more comprehensive understanding of CC than the layman in society when studying subjects such as Geography and Environmental Science. The majority of students (79%) said they believe CC is one of the world's biggest problems, which indicates that students are concerned about CC (Table 4.18; Figure 4.17).

Table 4.18: Chi-Square test summary for H_4

		Frequency	Percent	Valid percent	Cumulative percent
Valid	N	126	20.9	20.9	20.9
	Y	477	79.1	79.1	100.0
	Total	603	100.0	100.0	

As shown in Figure 4.17, 79% of the students indicated they believe that CC is the world's biggest problem. This agrees with a study done by Bevins (2020) in Waikato region of New Zealand, where students found CC to be the global problem and were concerned about how CC would impact their future lives and the lives of the people closest to them. The fact that students and young people have recognised the impact of CC globally resulted in students taking matters into their own hands in several ways. Throughout the world, young people use the courts to attempt compelling governments to intervene on CC in many landmark legal proceedings (Sanson et al., 2019). The students who believe CC is a world crisis are particularly concerned about certain aspects off CC, as shown in section 4.4.5 (H5).

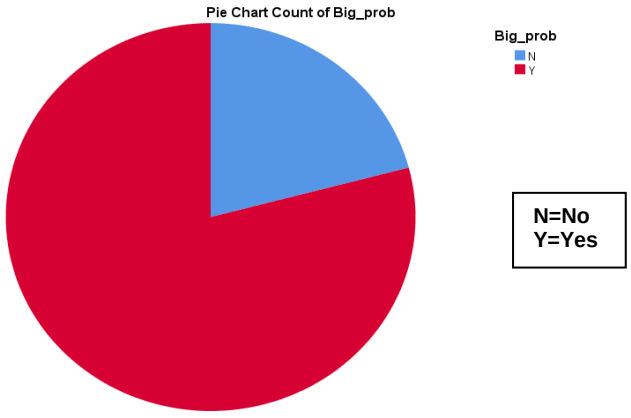


Figure 4.17: Students' perception of CC as the world's biggest problem

Finding 18: Students are concerned about climate change as they regard this as the world's biggest problem

4.4.5 H_5: Students are more concerned about certain climate change effects than others

This hypothesis aimed to identify certain climate change effects students are concern about.

H_5: Students have specific concerns about the effects CC has on the world

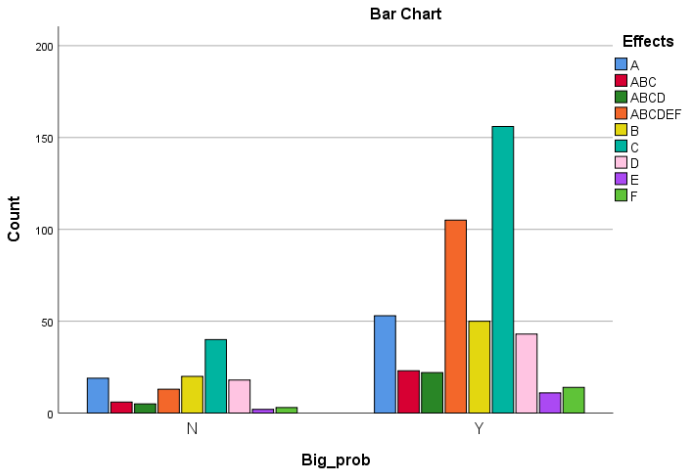
H_0: Students have no specific concerns about the effects CC has on the world

Table 4.19: Students are more concerned about certain effects of CC on the world than others (H_5; Chi-Square test)

Chi-Square test	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.982[a]	8	.082
Likelihood Ratio	14.623	8	.067
N of Valid Cases	603		

[a]2 cells (11.1%) have an expected count less than 5. The minimum expected count is 2.72.

The Chi-Square of H_5 (Table 4.19) indicates that H_0 (students have no specific concern about the effects CC has on the world) cannot be rejected; thus, there is more awareness about some CC effects than others. The bar chart (Figure 4.18) indicates that temperature increase ((c) global warming) creates the highest concern among the students.



(A=Drought/B=Flooding/C=Rising temperatures/D=Sea-level rise/E=Coastal erosion/F=Desertification)

Figure 4.18: Chi-Square test summary for H_5

Finding 19: H_0 cannot be rejected; students are particularly concerned about temperature

4.4.6 H6: Students feel that certain sectors of the public are more responsible for climate change than others

This hypothesis sought to evaluate what sectors students perceive to be responsible for the crisis of CC by comparing 'CC is world's biggest problem' and 'CC causes'.

H_6: Certain sectors of the public are more responsible for CC than others

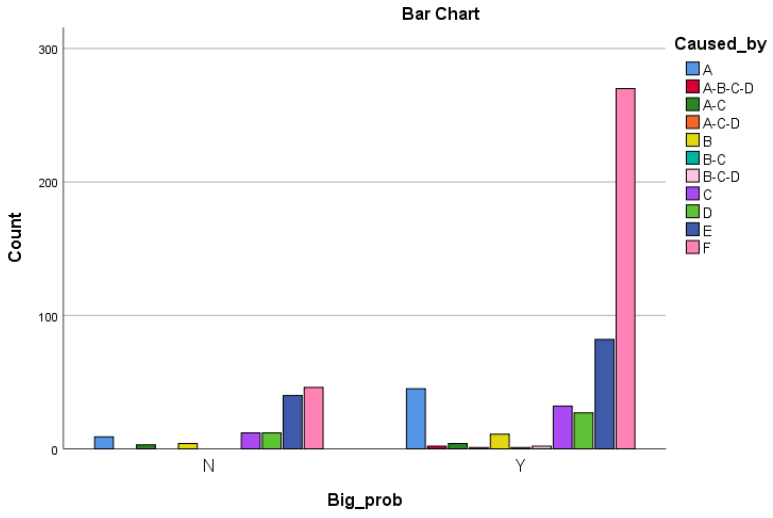
H_0: Students believe that CC is not caused by any one particular sector of the public

Table 4.20: Students believe that CC is not caused by any one particular sector of the public (H_6;Chi-Square test)

Chi-Square test	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	26.015[a]	10	.004
Likelihood Ratio	26.216	10	.003
N of Valid Cases	603		

[a]10 cells (45.5%) have an expected count less than 5. The minimum expected count is .21.

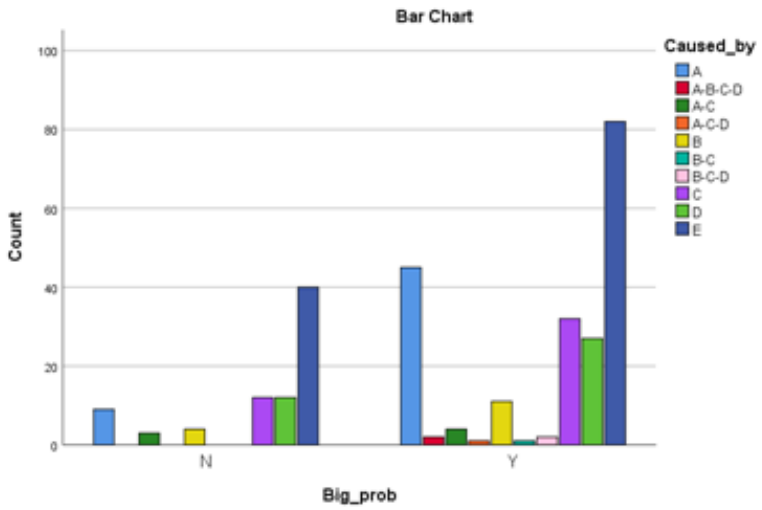
Data coded to achieve the objectives of the study are indicated by the legends in Figure 4.19. The resulting Chi-Square of .004 (Table 4.20; Figure 4.19) dictates that the null hypothesis is rejected and that the students believe that particular effects are more responsible for CC than others. However, the option named 'all', shows that the students feel everyone plays a part in creating CC. This concurs with Ali (2020), who reports that many various natural variables are known as determinants of CC. Widiyawati (2020) also agrees that many variables lead to climate issues, which tend to be the footprint of human activity and natural causes.



(A=Large countries/B=Government/C=Large corporations/D=Business in general/E=Individuals/F=All of the above)

Figure 4.19: Students believe that CC is not caused by any one particular sector of the public (H_6)

Rerunning the above test but ignoring the category ‘all’, delivered the following results (Figure 4.20):



(A=Large countries/B=Government/C=Large corporations/D=Business in general/E=Individuals)

Figure 4.20: Results with category ALL removed from the test where students believe CC is not caused by any one particular sector of the public (H_6)

In this case, students perceived individuals (‘E’) as the biggest contributors to CC, followed by large countries (‘A’), large corporations (‘C’), and business in general (‘D’). Despite numerous agreements between nations on the reduction of CC such as the UNFCCC (1992), the adoption of the Paris Agreement (UNFCCC, 2015), and the Kyoto Protocol that was enforced in 2005, it seems that the students are either unaware of the agreements, or do not differentiate between governments causing pollution through their SOEs such as power production, mining, airlines etc., and governments’ role in mitigating CC through these agreements. This has potential for further research. Williams et al. (2020) agree with the research findings that individuals contribute in many aspects to the nature of CC through their carbon footprint, transportation and field fires. Empirical studies found that individuals are ignorant that CC affects human beings until they personally experience climate-related risks in their respective communities, for example floods (Botzen et al., 2020).

Finding 20: Individuals are perceived as the biggest contributors to climate change

4.5 Cross tabulation of variables

4.5.1 Faculty, year of study and student awareness

This section presents the CC awareness of students in different faculties and different years of study. All the three-way Chi-Square tests rejected H_1 where H_0 is variable independent, except for ‘personal awareness’ being neutral, with a very slight relationship (p=.096), and even this would be deemed insignificant at the 10% probability level. First year Science students still stands out as an oddity.

Table 4.21: Cross tabulation: Case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Faculty * Year * Pers_ awareness	603	100.0%	0	0.0%	603	100.0%

Table 4.21 shows the results of the entire study's questionnaires as well as variables used. It shows all the respondents in numbers and in percentage. In total, 603 respondents participated in the study, and variables 'faculty', 'year of study' and 'personal awareness' were utilised.

Table 4.22: Faculty * Year * Pers_awareness cross tabulation

Count						
			Year			
Pers_awareness			1	2	3	4	Total
High	Faculty	Business	13	8	14	13	48
		Design	7	6	7	20	40
		Education	6	7	8	14	35
		Engineering	4	8	8	13	33
		Health	12	13	7	10	42
		Science	0	23	17	16	56
	Total		42	65	61	86	254
Low	Faculty	Business	11	11	11	5	38
		Design	14	6	6	7	33
		Education	8	21	9	2	40
		Engineering	6	7	9	0	22
		Health	10	3	10	9	32
		Science	0	0	2	3	5
	Total		49	48	47	26	170
Neutral	Faculty	Business	10	13	3	18	44
		Design	10	12	12	13	47
		Education	5	4	6	5	20
		Engineering	8	5	6	7	26
		Health	3	6	10	11	30
		Science	0	3	7	2	12
	Total		36	43	44	56	179
Total	Faculty	Business	34	32	28	36	130
		Design	31	24	25	40	120
		Education	19	32	23	21	95
		Engineering	18	20	23	20	81
		Health	25	22	27	30	104
		Science	0	26	26	21	73
	Total		127	156	152	168	603

Table 4.23: Chi-Square test for Faculty * Year * Pers_awareness cross tabulation

Pers_awareness		Value	Df	Asymptotic Significance (2-sided)
High	Pearson Chi-Square	35.275[b]	15	.002
	Likelihood Ratio	42.957	15	.000
	N of Valid Cases	254		
Low	Pearson Chi-Square	40.081[c]	15	.000
	Likelihood Ratio	43.420	15	.000
	N of Valid Cases	170		
Neutral	Pearson Chi-Square	22.452[d]	15	.096
	Likelihood Ratio	25.673	15	.042
	N of Valid Cases	179		
Total	Pearson Chi-Square	34.252[a]	15	.003
	Likelihood Ratio	48.863	15	.000
	N of Valid Cases	603		

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.37
[b] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.46

Table 4.22 and Figure 4.21 present the 'Faculty * Year * Pers_awareness' cross tabulation. A total of 603 questionnaires were used for analysis. From the 603 participants, 130 were from the Business Faculty, 120 from Informatics and Design, 95 from Education, 81 from Engineering, 104 from Health and Wellness, and 73 from Applied Sciences (Science). Table 4.22 also shows the number of students per faculty and the year of study. No attempt was made to obtain a representative sample of the number of students per year of study. This was difficult to do as the students were spread across 5 campuses and it was not possible to repeatedly visit the campuses to get the correct sample of the year of study due to time constrains and the costs of such visits.

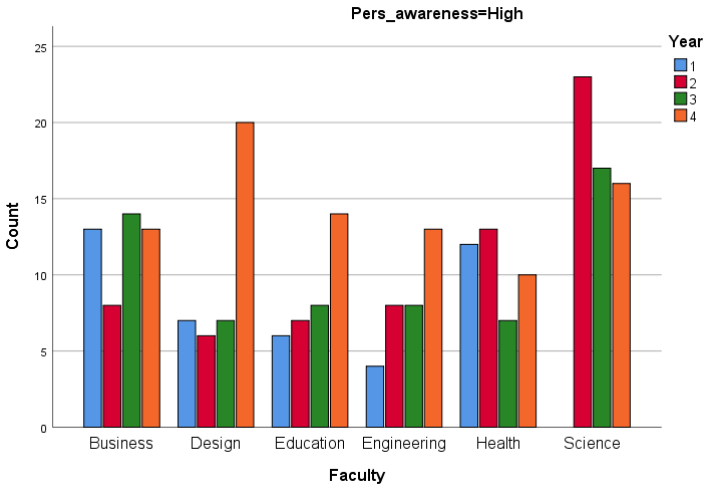


Figure 4.21: Personal awareness against year of study = high

Where personal awareness was rated by the students, it seems that the 4th year students are more aware of CC than 1st, 2nd and 3rd year students (section 5.5). However, it is only in the

Faculties of Informatics and Design, Education, and Engineering that awareness are significantly better as the year of study progresses from 1st to 4th year.

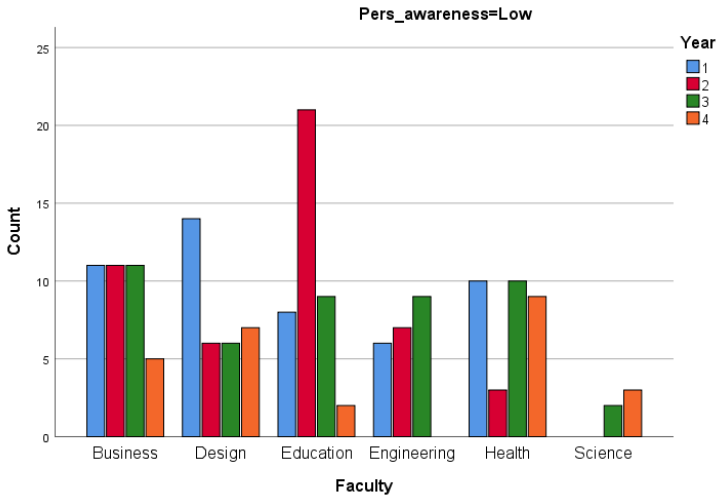


Figure 4.22: Personal awareness against year of study = low

In the case where the awareness was indicted as low, only Design 1st year and Education 2nd year students showed a higher level of awareness, but this could not be proved statistically. Therefore, it is concluded that there is no difference between the year of study and CC awareness.

In the scenario where students had no real opinion and were deemed 'neutral', students from the Business, Informatics and design and Health and Wellness seemed to be more aware of CC. BUT, the results are very erratic and it was difficult to assign it any meaning.

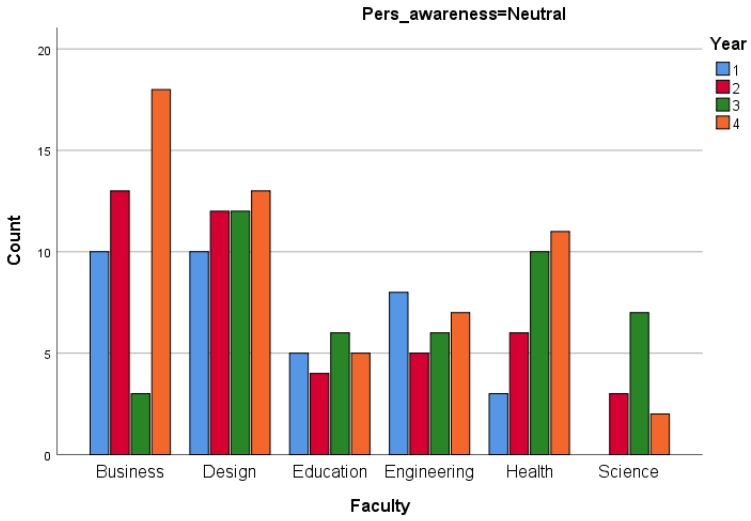


Figure 4.23: Personal awareness against year of study = neutral

4.6 Where have you heard about climate change?

This section addresses the two main variables, 'faculty' and 'year of study' (Table 4.24; Table 4.25). This was done in relation to the question where the students heard (became aware) of CC, and it answers the hypothesis that students prefer some communication models for CC-related information over others. The principle behind this is to determine how faculties and year of study do affect the participants' awareness of CC. Due to the severe impact of CC, it is important to study several media interests of students as it plays a critical role in education and information. The media plays a key role in raising CC awareness among students (Kakade, 2013).

Table 4.24: Students preference of communication models for CC in relation to faculties and year of study

Q1.4.1	TV	Radio	News-paper	Internet	Never heard of it	Face-book	Twitter	Govern-ment	School_ uni	Fam_ friends	Organisa-tions
Faculty	0.229	0.461	0.084	0.154	0.009	0.006	0.004	0.508	0.038	0.047	0.006
Year	0.089	0.528	0.435	0.225	0.078	0.11	0.863	0.185	0.262	0.008	0.119

Table 4.25: Students preference of communication models for CC in relation to faculties and year of study

Q1.4.2	TV	Radio	News-paper	Posters	Other	Facebook	Twitter	SMS	Email	Class-room	Seminar
Faculty	**0.012**	**0.001**	**0**	**0.206**	**0.001**	**0.001**	**0.24**	**0**	**0.393**	**0.026**	**0.074**
Year	**0.87**	**0.003**	**0.179**	**0.019**	**0.261**	**0.866**	**0.084**	**0.023**	**0.63**	**0.052**	**0.076**

The variable 'other' has been omitted as there were no responses for that category. The highlighted cells are '$H_0 < 0.05$', i.e. H_0 is rejected. Each variable's results, tables and graphs are shown in sections 4.7 and 4.8.

Finding 21: Students seem to prefer TV over other media interests

4.7 Students of different faculties' views of variables on climate change

In the following sections, the variables are analysed from a faculty perspective. The variables are: i) TV; ii) radio; iii) newspapers; iv) Internet; v) Facebook; vi) Twitter; vii) government; viii) school and university; ix) family and friends; x) organisations. The following faculties were included in the study: i) Business; ii) Informatics and Design (Design); iii) Education; iv) Health and Wellness (Health); v) Applied Science (Science).

4.7.1 Faculties and the role of TV in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through television. Table 4.26, Table 4.27 and Figure 4.24 represent the analysis.

Table 4.26: Number of students per faculty and the role of TV in CC awareness

Count		TV		
		0	1	Total
Faculty	Business	69	61	130
	Design	72	48	120
	Education	65	30	95
	Engineering	46	35	81
	Health	55	49	104
	Science	42	31	73
Total		349	254	603

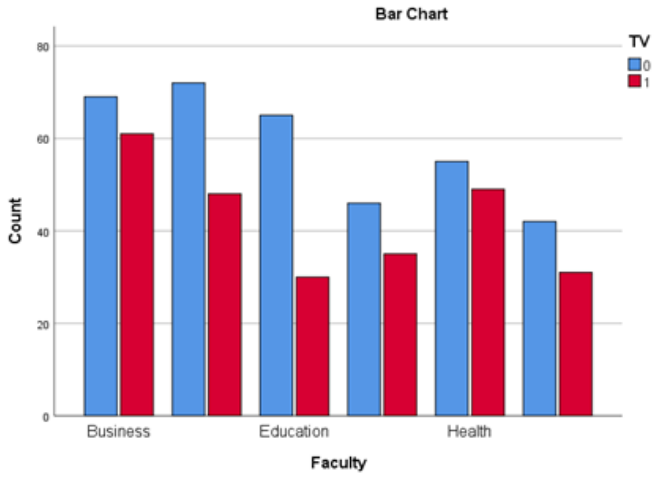
[0] Indicates the number of students per faculty not using TV for information on CC
[1] Indicates the number of students per faculty using TV for information on CC

Table 4.27: Chi-Square test on number of students per faculty and the role of TV in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.889[a]	5	.229
Likelihood Ratio	7.008	5	.220
N of Valid Cases	603		

[a] Cells (0.0%) have an expected count less than 5. The minimum expected count is 30.75

With $\chi 2 = .229$, H_0 cannot be rejected. There appears to be some relationship between the variables. The results suggest that most of the students from the faculties do not utilise TV to gain knowledge on CC. An increasing number of TV weather stations are reporting on the impacts of CC (Feygina et al., 2020) although the usefulness of such communication on student perspectives is little understood. Studies show that TV and radio are dominant sources of CC knowledge for most audiences (Adjin-Tettey, 2019).



[0] Indicates the number of students per faculty not using TV for information on CC
[1] Indicates the number of students per faculty using TV for information on CC

Figure 4.24: Number of students per faculty and the role of TV in CC awareness

Finding 22: Students across faculties do not use TV for information on climate change

4.7.2 Faculties and the role of radio in students climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through radio. Table 4.28, Table 4.29 and Figure 4.25 represent the analysis.

Table 4.28: Number of students per faculty and the role of radio in CC awareness

Count		Radio		
		0	1	Total
Faculty	Business	120	10	130
	Design	109	11	120
	Education	84	11	95
	Engineering	73	8	81
	Health	95	9	104
	Science	61	12	73
Total		542	61	603

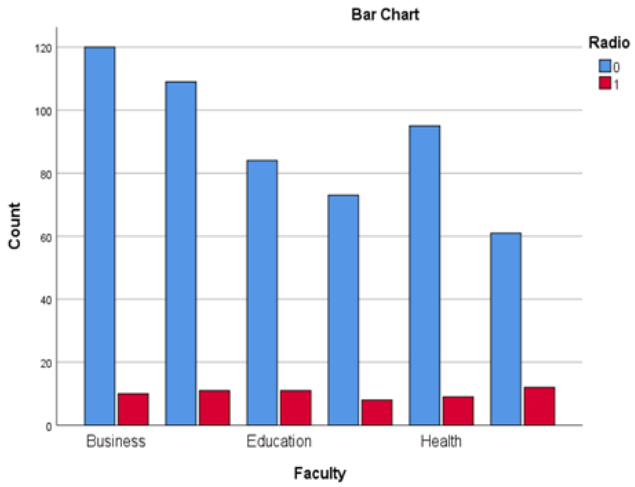
[0] Indicates the number of students per faculty not using radio for information on CC
[1] Indicates the number of students per faculty using radio for information on CC

In Table 4.29, $\chi 2 = .462$, H_0 cannot be rejected. There is some relationship between the variables. Only 61 students across all faculties answered 'Yes' that they are obtaining information through radio. It would seem that very few students listen to radio for information on CC.

Table 4.29: Chi-Square test on number of students per faculty and the role of radio in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.641[a]	5	.461
Likelihood Ratio	4.260	5	.513
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 7.38



[0] indicates the number of students per faculty not using radio for information on CC
[1] indicates the number of students per faculty using radio for information on CC

Figure 4.25: Number of students per faculty and the role of radio in CC awareness

Finding 23: Students do not use radio for information on climate change

4.7.3 Faculties and the role of newspapers in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through newspapers. Table 4.30, Table 4.31 and Figure 4.26 represent the analysis.

Table 4.30: Number of students per faculty and the role of newspapers in CC awareness

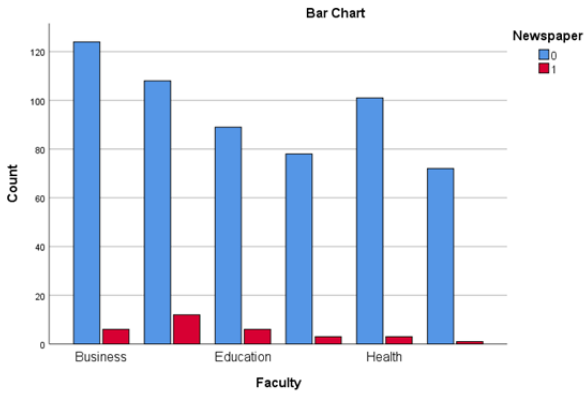
Count		Newspaper		
		0	1	Total
Faculty	Business	124	6	130
	Design	108	12	120
	Education	89	6	95
	Engineering	78	3	81
	Health	101	3	104
	Science	72	1	73
Total		572	31	603

[0] Indicates the number of students per faculty not using newspapers for information on CC
[1] Indicates the number of students faculty using newspapers for information on CC

Table 4.31: Chi-Square test on number of students per faculty and the role of newspapers in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.710[a]	5	.084
Likelihood Ratio	9.567	5	.088
N of Valid Cases	603		

[a] 3 cells (25.0%) have an expected count less than 5. The minimum expected count is 3.75



[0] indicates the number of students per faculty not using newspapers for information on CC
[1] indicates the number of students per faculty using newspapers for information on CC

Figure 4.26: Number of students per faculty and the role of newspapers in CC awareness

χ^2 = .084, H_0 cannot be rejected. There is a weak relationship between the variables. Only 31 students answered 'Yes' to the question that they use newspapers for information on CC. It would seem that either a few students buy newspapers, or CC is not presented in newspapers. The latter is demonstrably not true, so presumably the former is.

Finding 24: Students do not use newspapers for information on climate change

4.7.4 Faculties and the role of the Internet in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through the Internet. Table 4.32, Table 4.33 and Figure 4.27 represent the analysis.

Table 4.32: Number of students per faculty and the role of the Internet in CC awareness

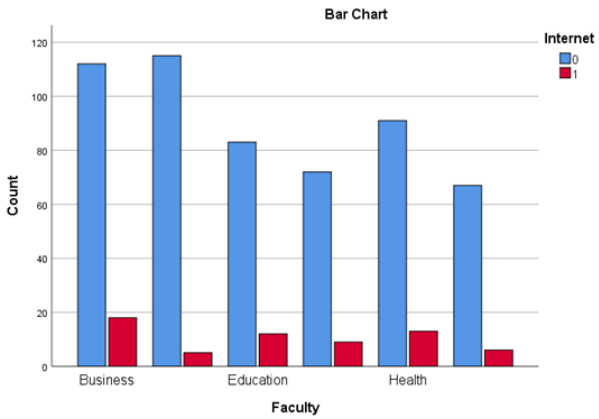
Count		Internet		
		0	1	Total
Faculty	Business	112	18	130
	Design	115	5	120
	Education	83	12	95
	Engineering	72	9	81
	Health	91	13	104
	Science	67	6	73
Total		540	63	603

[0] Indicates the number of students per faculty not using the Internet for information on CC
[1] Indicates the number of students per faculty using the Internet for information on CC

Table 4.33: Chi-Square test on number of students per faculty and the role of the Internet in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.043[a]	5	.154
Likelihood Ratio	9.224	5	.100
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 7.63



[0] Indicates the number of students not using the internet for information on CC
[1] Indicates the number of students using the internet for information on CC

Figure 4.27: Number of students per faculty and the role of the Internet in CC awareness

χ^2 = .154, H_0 cannot be rejected; there is a relationship between the variables, but what exactly, is unclear. Only 63 students answered 'Yes' that they use the Internet for information on CC.

Finding 25: Students do not use the Internet for information on climate change

4.7.5 Faculties and the role of Facebook in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through Facebook. Table 4.34, Table 4.35 and Figure 4.28 represent the analysis.

Table 4.34: Number of students per faculty and the role of Facebook in CC awareness

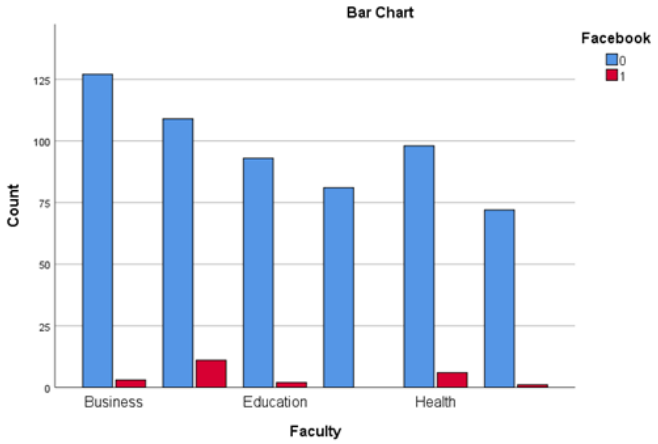
Count		Twitter		
		0	1	Total
Faculty	Business	127	3	130
	Design	109	11	120
	Education	93	2	95
	Engineering	81	0	81
	Health	98	6	104
	Science	72	1	73
Total		580	23	603

[0] Indicates the number of students per faculty not using Facebook for information on CC
[1] Indicates the number of students per faculty using Facebook for information on CC

Table 4.35: Chi-Square test on number of students per faculty and the role of Facebook in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.415[a]	5	.006
Likelihood Ratio	17.446	5	.004
N of Valid Cases	603		

[a] 6 cells (50.0%) have expected count less than 5. The minimum expected count is 2.78



[0] Indicates the number of students per faculty not using Facebook for information on CC
[1] Indicates the number of students per faculty using Facebook for information on CC

Figure 4.28: Number of students per faculty and the role of Facebook in CC awareness

χ^2 = .006, H_0 is rejected. Only 23 students use Facebook as a means of information on CC. Given that Facebook is such a popular medium, this result is rather surprising.

Finding 26: Students do not use Facebook for information on climate change

4.7.6 Faculties and the role of Twitter in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through Twitter. Table 4.36, Table 4.37 and Figure 4.29 represent the analysis.

Table 4.36: Number of students per faculty and the role of Twitter in CC awareness

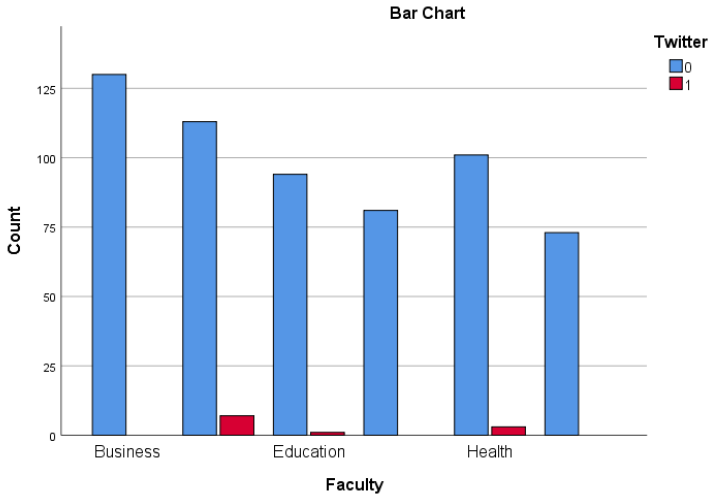
Count		Twitter		
		0	1	Total
Faculty	Business	130	0	130
	Design	113	7	120
	Education	94	1	95
	Engineering	81	0	81
	Health	101	3	104
	Science	73	0	73
Total		592	11	603

[0] Indicates the number of students per faculty not using Twitter for information on CC
[1] Indicates the number of students per faculty using Twitter for information on CC

Table 4.37: Chi-Square test on number of students per faculty and the role of Twitter in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.015[a]	5	.004
Likelihood Ratio	18.236	5	.003
N of Valid Cases	603		

[a] 6 cells (50.0%) have expected count less than 5. The minimum expected count is 1.33



[0] Indicates the number of students per faculty not using Twitter for information on CC
[1] Indicates the number of students per faculty using Twitter for information on CC

Figure 4.29: Number of students per faculty and the role of Twitter in CC awareness

χ^2 = .004, H_0 is rejected. Only 11 students confirmed that they became aware of CC through Twitter. This makes sense, since both Facebook and Twitter are chosen for their particular interest to students. Walter et al. (2019) suggested that the interest to discuss scientific issues on Twitter is still low.

Finding 27: Students do not use Twitter for information on climate change

4.7.7 Faculties and the role of government in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through government. Table 4.38, Table 4.39 and Figure 4.30 represent the analysis.

Table 4.38: Number of students per faculty and the role of government in CC awareness

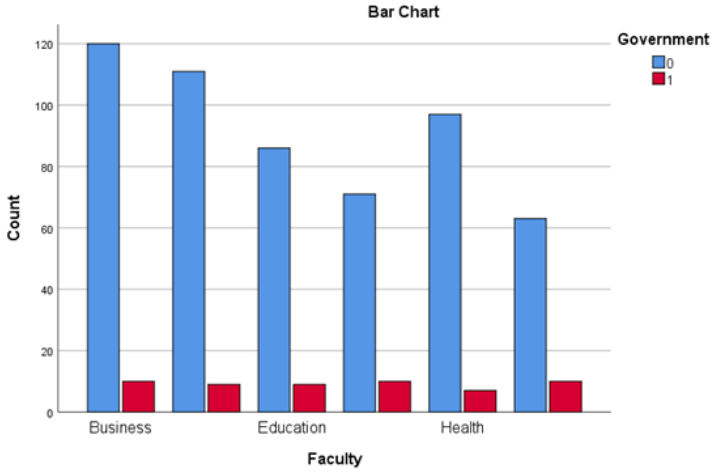
Count		Government		
		0	1	Total
Faculty	Business	120	10	130
	Design	111	9	120
	Education	86	9	95
	Engineering	71	10	81
	Health	97	7	104
	Science	63	10	73
Total		495	548	55

[0] Indicates the number of students per faculty not believing government creates CC awareness
[1] Indicates the number of students per faculty believing government creates CC awareness

Table 4.39: Chi-Square test on number of students per faculty and the role of government in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.293[a]	5	.508
Likelihood Ratio	4.082	5	.538
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 6.66



[0] Indicates the number of students per faculty not believing government creates CC awareness
[1] Indicates the number of students per faculty believing government creates CC awareness

Figure 4.30: The number of students per faculty and the role of government in CC awareness

χ^2 = .508, H_0 cannot be rejected. There is a relationship between the variables, but what exactly, is unclear. Only 55 students indicated that they believe government contributes towards CC awareness.

Finding 28: Students do not believe government creates climate change awareness

4.7.8 Faculties and the role of school and university in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through school and university. Table 4.40, Table 4.41 and Figure 4.31 represent the analysis.

Table 4.40: Number of students per faculty and the role of school and university in CC awareness

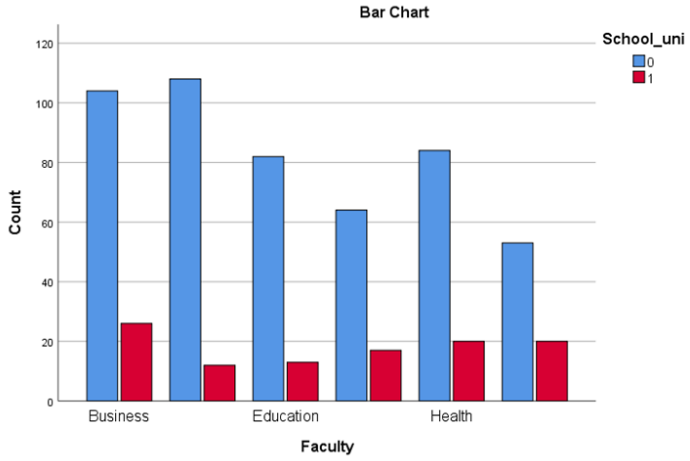
Count		School &_university		
		0	1	Total
Faculty	Business	104	26	130
	Design	108	12	120
	Education	82	13	95
	Engineering	64	17	81
	Health	84	20	104
	Science	53	20	73
Total		495	108	603

[0] Indicates the number of students per faculty not believing school and university create CC awareness
[1] Indicates the number of students per faculty believing school and university create CC awareness

Table 4.41: Chi-Square test on number of students per faculty and the role of school and university in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.761[a]	5	.038
Likelihood Ratio	12.101	5	.033
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 13.07



[0] indicates the number of students per faculty not believing schools and university create CC awareness
[1] indicates the number of students per faculty believing schools and university create CC awareness

Figure 4.31: Number of students per faculty and the role of school and university in CC awareness

χ^2 = .006, H^0 is rejected. Faculties informing students appear to be relatively uniform. There is no visible evidence that any faculty is significantly better or worse than others. Only 108 students (approximately 20%) answered 'Yes' to the question that schools and universities create CC awareness.

Finding 29: Students believe school and university create climate change awareness

4.7.9 Faculties and the role of family and friends in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through family and friends. Table 4.42, Table 4.43 and Figure 4.32 represent the analysis.

Table 4.42: Number of students per faculty and the role of family and friends in CC awareness

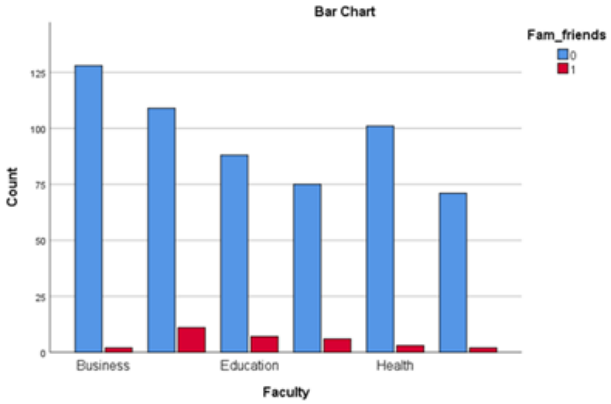
Count		Family and friends		
		0	1	Total
Faculty	Business	128	2	130
	Design	109	11	120
	Education	88	7	95
	Engineering	75	6	81
	Health	101	3	104
	Science	71	2	73
Total		572	31	603

[0] Indicates the number of students per faculty not believing family and friends create CC awareness
[1] Indicates the number of students per faculty believing family and friends create CC awareness

Table 4.43: Chi-Square test on number of students per faculty and the role of family and friends in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.216[a]	5	.047
Likelihood Ratio	11.913	5	.036
N of Valid Cases	603		

[a] 3 cells (25.0%) have an expected count less than 5. The minimum expected count is 3.75



[0] Indicates the number of students per faculty not believing family and friends create CC awareness
[1] indicates the number of students per faculty believing family and friends create CC awareness

Figure 4.32: Number of students per faculty and role of family and friends in CC awareness

χ^2 = .047, H_0 is rejected. Only 31 students said they believe friends and family do create an awareness of CC. Clearly CC is not a conversation point, which tends to support the 'Faculty vs. FB, Twitter, newspapers' etc. variables.

Finding 30: Family and friends do not create CC awareness

4.7.10 Faculties and the role of organisations in students' climate change awareness

The analysis approach was to determine if there is any difference in CC awareness between students of the various faculties through organisations. Table 4.44, Table 4.45 and Figure 4.33 represent the analysis. Note that by organisation is meant any business with influence. This was not clearly define in survey questionnaire and may have led to misinterpretation of the question.

Table 4.44: Number of students per faculty and the role of organisations in CC awareness

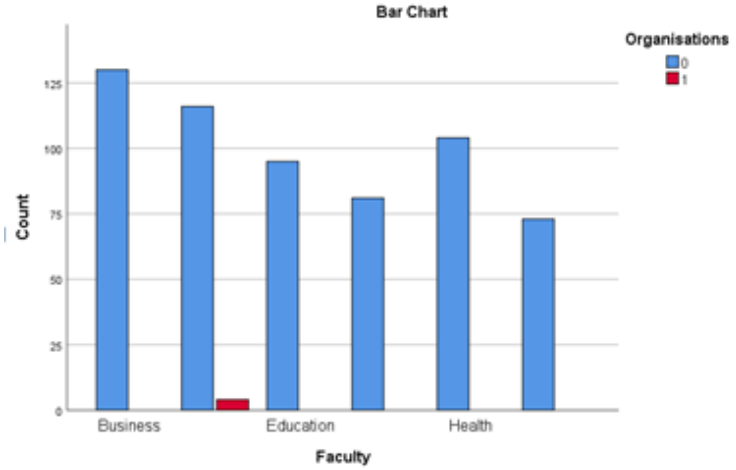
Count		Organisations		
		0	1	Total
Faculty	Business	130	0	130
	Design	116	4	120
	Education	95	0	95
	Engineering	81	0	81
	Health	104	0	104
	Science	73	0	73
Total		599	4	603

[0] Indicates the number of students per faculty not believing organisations create CC awareness
[1] Indicates the number of students per faculty believing organisations create CC awareness

Table 4.45: Chi-Square test on number of students per faculty and the role of organisations in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.208[a]	5	.006
Likelihood Ratio	13.024	5	.023
N of Valid Cases	603		

[a] 6 cells (50.0%) have an expected count less than 5. The minimum expected count is 48



[0] indicates the number of students per faculty not believing organisations create CC awareness
[1] indicates the number of students per faculty believing organisations create CC awareness

Figure 4.33: Number of students per faculty and the role of organisations in CC awareness

χ^2 = .006, H_0 is rejected. Only four students said they believe organisations assist in creating CC awareness.

Finding 31: Organisations do not assist in creating climate change awareness

4.8 Year of study of students and the climate change variables

In the following sections, the variables have been analysed from the perspective of the year (level) of students.

The variables are: i) TV; i) radio; iii) newspapers; iv) Internet; v) Facebook; vi) Twitter; vii) government; viii) school and university; ix) family and friends; and x) organisations. The following faculties were included in the study: i) Business; ii) Informatics and Design (Design); iii) Education; iv) Health and Wellness (Health); and Applied Science (Science).

4.8.1 Year of study and the role of TV in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through TV. Table 4.46, Table 4.47 and Figure 4.34 represent the analysis.

Table 4.46: Number of students per year of study and the role of TV in CC awareness

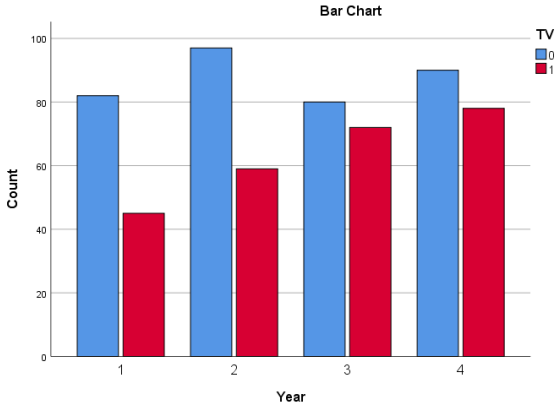
Count		TV		
		0	1	Total
Year	1	82	45	127
	2	97	59	156
	3	80	72	152
	4	90	78	168
Total		349	254	603

[0] Indicates the number of students per year of study not using TV for information on CC
[1] Indicates the number of students per year of study using TV for information on CC

Table 4.47: Chi-Square test on number of students per year of study and the role of TV in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.509[a]	3	.089
Likelihood Ratio	6.537	3	.088
Linear-by-Linear Association	5.333	1	.021
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 53.50



[0] Indicates the number of students per year of study not using TV for information on CC
[1] Indicates the number of students per year of study using TV for information on CC

Figure 4.34: Number of students per year of study and the role of TV in CC awareness

χ^2 = .089, H_0 cannot be rejected, but there is some relationship between the variables. There is an increase in CC awareness through TV as students are progressing, but whether this is because they are increasingly interested in CC or whether they simply watch more TV cannot be assessed.

Finding 32: TV does not play a role in creating CC awareness in students as their years of study progress

4.8.2 Year of study and the role of radio in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through radio. Table 4.48, Table 4.49 and Figure 4.35 represent the analysis.

Table 4.48: Number of students per year of study and the role of radio in CC awareness

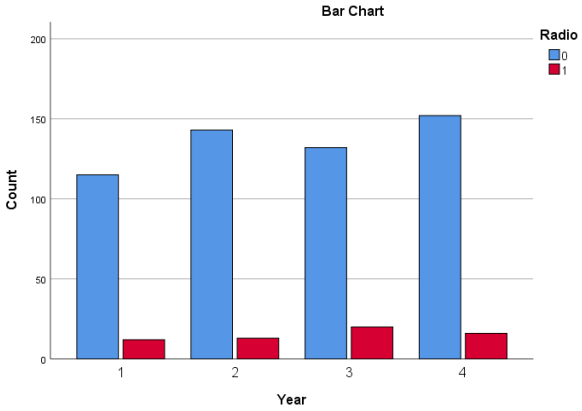
Count		Radio		
		0	1	Total
Year	1	115	12	127
	2	143	13	156
	3	132	20	152
	4	152	16	168
Total		542	61	603

[0] Indicates the number of students per year of study not using radio for information on CC
[1] Indicates the number of students per year of study using radio for information on CC

Table 4.49: Chi-Square test on number of students per year of study and the role of radio in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.219[a]	3	.528
Likelihood Ratio	2.133	3	.545
Linear-by-Linear Association	.181	1	.670
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 12.85



[0] Indicates the number of students per year of study not using radio for information on CC
[1] Indicates the number of students per year of study using radio for information on CC

Figure 4.35: Number of students per year of study and the role of radio in CC awareness

χ^2 = .435, H_0 cannot be rejected; there is some relationship between the variables although difficult to determine. Only 61 students responded that radio assists in creating students' CC awareness.

Finding 33: Radio does not play a role in creating CC awareness in students as their years of study progress

4.8.3 Year of study and the role of newspapers in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through newspapers. Table 4.50, Table 4.51 and Figure 4.36 represent the analysis.

Table 4.50: Number of students per year of study and the role of newspapers in CC awareness

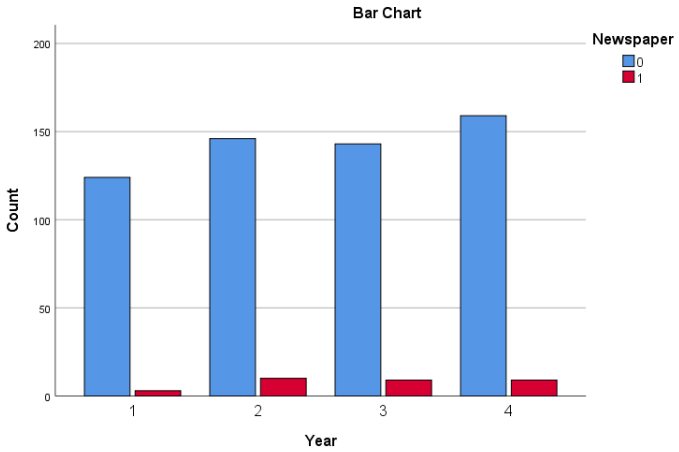
Count		Newspaper		
		0	1	Total
Year	1	124	3	127
	2	146	10	156
	3	143	9	152
	4	159	9	168
Total		572	31	603

[0] Indicates the number of students per year of study not using newspapers for information on CC
[1] Indicates the number of students per year of study using newspapers for information on CC

Table 4.51: Chi-Square test on number of students per year of study and the role of newspapers in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.732[a]	3	.435
Likelihood Ratio	3.171	3	.366
Linear-by-Linear Association	.825	1	.364
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 6.53



[0] Indicates the number of students per year of study not using newspapers for information on CC
[1] Indicates the number of students per year of study using newspapers for information on CC

Figure 4.36: Number of students per year of study and the role of newspapers in CC awareness

χ^2 = .225, H_0 cannot be rejected. Only 31 students responded that newspapers did make them more aware of CC in contrast to 572 that hold the opposite position.

Finding 34: Newspapers do not play a role in creating CC awareness in students as their years of study progress

4.8.4 Year of study and role of the Internet in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through the Internet. Table 4.52, Table 4.53 and Figure 4.37 represent the analysis.

Table 4.52: Number of students per year of study and the role of the Internet in CC awareness

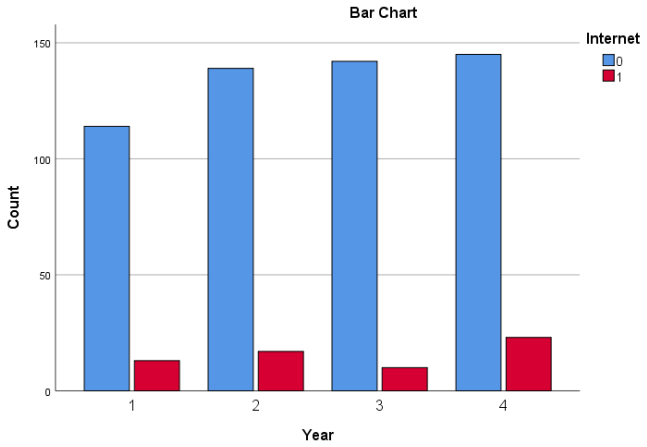
Count		Internet		
		0	1	Total
Year	1	114	13	127
	2	139	17	156
	3	142	10	152
	4	145	23	168
Total		540	63	603

[0] indicates the number of students per year of study not using the Internet for information on CC
[1] indicates the number of students per year of study using the Internet for information on CC

Table 4.53: Chi-Square test on number of students per year of study and the role of the Internet in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.360[a]	3	.225
Likelihood Ratio	4.539	3	.209
Linear-by-Linear Association	.405	1	.524
N of Valid Cases	603		

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.27



[0] Indicates the number of students per year of study not using the Internet for information on CC
[1] Indicates the number of students per year of study using the Internet for information on CC

Figure 4.37: Number of students per year of study and the role of the Internet in CC awareness

χ^2 = .078, H_0 cannot be rejected. In total, 63 students indicated that the internet contributed towards their awareness of CC.

Finding 35: The Internet does not play a role in creating CC awareness in students as their years of study progress

4.8.5 Year of study and the role of Facebook in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through Facebook. Table 4.54, Table 4.55 and Figure 4.38 represent the analysis.

Table 4.54 Number of students per year of study and the role of Facebook in CC awareness

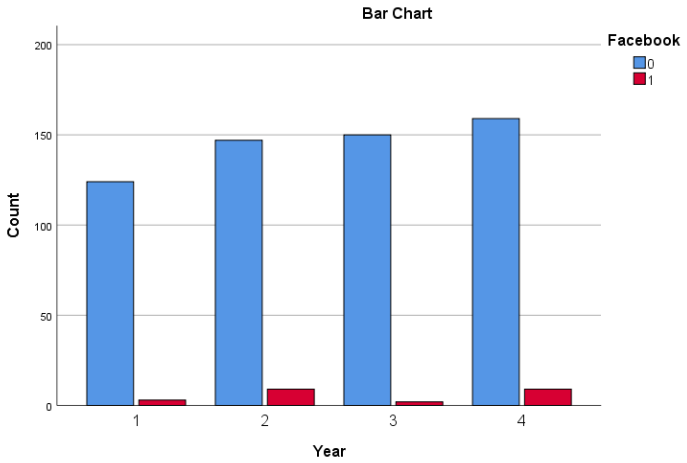
Count		Facebook		
		0	1	Total
Year	1	124	3	127
	2	147	9	156
	3	150	2	152
	4	159	9	168
Total		580	23	603

[0] Indicates the number of students per year of study not using Facebook for information on CC
[1] Indicates the number of students per year of study using Facebook for information on CC

Table 4.55: Chi-Square test on number of students per year of study and the role of Facebook in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.031[a]	3	.110
Likelihood Ratio	6.660	3	.084
Linear-by-Linear Association	.386	1	.534
N of Valid Cases	603		

[a] 1 cell (12.5%) have an expected count less than 5. The minimum expected count is 4.84



[0] Indicates the number of students per year of study not using Facebook for information on CC
[1] Indicates the number of students per year of study using Facebook for information on CC

Figure 4.38: Number of students per year of study and the role of Facebook in CC awareness

χ^2 = .078, H_0 cannot be rejected; there is some relationship between the variables. Only 23 students responded that Facebook increased their awareness of CC.

Finding 36: Facebook does not play a role in creating CC awareness in students as their years of study progress

4.8.6 Year of study and the role of Twitter in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through Twitter. Table 4.56, Table 4.57 and Figure 4.39 represent the analysis.

Table 4.56: Number of students per year of study and the role of Twitter in CC awareness

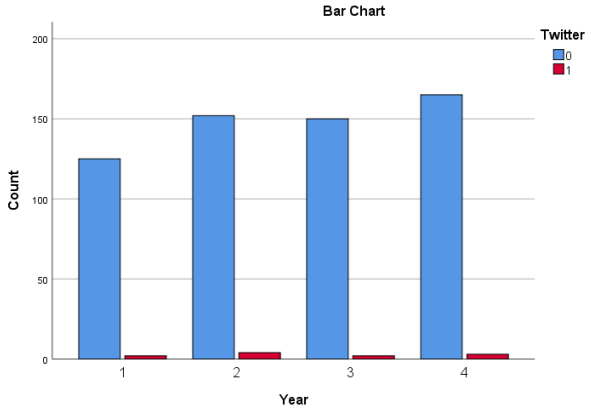
Count		Twitter		
		0	1	Total
Year	1	125	2	127
	2	152	4	156
	3	150	2	152
	4	165	3	168
Total		592	11	603

[0] Indicates the number of students per year of study not using Twitter for information on CC
[1] Indicates the number of students per year of study using Twitter for information on CC

Table 4.57: Chi-Square test on number of students per year of study and the role of Twitter in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.742[a]	3	.863
Likelihood Ratio	.714	3	.870
Linear-by-Linear Association	.026	1	.872
N of Valid Cases	603		

[a] 4 cells (50.0%) have an expected count less than 5. The minimum expected count is 2.32



[0] Indicates the number of students per year of study not using Twitter for information on CC
[1] Indicates the number of students per year of study using Twitter for information on CC

Figure 4.39: Number of students per year of study and the role of Twitter in CC awareness

χ^2 = .863, H_0 cannot be rejected. Eleven (11) of the 603 students indicated that Twitter played a role in their awareness of CC.

Finding 37: Twitter does not play a role in creating CC awareness in students as their years of study progress

4.8.7 Year of study and the role of government in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through government. Table 4.58, Table 4.59 and Figure 4.40 represent the analysis.

Table 4.58: Number of students per year of study and the role of government in CC awareness

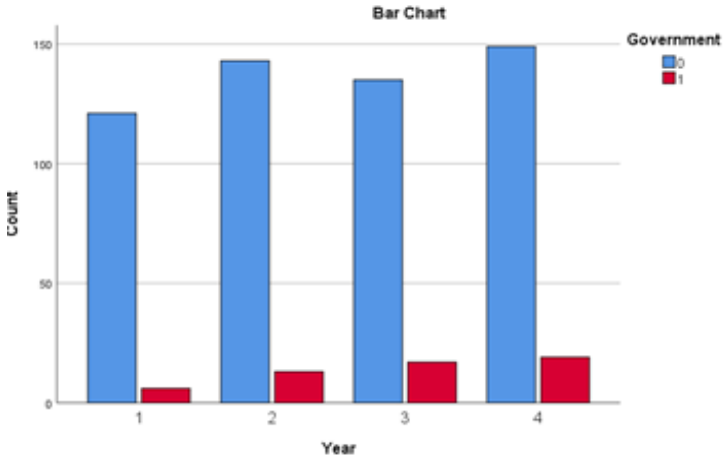
Count		Government		
		0	1	Total
Year	1	121	6	127
	2	143	13	156
	3	135	17	152
	4	149	19	168
Total		548	55	603

[0] Indicates the number of students per year of study not gaining CC awareness through government
[1] Indicates the number of students per year of study gaining CC awareness through government

Table 4.59: Chi-Square test on number of students per year of study and the role of government in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.830[a]	3	.185
Likelihood Ratio	5.300	3	.151
Linear-by-Linear Association	4.234	1	.040
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 11.58



[0] Indicates the number of students per year of study not gaining CC awareness through government
[1] Indicates the number of students per year of study gaining CC awareness through government

Figure 4.40: Number of students per year of study and the role of government in CC awareness

χ^2 = .185, H_0 cannot be rejected; there is some relationship between the variables. There seems to be an increase in the awareness of government's effort over time. Whether this is an interest in CC or just increasing maturity is impossible to tell. With only 55 students reporting 'Yes', it may be too little to truly identify a trend.

Finding 38: Government plays some role in increasing students' awareness of CC as their years of study progress

4.8.8 Year of study and the role of school and university in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through school and university. Table 4.60, Table 4.61 and Figure 4.41 represent the analysis.

Table 4.60: Number of students per year of study and the role of school and university in CC awareness

Count		School & university		
		0	1	Total
Year	1	97	30	127
	2	131	25	156
	3	129	23	152
	4	138	30	168
Total		495	108	603

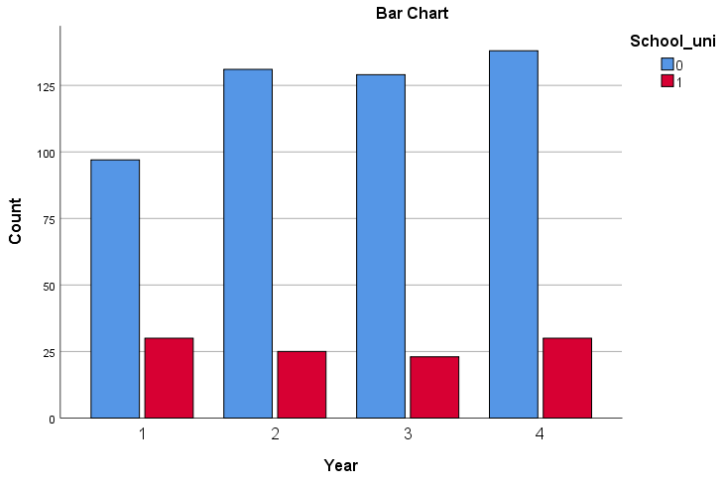
[0] Indicates the number of students per year of study not gaining CC awareness through school and university
[1] Indicates the number of students per year of study gaining CC awareness through school and university

Table 4.61 shows that χ^2 = .262; H_0 cannot be rejected, with some relationship between the variables. In total, 108 students indicated that school and university did play a role in their awareness of CC. However this is not statistically significant.

Table 4.61: Chi-Square test on number of students per year of study and the role of school and university in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.993[a]	3	.262
Likelihood Ratio	3.839	3	.279
Linear-by-Linear Association	1.256	1	.263
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 22.75



[0] Indicates the number of students per year of study not gaining CC awareness through school and university
[1] Indicates the number of students per year of study gaining CC awareness through school and university

Figure 4.41: Number of students per year of study and the role of school and university in CC awareness

Finding 39: School and university play a small role in increasing students' awareness of CC as their years of study progress

4.8.9 Year of study and the role of family and friends in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through family and friends. Table 4.62, Table 4.63 and Figure 4.42 represent the analysis.

Table 4.62: Number of students per year of study and the role of family and friends in CC awareness

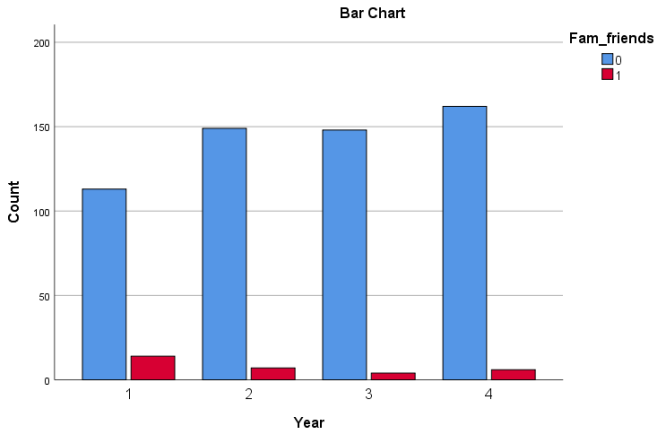
Count		Family and friends		
		0	1	Total
Year	1	113	14	127
	2	149	7	156
	3	148	4	152
	4	162	6	168
Total		572	31	603

[0] Indicates the number of students per year of study not gaining CC awareness through family and friends
[1] Indicates the number of students per year of study gaining CC awareness through family and friends

Table 4.63: Chi-Square test on number of students per year of study and the role of family and friends in CC awareness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.960[a]	3	.008
Likelihood Ratio	10.349	3	.016
Linear-by-Linear Association	7.638	1	.006
N of Valid Cases	603		

[a] 0 cells (0.0%) have an expected count less than 5. The minimum expected count is 6.53



[0] indicates the number of students per year of study not gaining CC awareness through family and friends
[1] indicates the number of students per year of study gaining CC awareness through family and friends

Figure 4.42: Number of students per year of study and the role of family and friends in CC awareness

$X^2 = .008$ H_0 cannot be rejected. Surprisingly, 1st years talk about CC more than other years, which seems contradictory to some of the other findings although the numbers are small – 31 students responded 'Yes'.

Finding 40: Students are not talking about CC

4.8.10 Year of study and role of organisations in students' climate change awareness

The analysis approach was to explore if there is any difference in students' year of study and CC awareness through organisations. Table 4.64, Table 4.65 and Figure 4.43 represent the analysis.

Table 4.64: Number of students per year of study and the role of organisations in CC awareness

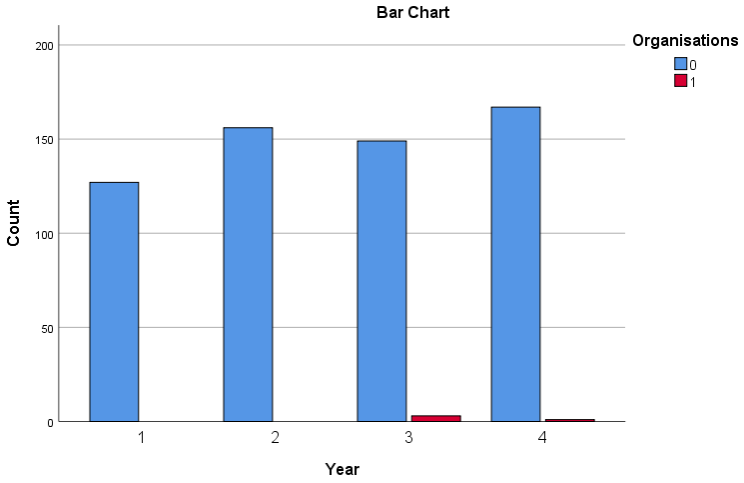
Count		Organisations		
		0	1	Total
Year	1	127	0	127
	2	156	0	156
	3	149	3	152
	4	167	1	168
Total		599	4	603

[0] indicates the number of students per year of study not gaining CC awareness through organisations
[1] indicates the number of students per year of study gaining CC awareness through organisations

Table 4.65: Chi-Square test on number of students per year of study and the role of organisations in CC awareness

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.862[a]	3	.119
Likelihood Ratio	6.364	3	.095
Linear-by-Linear Association	1.399	1	.237
N of Valid Cases	603		

[a] 4 cells (50.0%) have an expected count less than 5. The minimum expected count is .84



[0] indicates the number of students per year of study not gaining CC awareness through organisations
[1] indicates the number of students per year of study gaining CC awareness through organisations

Figure 4.43: Number of students per year of study and the role of organisations in CC awareness

χ^2 = .119, H_0 cannot be rejected, with some relationship between the variables. Only 3rd year and 4th year students seem to have gained an awareness from organisations, but overall, students did not.

Finding 41: Organisations do not necessarily play any role in increasing students' awareness of CC as their years of study progress

4.8.11 Findings on the hypotheses, faculties and year of study

In total, 27 findings are presented in Table 4.66.

Table 4.66: Findings summary

Hypotheses	Finding No.	Finding description
H_1: Students aware of climate change are more likely to study in some faculties rather than others	**14**	Business Faculty students are more aware of climate than students of other faculties
	15	There is a lack of climate change awareness in the other faculties
H_2: The number of students who believe in climate change is to increase as they progress through university	**16**	The year of study increases the level of students' climate change awareness

H_3: The level of acceptance of the existence of climate change are different in the faculties	**17**	Further research is needed as there are no clear findings on students' climate change awareness in different faculties
H_4: Students are not concerned about climate change	**18**	Students are concerned about climate change as they regard this as the world's biggest problem
H_5: Students are more concerned about certain climate change effects than others	**19**	H0 cannot be rejected; students are particularly concerned about temperature
H_6: Students feel that certain sectors of the public are more responsible for climate change than others	**20**	Individuals are perceived as the biggest contributors to climate change
Where have you heard about climate change?		
The faculty, year of study of students and climate change variables	**21**	Overall, students seem to prefer TV over other media interests
Faculties students' views of climate change variables		
	22	Students across faculties do not use TV for information on climate change
	23	Students do not use radio for information on climate change
	24	Students do not use newspapers for information on climate change
	25	Students do not use the Internet for information on climate change
	26	Students do not use Facebook for information on climate change
	27	Students do not use Twitter for information on climate change
	28	Students do not believe government creates climate change awareness
	29	Students believe school and university create climate change awareness
	30	Family and friends do not create CC awareness
	31	Organisations do not assist in creating climate change awareness
The year of study of students and climate change variables		
	32	TV does not play a role in creating CC awareness in students as their years of study progress
	33	Radio does not play a role in creating CC awareness in students as their years of study progress
	34	Newspapers do not play a role in creating CC awareness in students as their years of study progress
	35	The Internet do not play a role in creating CC awareness in students as their years of study progress
	36	Facebook does not play a role in creating CC awareness in students as their years of study progress
	37	Twitter does not play a role in creating CC awareness in students as their years of study progress
	38	Government plays some role in increasing students' awareness of CC as their years of study progress
	39	School and university play a small role in increasing students' awareness of CC as their years of study progress
	40	Students are not talking about CC
	41	Organisations do not necessarily play any role in increasing students' awareness of CC as their years of study progress

4.9 Exploratory factor analysis

Exploratory factor analysis has been done in an effort to determine if any correlation exists between the variables of the research. The factor analysis proved to be of little use. The problem can first be seen in the correlation matrix (Table 4.67). No variables meet the 'r >= 0.3' requirement, which is the generally accepted minimum measurement of related variables. The output of the factor analysis is attached as Appendix E.

Table 4.67: Correlation matrix for the variables

		Year	Big_ prob	Pers_ awareness	Pers_ background	Humans_ responsible	Lack_of_ Ed
Correlation	Year	1.000	-.040	.156	-.024	-.028	-.037
	Big_prob	-.040	1.000	.099	.152	.178	.082
	Pers_awareness	.156	.099	1.000	.104	.102	.116
	Pers_background	-.024	.152	.104	1.000	.133	.171
	Humans_responsible	-.028	.178	.102	.133	1.000	.196
	Lack_of_Ed	-.037	.082	.116	.171	.196	1.000

[a] Only cases for which CC exists = 1 are used in the analysis phase
[b] Determinant = .824

Bartlett's Test of Sphericity ($p < 0.01$) indicates that there may be some pattern(s) within the data (Table 4.66). The Eigen values from the PCA show that two components meet the commonly accepted requirement of 'eigenvalue > 1', although component three is very marginal (eigenvalue = 1.005). The Kaiser-Meyer Olkin (KMO) (Kaiser, 1974) measure of sampling adequacy meets the required cut off of .50 (KMO = 0.604).

For convenience, the rotated component matrix is reproduced in Table 4.68.

Table 4.68: Rotated component matrix

Rotated Component Matrix[a,b]	Component	
	1	2
Year	-.204	.811
Big_prob	.554	-.011
Pers_awareness	.292	.703
Pers_background	.581	.046
Humans_responsible	.630	.015
Lack_of_Ed	.592	.039

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalisation
[a] Rotation converged in 3 iterations
[b] Only cases for which CC exists = 1 are used in the analysis phase

The Alpha level of .01 (two-tailed), is used for a rotated factor loading to be considered statistically meaningful, a sample size of 300 to achieve a factor loading of .32 to give approximately 10% of the overlapping variance is needed (Tabachnick & Fidell, 2001). SPSS identified only two factors. In reverse order, the second factor comprises of only two

variables and is deemed unsuitable for reporting (Yong & Pearce, 2013). This leaves only one factor, namely: there is no statistically significant relationship between the variables. This lack of communality among the variables can be further highlighted through a Cronbach Alpha test. Cronbach Alpha attempts to measure the *internal consistence* of the data presented. The cut-off figure for Cronbach Alpha is generally considered to be 0.08. In Table 2.9, SPSS does not predict a sufficient increase in the Cronbach Alpha measurement to make a significant difference. Even if a row were eliminated, SPSS does not predict a sufficient increase in Cronbach's Alpha measurement to make a significant difference. Despite the fact that the alpha measurement showed that the H_0 is true, there is a probability that a Type 1 error may indicate that the alternative hypothesis is possibly true.

Table 4.69: Cronbach's Alpha measurements results

Item – Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Year	4.92	2.271	.027	.049	.400
CC_exists	6.59	3.499	.015	.011	.286
Big_prob	6.73	3.184	.162	.050	.231
Pers_awareness	6.38	2.199	.286	.086	.080
Role of LoS	7.00	3.125	.119	.079	.245
Pers_backgrou0d	6.82	3.108	.165	.076	.224
Lack_of_Ed	6.68	3.274	.133	.054	.246

This may be attributed to the inconsistency of the data, e.g. many multiple response questions being answered by a single answer, and in one, case only one response for one of the Likert answers was given. These are probably due to a less than optimal questionnaire design, and some administration issues on the side of the data collectors (for example, not explaining the meaning of questions to potential respondents).

Finding 42: There is no correlation between the variables analysed

4.10 Chapter summary and general conclusions

This chapter examined tertiary students' awareness of CC as case study of a selected University of Technology. Ain total, 603 questionnaires were collected and analysed using MS Excel and SPSS. The descriptive statistics, Chi-Square test and exploratory factor analysis were formulated. Different faculties and levels of studies were all represented fairly. Forty-two (42) research finding were identified. The results indicate that students, through their acknowledgement of the existence of CC, are aware of climate change. CC is identified as the world's biggest problem. The findings shows that many contributing factors to the causes of CC, including large countries, governments, large corporates, businesses and individuals are seen as being responsible for CC. Personal background, human behaviour

and level of education are influential in one's awareness of CC. Overall, results identify TV as the most utilised channel of communication for CC-related matters. An analysis of faculties and year of study was analysed using the following variables: i) TV; ii) radio; iii) newspapers; iv) Internet; v) Facebook; vi) Twitter; vii) government; viii) school and university; ix) family and friends; and x) organisations. The following faculties were included in the study: i) Business; ii) Informatics and Design (Design) ; iii) Education; iv) Health and Wellness (Health); and v) Applied Science (Science). Most of the variables did not seem to contribute anything towards the CC awareness of students, although government and school/universities seemed to play some role in the increase in awareness as the year level progresses. The factor analysis indicated no correlation between the variables analysed.

CHAPTER FIVE: DISCUSSION

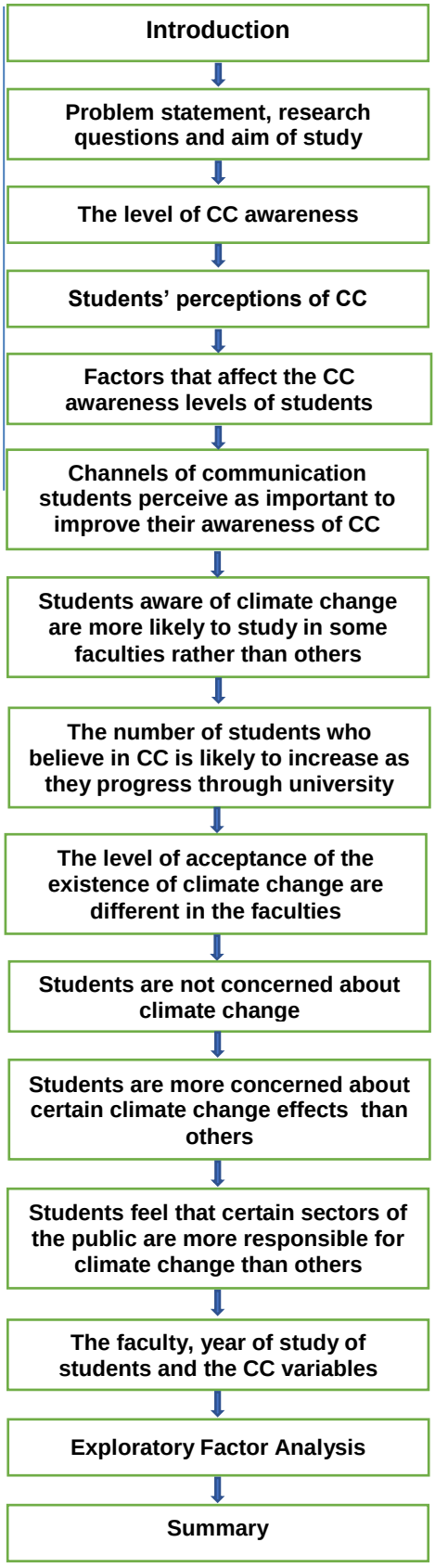


Figure 5.1: Chapter Five layout

5.1 Introduction

Chapter Three described the research method that was followed for the study to collect and analyse data on tertiary students' awareness of climate change (CC). Chapter Four reported on the results and findings of the research. Chapter Five interprets the answers to the research questions and hypotheses posed in Table 5.1.

Section A focuses on the research questions under the following headings: i) the level of climate change awareness; ii) students' perceptions of climate change; iii) factors that affect the climate change awareness levels of students; iv) channels of communication that students perceive as important to improve their awareness of climate change.

Section B discusses the hypotheses under the following headings: i) **H_1:** Students aware of climate change are more likely to study in some faculties rather than others; ii) **H_2:** The number of students who believe in climate change is to increase as they progress through university; iii) **H_3:** The level of acceptance of the existence of climate change are different in the faculties; iv) **H_4:** Students are not concerned about climate change; v) **H_5:** Students are more concerned about certain climate change effects than others; vi) **H_6:** Students feel that certain sectors of the public are more responsible for climate change than others; vii) The faculty, year of study of students and climate change variables; viii) chapter summary.

SECTION A: RESEARCH QUESTIONS

5.2 Problem statement, research questions and aim of the study

For the convenience of the reader, the problem statement, RQs and aim of the study as formulated in section 1.4 are again presented in Table 5.1.

Table 5.1: Research problem, research question, research sub-questions, methods, and objectives

Research problem	It is unclear whether students at tertiary institutions are aware of climate change.	
Primary Research Question (PRQ)	What is the level of climate change awareness of students at a selected University of Technology in South Africa?	
Sub-Research Questions (SRQs)	**Research method(s)**	**Objectives**
SRQ1: What are students' perceptions of climate change?	Survey	To determine the climate change perceptions of students
SRQ2: What are the differences in the climate change awareness levels of students?	Survey	To assess the different levels of climate change awareness of students
SRQ3: What are the factors affecting the climate change awareness levels of students?	Survey	To examine the factors that affect the climate change awareness levels of students
SRQ4: What channel of communication do students perceive as important to improve their awareness of climate change?	Survey	To identify and recommend a climate change awareness communication model to use for students.

5.3 The level of climate change awareness

The majority (92%) of students are to some level aware of CC. The results show that students do not fully realise the impact of CC on humans and the planet, which agrees with Salehi et al.'s (2016) findings that students have a moderate awareness of the CC phenomenon. Akrofi et al. (2019) reported that students have limited understanding of the impact of CC and how CC affects important issues such as conflict, gender inequality, and job insecurity. Zummo et al. (2020) and Ratinen (2021) found that students are not as aware of CC as one would expect them to be. A few students (7%) from this study stated that they are not aware of CC. This is a concern as students are generally perceived as an influencer group in the communities where they function. However, the finding that there is some lack of CC awareness in students in the context of the study is not a complete surprise as in Africa CC awareness is low – two-thirds of adults in South Africa and Nigeria never heard of CC (Lee et al., 2015). Many different reasons could be attributed to this, such as poverty, level of illiteracy and other socioeconomic challenges (Nyahunda & Tirivangasi, 2020). Everyone needs to be actively aware of CC, as it is no longer a looming threat but a harsh reality with grave predictions for the future (Hayes et al., 2018).

The World Health Organisation (WHO) estimates that between the years 2030 and 2050, the well-known impacts of CC will increase with 250,000 additional deaths per year (Watts et al., 2015). According to Parant et al. (2016), students' awareness and knowledge of CC is seen as a way to reinforce populations, people, and systems' resilience to CC. CC awareness is needed to motivate students to take action. Further research is needed on the reasons behind this phenomenon.

5.4 Students' perceptions of climate change

Based on the results of SRQ1 (Table 4.4), it can be concluded that students who are aware of CC, even if it is only to some extent, perceive CC as one of the world's biggest challenges. Rocklöv et al. (2021) agree with the study's findings that CC is a well-known 21st century global problem. There is scientific evidence of the CC phenomenon occurring and that it affects the lives of millions of people all over the world (Leal Filho et al., 2019). It is essential to comprehend the perception of students about the topic as it may assist with managing the effects of CC. Students' perceptions of CC are critical in promoting improved CC awareness and attitudes (Alves et al., 2018). Students also need to be active participants in creating CC awareness to deal with environmental crises and CC challenges.

There are different opinions in the research community about the major causes or contributors to CC (Hutchins et al., 2019). Since natural processes and human activity are interconnected, CC is one of the most divisive topics in environmental history (Khadka et al., 2020). There is still a lack of evidence of students' awareness about the causes of CC

(Ratinen, 2021). The views on the effects of CC are largely contested among researchers (Mach & Kraan, 2020).

Students are of the view that CC is the cause of rising temperatures, which supports Mason et al. (2021) finding that temperatures have been rising at an alarming pace around the world as result of CC. This is certainly the most mentioned cause of CC in research (Sodangi et al., 2011). As a result of the impact of CC across the globe, rising local temperatures and severe weather events continue to be at the forefront of climate debates (Howe et al., 2019). Temperature patterns confirm the effects of global warming/CC (Daneshvar et al., 2019). Not surprisingly, in the context of this study, students believe CC is responsible for droughts. SA is a drought-stricken country; the impact of CC on students' awareness is therefore high. South Africa has become a drought prone and water-scarce region (Bhaga et al., 2020). According to Ndlovu and Demlie (2020), in recent years, South Africa experienced a series of droughts that limited the supply of water sources in reservoirs and affected several sectors of the economy. Nordstrom and Cotton (2020) and Smith and Fitchett (2020) report that as a result of CC, some regions in Southern Africa have undergone a prolonged drought period that started around 2015.

5.5 Factors that affect the climate change awareness levels of students

Students opine that an individual's background contributes to the awareness of CC, and that this plays are role in CC awareness. Personal experiences are regarded as the best predictors of CC risk perception (refer to section 2.10). CC has now become a way of life, requiring people to change their lifestyle, the way they think, and the way they live. The way we are raised will in future haunt us as CC is no longer merely speechmaking; all people should adopt a new way of life. The research findings presented in Table 4.9 suggest that 70% of students believe personal background has an influence on the way CC is understood. Individual culture and history shape local and regional reactions to climate change. Personal background and family influence one's conscience on climate change (refer to section 2.12). Nguyen et al. (2016) report that variations in students' CC awareness are influenced by personal background, socio-cultural and institutional contexts, as well as their views on the perceived impact of CC and their understanding of the factors that play an important role in the CC awareness, as CC is attributed to human actions. Table 4.10 presents the findings of the statement, "the lack of CC education as major contributor to students' CC awareness". Students are of the view that the lack of CC education contributes to low CC awareness. In total, 47% of the students strongly agree that the lack of CC education is a main contributor to students' CC awareness, while 37% somewhat agree. Even though there are no convincing outcomes on the role of schools in terms of CC education, Bello (2017) suggests that school are among the top sources of CC information for students. Students themselves

are making the most convincing demands for CC education, as they predict the uncertainties of future practice in a rapidly changing environment (Goshua et al., 2020).

Students' responses to the statement, "human behaviour is responsible for CC" seem to suggest that human behaviour contributes to the challenges of CC. Table 4.11 shows that 55% of students who participated in the study strongly agree that human behaviour is responsible for these changes in climate, while 32% somewhat agree. The findings show agreement among students that all humans must take personal responsibility of what is happening with the climate as their behaviours are suggested to be a liability. The finding resonates well with the anthropogenic cause of CC as confirmed by scientific evidence that human behaviour is at the heart of CC (Sorvali, et al., 2021). Future behavioural approaches are advised, with special regard for CC (i.e., between and within nations, at intergenerational level, and between men and women) (Chevance et al., 2021). It is suggested that since the mid-19th century, human activities have largely increased greenhouse gases such as methane, carbon dioxide, and nitrous oxide, which resulted in CC (refer to section 2.12). Gardner (2021) proposes a harsh government response before the world reaches a tipping point. This research proposes a CC educational initiative at all levels of education.

There are many other factors that contribute to the causes of CC. According to the research findings, an overall number of 52% of students suggest that large countries, government, large corporations, all businesses and individuals are major contributors to causing CC. However, the results do not really seem to be beneficial as the students chose all players as contributing factors to the challenge of CC. It is suggested that the question should had been posed differently to deliver with more specific outcomes (Table 4.5). The research narrative on the responsibility of CC seems to differ, but large countries such as China, the USA and India are among the countries regarded as major contributors to the challenge of CC (Murali et al., 2021). Some groups argue that large and industrialised countries must take full responsibility as they have a history of contributing to the highest proportion of emissions leading to CC (refer to section 2.11). The impact of the mentioned CC contributors was proven during the COVID-19 pandemic when more than 140 countries forced lockdown regulations, restricting the movement of the people and many socio-economic activities, especial in large cities, which resulted to a significant reduction in industrial activity and vehicle usage, causing a significant reduction of air pollutant emissions (Liu et al., 2021).

5.6 Channels of communication students perceive as important to improve their awareness of climate change

Three major findings on the sources of CC information emerged (Table 4.12; Table 4.13). The first finding states that most students became aware of CC by watching television (TV), which, in their opinion, is a preferred and good source for conveying the message of CC

awareness. This supports Chukwuji et al. (2019) finding that television is a major source of CC information. A number of studies have shown that young people's views of CC are predominantly constrained, inaccurate, and highly influenced by mass media (refer to section 2.15).

The second finding is on social media, which includes the Internet. Surprisingly, social media seems to be less of a CC information platform for the students. This is contrary to the popular view that social media and internet have added more voice to the subject of CC. In the fight for public opinion on CC, Facebook, Twitter, other social-media sites, and Internet blogs are influential voices (Harvey et al., 2017). The reason for this finding might be that students do not really use social media or the Internet for educational-related topics, but more for social interaction. Contrary to the findings, students obtain knowledge on CC from different sources, including media such as television, radio, and newspapers (refer to section 2.17). This research supports Abbas et al. (2019) research conducted in Pakistan, which found that Internet and social media usage do not contribute towards students' awareness of CC.

Finding 3 indicates that school and universities are not perceived as a source that creates awareness among students. This research was conducted 20 years after Arocena and Sutz (2001) reported that universities were not on the forefront of the CC debate. At this point in time, the outcome is still the same. According to a new global study on CC at universities (involving 1,250 students from 166 universities), 43% of the students believe CC is not adequately addressed in their programmes (Preston-Jones, 2020). CC should be taught to students in school, along with its causes and consequences (Namboodhiri & Raghavendra, 2021). Including new courses on the climate and CC to disconnected fields is absolutely critical (Ahmadi et al., 2020). Educators need to incorporate the CC topic into their curricula (Li et al., 2019).

SECTION B: HYPOTHESES

In this section, the six hypotheses as presented in section 3.6.2 are discussed.

5.7 H_1: Students aware of climate change are more likely to study in some faculties rather than others

After the Chi-Square goodness-of-fit test was done where two variables (faculties & CC existence) were compared (Table 4.15), it was found that students in the Business Faculty are more aware of CC than students in other faculties. This is surprising, as Business faculties are usually teaching CC or environment related matters the least, while Science students are usually more informed. This is contrary to the findings of Blackmore et al. (2018), who argue that students in Business and Management are taught the least about

CC-related problems, while students in General Sciences and Environmental Science are more exposed to information on CC.

The second finding from Hypothesis 1 shows a lack of CC awareness in other faculties. These results are more surprising, especially since the debate on CC and the importance of higher education have been in the spotlight. Students in all faculties should be educated on CC as they are the next generation that will be responsible for policies and decision-making concerning CC for the planet. Marcus et al. (2015) opines that teaching CC-related education in all curricula will significantly influence sustainable CC policy and decision making. Student courses with embedded climate-related activities may provide the opportunity to potential decision makers to improve climate science awareness and risk perceptions (refer to section 2.10).

5.8 H_2: The number of students who believe in climate change is to increase as they progress through university

The finding that the year of study increases students' level of CC awareness is not surprising, as it is expected that the more a student progresses, the more the student becomes knowledgeable on CC. It is not clear which levels of study include CC in the curriculum. According to Ajuang et al. (2016), one's level of education has a huge impact on CC awareness. Educational levels are positively influencing CC practices and awareness (Falaye et al., 2016). Since the aim of the study did not include exploring the curricula of the faculties, further research within the context of this study is needed.

5.9 H_3: The level of acceptance of the existence of climate change are different in the faculties

The comparison of the variables 'faculty', 'year of study' and 'CC existence' delivered results that are difficult to reconcile. It is worth noting that none of the Science Faculty's first-year students are aware of CC. In year two, CC awareness shifts dramatically, but then remains unchanged in years three and four. It is uncertain whether this is due to the inclusion or exclusion of CC education in the curriculum. Further research is needed as there are no clear findings.

5.10 H_4: Students are not concerned about climate change

CC of the general public has become a political matter. Some citizens regard CC as a myth, while other are politicising it as non-existent. CC is polarising politics throughout, where right-wing political parties and agendas have been linked to a lack of concern about CC. As a result, right-wing populism in various regions and nations, such as the United States, Australia, and Europe, appears to be anti-climate policy (McCright et al., 2015). However, regardless of this political polarisation, the findings of this research show that students are

concerned about CC as they regard it as the world's biggest problem. This is evident by the renewed activism of students, as, since 2018, millions of students in the world took the struggle of CC to the streets, protesting against governments and requiring them to take action (Von Storch et al., 2021). This generation of students has made their voices heard, clearly raising their concerns about CC challenges that will ultimately affect their future (Wallis & Loy, 2021). Today's younger students' future lifestyles and pro-environmental behaviour will be a critical factor in reducing the severity of predicted CC (Lehnert et al., 2019). For students and youth to comprehend CC and its expected consequences, they need to be educated on CC (refer to section 2.14).

5.11 H_5: Students are more concerned about certain climate change effects than others

The findings show that students are particularly concerned about the increase in temperature as an effect of CC. Student thinking on the CC system is significantly linear, i.e., human activity triggers global rising temperatures, which eventually has an effect on humans themselves (Handayani & Putra, 2019). The average global temperature is slowly rising and is expected to increase by $2^{o}C$ by the year 2100, resulting in a major climate crisis (Malhi et al., 2021).

5.12 H_6: Students feel that certain sectors of the public are more responsible for climate change than others

Even though sectors such as large corporates, large countries and businesses in general were stated as options to choose from, the research findings show that Individuals are perceived as the biggest contributors to CC. In terms of causes and effects, COVID-19 and CC have much in common, particularly in terms of individual actions (Botzen et al., 2020).

5.13 The faculty, year of study of students and climate change variables

After the Chi-Square testing of the variables 'faculty', 'CC awareness' and 'year of study', it was found that various variables were not contributing to the awareness of CC. Research shows that radio is not seen as a medium to create CC awareness among students. Newspapers also do not contribute to students' awareness of CC. Surprisingly the Internet is not used as a medium to gain awareness of CC. Taking into account the high usage of Facebook by students, it was expected that Facebook as medium would contribute to a large extent to the awareness of CC; however, this was not the case. Furthermore, social media, including Twitter, also does not seem to contribute towards the CC awareness of students. Organisations do not necessarily play any role in CC awareness. However, government plays some role in increasing CC awareness as the year level increases. Schools and universities play a small role in creating CC awareness w among students, but it seems that students generally do not talk about CC.

5.14 Exploratory factor analysis

Factor analysis was performed on the data in an attempt to gain a deeper understanding of the fundamental design of a progression of factors (Conway & Huffcut, 2003). No correlation between the variables was found. This lack of a substantial relationship between the variables is a significant result in itself (Worthington & Whittaker, 2006). The lack may be attributed to data inconsistency, for example, several multiple response questions were answered with a single answer and in one case, only one of the Likert scale questions was answered. The Eigen values from the Principal Component Analysis PCA show that two components meet the commonly accepted requirement of the "eigenvalue>1", although component three is marginal (eigenvalue=1.005). The Kaiser-Meyer Olkin Measure (KMO) of sampling adequacy meets the required cut-off of .50 (KMO=0.604) (Table 4.67).

5.15 Chapter summary

The current study's findings were further explored in this chapter. It was found that students are aware of the existence of CC, perceiving it as the world's biggest problem. Students view large countries, government, businesses, and individuals as responsible for the causes of CC and they perceive temperature as a major effect of CC. Students measured their awareness of CC as moderate to high. Human behaviour and personal backgrounds are regarded as contributing factors to CC. The majority of students learned of CC by watching television, and they regard TV as a good medium for spreading CC awareness. It was found that the Business Faculty's students are more aware of CC. The level of education increases the level of CC awareness.

The research findings suggest that students' awareness of CC seems to increase as the student progress to higher levels of study. Students across the globe seem to engage in mass actions to protest against CC, and the research results in this study seem to correlate as students seem to be concerned about CC and its impact. Even though there many effects of CC, such as drought, sea-levels rising and floods, students highlighted rising temperatures as the most noticeable effect. Environmental studies suggest many factors contributing to CC science; however, the outcomes of this research suggest that individuals are most responsible for CC.

Following Chi-Square testing of the variables 'faculty', 'CC awareness' and 'year of study', it was found that various variables do not contribute to CC awareness. Furthermore, radio, newspapers, the Internet, Facebook, and Twitter do not necessarily play a role in CC awareness. As students' progress with their studies, they seem to suggest that government plays a part in raising awareness, while schools and universities play a minor role. Students in general do not discuss CC-related issues. The findings of the factor analysis show no correlation between the variables analysed.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

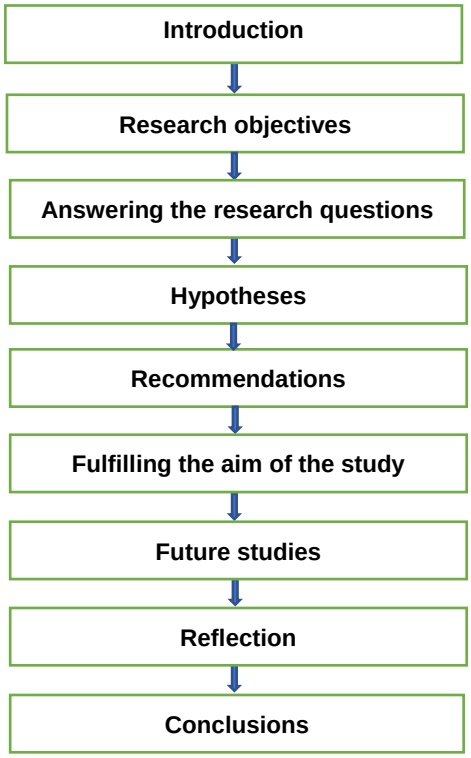


Figure 6.1: Chapter Six layout

6.1 Introduction

The current study's conclusion and recommendations are summarised in this chapter. The research objectives, research questions, and hypotheses are outlines and the key findings are re-stated. Recommendations are made to raise students' awareness of CC. The chapter concludes with a final reflection by the researcher.

6.2 Research objectives

6.2.1 Objective 1

The first objective of this study was to assess the CC awareness of students at a University of Technology in South Africa. The questionnaire was developed to gather responses from the students. Chapter Four (section 4.3.1.1) of the study addressed the findings of this particular objective, which demonstrate that the majority of students are aware of CC.

6.2.2 Objective 2

The second objective of this research was to assess the different levels of students' CC awareness. The study used questionnaires as tool to gather the students' responses. Chapter Four (section 4.3.1.2) shows the results of this objective. The students tend to have an average understanding of climate change. Students are also uncertain whether the level of study plays a significant role in creating CC awareness.

6.2.3 Objective 3

The third objective was to examine the type of factors that affect the CC awareness level of students. Questionnaires were used to collect this information from the respondents. Chapter Four (section 4.3.1.3) demonstrates that this research objective has been met. The findings suggest that students are of the opinion that an individual's background contributes to the awareness of CC. Students are of the view that the lack of CC education contributes to a low awareness of CC (Table 4.10). Figure 4.11 of the research shows that human behaviour contributes to CC awareness.

6.2.4 Objective 4

The final of objective of the study was to identify and recommend a climate change awareness communication model to use for students CC awareness. The questionnaire was developed to gather the responses from the students. Chapter Four (section 4.3.1.4) presents the findings of this objective. Most of the respondents became aware of CC through TV as communication medium. Table 4.13 shows that TV is preferred as the medium for creating and communication CC awareness.

6.3 Answering the research questions

6.3.1 SRQ1: What are students' perceptions of climate change?

Figure 4.4 shows that the majority of students are aware of CC and perceive this as the world's biggest challenge. Students also opine that large countries, governments, large corporates, businesses and individuals are responsible for CC. The rise in temperature of the planet is a major challenge created by CC.

6.3.2 SRQ2: What are the differences in the climate change awareness levels of students?

Figure 4.8 suggest that the students tend to have an average understanding of climate change. Meanwhile figure 4.9 shows that students are uncertain if the level of study plays a significant role in creating CC awareness.

6.3.3 SRQ3: What are the factors affecting the climate change awareness levels of students?

Figure 4.10 of the study suggests that an individual's background contributes towards the awareness of CC. Students are also of the view that the lack of CC education contributes to low CC awareness. Human behaviour contributes to CC.

6.3.4 SRQ4: What channel of communication do students perceive as important to improve their awareness of climate change?

Table 4.12 shows that most students became aware of CC through television. Social media including the internet seems to be less of a CC information platform for the students. Schools and universities are not perceived as creating awareness among students. TV is the preferred medium for creating and communicating CC awareness.

6.4 Hypotheses

6.4.1 H1: Students aware of climate change are more likely to study in some faculties rather than others

Table 4.15 of the study shows the results of this hypothesis. The results show that students in the Business Faculty are more aware of CC than students in other faculties. It also shows that there is some lack of CC awareness in the other faculties.

6.4.2 H2: The number of students who believe in climate change is to increase as they progress through university

The results of this hypothesis are shown in Table 4.16. The findings show that the year of study increases the level of CC awareness of students.

6.4.3 H_3: The level of acceptance of the existence of climate change are different in the faculties

Table 4.17 presents the outcome of this hypothesis. Further research is needed as there are no clear findings. It is worth noting that none of the Science Faculty's first-year students are aware of CC. In year two, this awareness shifts dramatically, but in years three and four, it remains unchanged.

6.4.4 H4: Students are not concerned about climate change

Table 4.18 of the research demonstrate the results of this hypothesis. It shows that students are concerned about CC as they regard this as the world's biggest problem.

6.4.5 H_5: Students are more concerned about certain climate change effects than others

Table 4.19 shows that students are particularly concerned about temperatures.

6.4.6 H6: Students feel that certain sectors of the public are more responsible for climate change than others

Individuals are perceived as the biggest contributors to CC, as shown in table 4.20 of the research.

6.5 Recommendations

Although there is awareness of CC among the students, the following recommendations are made to further the awareness of CC in students:

i) A coordinated national strategy is needed in all tertiary institutions. The current curriculum should be reviewed to include CC.
ii) Universities should appoint environmental officers to seat in all their curriculum decision making forums.
iii) An introduction of weekly CC awareness campaigns is necessary.
iv) Universities should introduce special modules dealing with CC at all levels, or integrate CC into existing modules.
v) Workshops and seminars must be done.
vi) A CC university ombudsman is required.
vii) Nationwide university CC clubs and competitions should be introduced.
viii) The Student Representative Council should introduce a CC portfolio.
ix) The university should encourage the use of environmentally friendly technology and a paperless academic environment.
x) An urgent appointment of national and provincial CC Environmental Commissioners is needed, and they must be made Chapter 9 institutions and given powers equal to judges, public protector, etc.
xi) Nations should introduce CC courts.
xii) Countries should include CC education in all schools.
xiii) Governments should introduce climate annual base tax for all major contributing companies.
xiv) Government should compile national CC manuals with solutions to reduce CC.
xv) CC education must be instilled at an early age of schooling.
xvi) Parents should be encouraged to promote CC-related education in their homes.
xvii) Companies should create educational children's toys that focus on climate issues.
xviii) Introduction of national CC education in all schools.
xix) All persons must learn to change their lifestyles.
xx) The United Nations should have national offices that advocate a world climate-friendly society in every nation.
xxi) There needs to be universal policies to combat the threats of this gigantic world challenge.

6.6 Fulfilling the aim of the study

The aim of this research was to explore the level of CC awareness of tertiary students. The study showed that students are aware of CC. The awareness of students was recognised by answering the primary research question, "What is the level of climate change awareness of

students at a selected University of Technology in South Africa?" The research findings show that students are awareness of climate change (section 4.3.1.1).

6.7 Future studies

This study focused only on students of one University of Technology. Future research is needed to assess the CC level of awareness of students at other universities in South Africa. There is also a need for research on the relationship between CC and the curricula offered by universities. Further research could also be done with TVET college students as participants to expand the scope to all tertiary institutions.

6.8 Reflection

The study used questionnaires to collect data. The research results are a true reflection of all 603 participants. Challenges were experienced with some questions, especially questions with multiple answers. Some of the questions seemed to be confusing and created challenges during the analysis phase. This was a learning experience for the researcher and it became clear that quality pilot studies are of the utmost importance. However, it is the researcher's view that the study was effective in answering the research questions, as evident by the findings presented in Chapter Four. The supervisor's guidance and leadership clearly shaped this research.

6.9 Conclusion

The study was conducted at one the Universities of Technology in the Western Cape, South Africa. The majority of this university's students are aware of climate change, according to the results of the study. Notwithstanding the restriction of conducting the study at only one university, which is not representative of all South African universities, it provided sufficient exposure to CC knowledge among the university's students. CC awareness can play an important role in shaping students' pro-environmental attitudes and empowering them to fight the negative effects of CC in the country and throughout the globe.

In Chapter One, a general introduction of the research was provided, the problem statement was discussed, and research objectives and questions were outlined. Chapter Two dealt with the theoretical perspective of the topic from different authors. Chapter Three outlined the methods used to generate the research findings. Chapter Four presented the results and findings of the study. Chapter Five discussed the research findings, and Chapter Six concluded with provide recommendations to assist with managing the CC problem. Although the study found that students are aware of climate change, much more needs to be done to empower students to become advocates of climate change in the future.

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APPENDIX A: CONSENT FORM

Cape Peninsula
University of Technology

Office of the Assistant Dean
Research & Innovation Unit
Faculty of Business and Management Sciences
Room 4.32, 4th Floor
Commerce Building
Cape Town 8000

Tel.: +27 (0)21 460 8339
E-mail: iwuc@cput.ac.za

To Chairperson, FoBMS Ethics Committee

I Prof Chux Gervase Iwu, in my capacity as Acting Assistant Dean, Research & Innovation at the Faculty of Business and Management Sciences, give consent in principle to allow Vuyolwethu Dyani (207174113) a student at the Cape Peninsula University of Technology, to collect data in this company as part of his/her M Tech (Business Administration) research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No				

Prof Chux Gervase Iwu

13/03/19

APPENDIX B: ETHICS CERTIFICATE

Cape Peninsula University of Technology

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 4603291 • Email: fbmsethics@cput.ac.za
Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	Faculty: BUSINESS AND MANAGEMENT SCIENCES

At a meeting of the Faculty's Research Ethics Committee on **30 April 2019**, Ethics **Approval** was granted to **Vuyolwethu Dyani (207174113)** for research activities of **M Tech: Business Administration** at Cape Peninsula University of Technology.

Title of dissertation/thesis/project:	TERTIARY STUDENT'S AWARENESS OF CLIMATE CHANGE: A CASE STUDY OF A SELECTED UNIVERSITY OF TECHNOLOGY Lead Researcher/Supervisor: Dr A de la Harpe

Comments:

Decision: Approved

	**4 May 2019**
Signed: Chairperson: Research Ethics Committee	**Date**

APPENDIX C: QUESTIONNAIRE

SEMI-STRUCTURED-QUESTIONNAIRES

Interview schedule

Introductory remarks: Climate Change has become one of the most debated environmental issues both locally and internationally. This study will be looking at the Tertiary Students' awareness of Climate Change: a case study of a selected University of Technology.

Aim: The aim of the research is to explore the level of awareness of tertiary students on climate change.

We are kindly requesting answers to the questions listed below in your good faith. Your answers will be used specifically for this study purposes only and they will be treated with the highest degree of confidentiality and privacy. Also participation in this interview is voluntary and allows anonymity as well as autonomy.

Section A: Participant's details

Faculty (tick one below**)**

Business and Management Sciences	Applied Sciences	Informatics and Design	Education	Engineering and the Built Environment:	Health and Wellness Sciences

Year of study (tick one below)

1st year	2nd year	3rd year	4th year

Section B: Questions

Primary Research Question (PRQ): What is the level of climate change awareness of students at a selected University of Technology in South Africa?
Sub-Research Question 1: What are students' perceptions of climate change? **(please tick one or more below)**
IQ 1.1.1: Do you think climate change exists? Yes **( )** No **( )**

IQ 1.1.2: Do you think climate change is a world biggest problem?

Yes ( ) No ( )

IQ 1.1.3: What do you think is the cause of climate change?

□ Large countries

□ Government

□ Large corporations

□ Businesses in general

□ Individuals

□ All of the above

IQ 1.1.4: Which of the following do you perceive happen as a result of climate change? Tick all that apply.

□ Drought

□ Flooding

□ Rising temperatures

□ Sea-level rise

□ Coastal erosion

□ Desertification

□ Other……..

Sub-Research Question 2: What are the differences in the climate change awareness levels of students? **(please tick one below)**

IQ 1.2.1: On a scale of 1 to 5, how would you rate your level of awareness of climate change?

□ 1 out of 5 =Poor

□ 2 out of 5= little aware

□ 3 out of 5= I have an idea

□ 4 out of 5= Aware

□ 5 out of 5= Very aware

IQ 1.2.2: Does your level of study play any role in how you understand climate change?

Yes ( ) No ( )

Sub-Research Question 3: What are the factors affecting the climate change awareness levels of students? **(please tick one below)**

IQ 1.3.1: Do you think your personal background has an influence on the way you understand climate change?

□ Yes

□ No

IQ 1.3.2: Lack of CC education is a major contributor to students' awareness of climate change.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
4	**3**	**2**	**1**

IQ 1.3.3: Human behaviour is responsible for climate change.			
Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
4	**3**	**2**	**1**

Sub-Research Question 4: What channel of communication do students perceive as important to improve their awareness of climate change?

(please tick one or more below)

IQ 1.4.1: Where have you heard about climate change?

□ TV	□ Government
□ Radio	□ School/university
□ Newspaper	□ Family/friends
□ Internet	□ Organisations
□ Never heard of it	□ Other
□ Facebook	
□ Twitter	

IQ 1.4.2: Which communication model would you prefer to communicate issues of climate change?

□ TV	□ SMS
□ Radio	□ Emails
□ Newspaper	□ Classroom
□ Posters	□ Seminars
□ Other	
□ Facebook	
□ Twitter	

Thank you for your time and patience in answering the questions. Your contribution is highly appreciated.

…….. **……**

Date **Signature**

APPENDIX D: SPREADSHEET

THESIS
SPREADSHEET(1) (2)

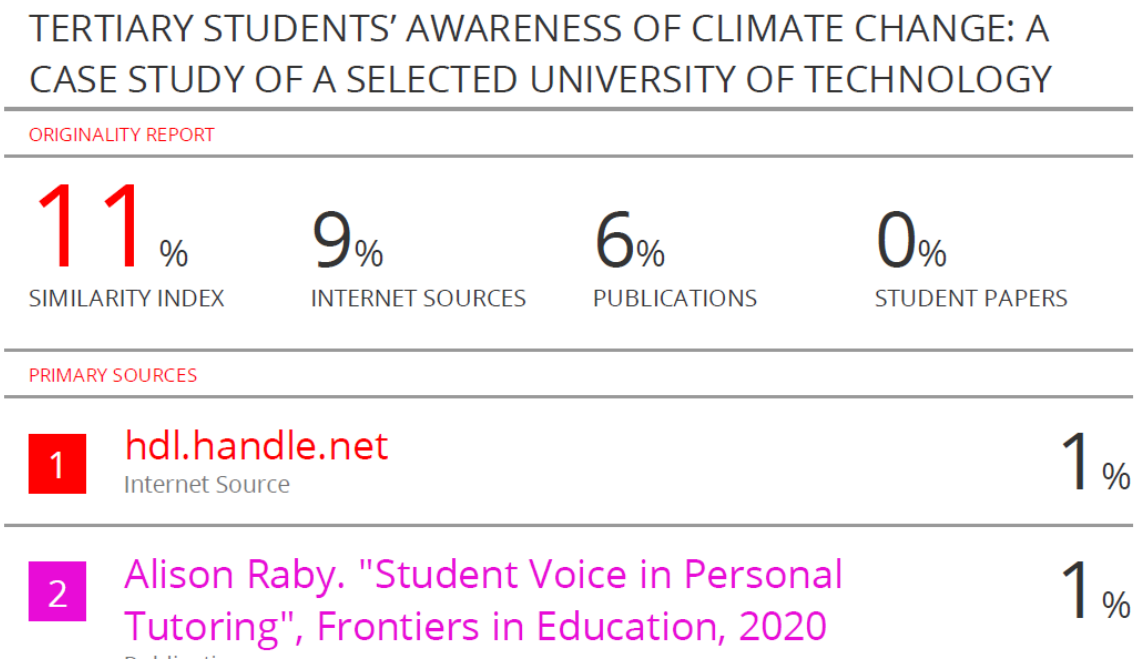
(Double click)

APPENDIX E: EXPLORATORY FACTOR ANALYSIS (EFA)

Exploratory factor analysis (EFA).docx

(Double click)

APPENDIX F: TURNITIN



TERTIARY STUDENTS' AWARENESS OF CLIMATE CHANGE: A CASE STUDY OF A SELECTED UNIVERSITY OF TECHNOLOGY

ORIGINALITY REPORT

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1	hdl.handle.net Internet Source	1%
2	Alison Raby. "Student Voice in Personal Tutoring", Frontiers in Education, 2020	1%

APPENDIX G: EDITING CERTIFICATE

5 July 2021

VUYOLWETHU DYANI
Faculty of Business and Management Science
Cape Peninsula University of Technology
Cape Town

RE: CERTIFICATE - TECHNICAL EDITING AND PROOFREADING OF MASTER'S THESIS

I, the undersigned, herewith certify that the technical editing and proofreading of the Master's thesis of Vuyolwethu Dyani, *"TERTIARY STUDENTS' AWARENESS OF CLIMATE CHANGE: A CASE STUDY OF A SELECTED UNIVERSITY OF TECHNOLOGY"*, has been conducted and concluded.

The finalised thesis was submitted to Mr Dyani on 5 July 2021.

Sincerely

Professor Annelie Jordaan
DTech: Information Technology
Ph: 065 990 3713

Member: SATI 1003347

South African Translators' Institute (SATI)