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The relationship between adolescents' knowledge of climate change, perceived risk and psychosocial wellbeing.

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The Relationship between Adolescents' Knowledge of Climate Change, Perceived Risk and Psychosocial Wellbeing.

Tayla Rosslee
847321

Supervisor: Adri Vorster

A research report submitted in partial fulfilment of the requirements for the degree of Master of Education by Coursework and Research Report in the field of Educational Psychology in the Faculty of Humanities, University of Witwatersrand, Johannesburg

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ABSTRACT

Younger generations are believed to be more susceptible to the detrimental impacts of global climate change in the long term. The purpose of this study was to investigate the potential relationship between adolescents' knowledge of climate change, their perceived risk and the impact thereof on their psychosocial wellbeing. A total of 137 male and female adolescents, between the ages of 15 and 18, were recruited from two private high schools in the province of Gauteng, South Africa. A non-probability, purposive sampling technique was used to select the participants. The participants completed a paper-based questionnaire consisting of four sections: demographics, knowledge of climate change, perceived risk and psychosocial wellbeing. The data was analysed according to the relevant statistical techniques, which included Cronbach's Alpha, descriptive statistics, skewness coefficient, kurtosis estimate coefficient, Pearson's correlation coefficient and multiple regression. The results revealed that adolescents with more climate change knowledge, display more interest towards it, engaged in less oppositional defiant behaviours and their overall functioning is impacted less. Furthermore, adolescents' level of risk perception has an impact on their engagement in positive behaviours as well as whether they will experience emotional difficulties. The results of this study demonstrate the importance of further research within different South African school settings, in which richer data can be established. This will therefore contribute to the climate change literature as well as enhance the understanding of the potential impact adolescents' climate change knowledge and perceived risk has on their psychosocial wellbeing.

Keywords: Adolescents, Climate Change Knowledge, Perceived Risk, Psychosocial Wellbeing

DECLARATION

I, Tayla Rosslee, hereby declare that this research report is my own independent work, and has not been submitted for any other degree, examination or at any academic institution.

Sign: 

Date: 5 September 2021

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CHAPTER 1: INTRODUCTION

1.1 Background to the Research Study and Rationale

Globally, climate change and the environmental impact thereof, is becoming an increasing concern. Anthropogenic or human factors have not only been identified as a large contributor to climate change and the vast rate of acceleration, but international literature has begun to also identify and discuss the psychological impact of climate change – direct, indirect and psychosocial (Doherty & Clayton, 2011). The direct impact of climate change involves the effects of natural disasters on mental health, such as depression, somatic disorders and post-traumatic stress disorder (Marshall et al., 2007; Xiong et al., 2008; Zaetta et al., 2011). The indirect impact involves the emotional consequences attached to the experience of climate change, such as anxiety, depression, denial, numbness and apathy (Lertzman, 2010; Norgaard, 2009; Pihkala, 2018). Literature on the psychosocial impact includes the gradual psychological and social effects that climate change has on individuals; including heat-related violence, resource-based conflicts, place attachment, dislocation and migration (Agyeman et al., 2009; Anderson & DeLisi, 2011; Theisen et al., 2013). Additionally, research has focused on the role people's knowledge of climate change has played in relation to perceived risk, awareness, attitudes and scepticism towards it (Corner et al., 2015; Mead et al., 2012; Ojala, 2015a; Skalík, 2015). However, based on the studies found, only a few of these international studies focus on adolescents (Bachofen et al., 2014; Corner et al., 2015; Dean & Stain, 2010; Mead et al., 2012; Ojala, 2015a, 2016; Sanson et al., 2018, 2019; Schreiner & Sjøberg, 2005; Skalík, 2015; Yilmaz et al., 2004). This is despite climate change gaining more attention from adolescents on a global scale, especially in European countries. More adolescents are beginning to speak out on climate change and form environmental activist groups and movements consisting of profound environmental activists. One of the most well-known adolescent environmental activists, is Greta Thunberg. Greta Thunberg is a young Swedish woman (18 years of age at time of writing) who became increasingly concerned about climate change when she started to learn about the phenomenon in school (Felsenthal, 2019). This increased level of concern led to her first protest action when she was 16 years of age, labelled "School strike for the climate", which aimed to create a general awareness and global change (Ernman, 2020). In doing so, she not only created more awareness on climate change amongst adolescents, but also mobilized this age group to take stronger action on the matter.

In addition to their ongoing awareness about climate change and the potential impact thereof, the United Nations Children's Fund (UNICEF) (2011b) and the World Health Organization (WHO) (2014) also express concern about the mental health of children and adolescents because of their vulnerabilities associated with ongoing development, as well as immaturity. In this regard, a WHO report (2014) identified self-harm as a result of underlying psychological difficulties, as one of the leading causes of death amongst adolescents worldwide. In addition, it was noted that the wellbeing of an increasing number of adolescents are impacted by psychological difficulties such as unipolar depressive and anxiety disorders (WHO, 2019). Majeed and Lee (2017) agree that adolescents are at an increased risk for developing anxiety and depression because of the transitions associated with this particular stage of life.

From the view of an educational psychologist in training, it is important to continually investigate the factors which place adolescents at a risk and increase their vulnerability. One such potential factor is climate change, and the risk to adolescents associated with it. Furthermore, educational psychologists may gain a better understanding of adolescents and the factors which impact their functioning. When taking into consideration that South African research on climate change and the impact thereof on the psychosocial wellbeing of individuals within this particular age group seems lacking, this is considered a potentially valuable study which can add to the growing body of research on climate change and on the factors which place adolescents at an increased risk for developing psychological disorders.

Although research is continuing to emerge on an international scale, there is a great need to fill this gap in Africa. This can be achieved by conducting more studies related to the psychosocial impact of climate change in African countries, such as South Africa. Although there has been an increasing emergence of South African based studies focusing on the correlation between climate change and the wellbeing of individuals, amongst the research emerging in South Africa, a predominant focus is the impact climate change has on the health and general wellbeing of the population and not necessarily the psychosocial impact thereof (Chersich et al., 2018; UNICEF, 2011b). Also, studies focussing specifically on adolescents appear to be lacking. For instance, a study conducted in the province of Gauteng focused on the relationship between university students' views on the future, in relation to climate change, and the impact thereof on their behaviour; specifically their engagement in pro- environmental behaviours (Van Niekerk, 2018). Mugambiwa and Dzomonda (2018) also conducted a study in Limpopo, focusing on university students' education, knowledge and understanding relating to climate

change and the risks that it poses. Thus, although there have been some attempts to conduct research on the phenomenon of climate change and the impact thereof on the psychological wellbeing of people, specifically adolescents, these have been done at an international level, with local research left wanting. As such, this study aims to contribute to the understanding of climate change, adolescents, and their psychosocial wellbeing from a South African perspective.

As noted, South African research is slowly emerging and contributing to the literature on climate change and psychology, thus creating more awareness. However, there is still a need for further research to be conducted from a South African perspective, to contribute to a greater conceptualisation and understanding of this phenomenon, specifically as far as adolescents are concerned. This study hopes to contribute to literature in this regard by gaining a better understanding of the relationship between adolescents' knowledge of climate change, the risk they associate with it and the perceived impact of these factors on their psychosocial wellbeing.

1.2 Aims

Whilst taking the above into consideration, the aim of this research study was to investigate the potential correlation between South African adolescents' knowledge of climate change, their perceived risk and the impact thereof on their psychosocial wellbeing.

1.3 Research Questions

In line with the aim of the study, it focussed on answering four research questions:

- Is there a relationship between adolescents' knowledge of climate change and the risk they associate with it?
- Is there a relationship between adolescents' knowledge of climate change and their psychosocial wellbeing?
- Is there a relationship between the risk adolescents' associate with climate change and their psychosocial wellbeing?
- To what extent does knowledge of climate change and the risk associated with it predict adolescents' psychosocial wellbeing?

1.4 Concept Clarification

1.4.1 Climate Change Knowledge

For the purpose of this research study, climate change knowledge is referring to adolescents' knowledge pertaining to climate change as well as their knowledge of known causes, and environmental impacts.

1.4.2 Perceived Risk

Within the context of this research study, the term perceived risk is defined as the perception of the potential adverse outcomes and severity of climate change. This study refers to an adolescents' perception of climate change as a risk to themselves, their family and society.

1.4.3 Psychosocial Wellbeing

The definition of psychosocial wellbeing was adopted by the World Health Organisation, who has defined the state of psychosocial wellbeing as the physical, mental and social aspects of functioning (WHO, 2005). For the purpose of this study the focus is placed specifically on adolescents' psychosocial wellbeing as well as on factors which may impact their psychosocial wellbeing.

1.4.4 Adolescents

Adolescents are defined as individuals between the ages of 10 to 19 years old experiencing the phase of life between childhood and adulthood (WHO, 2020). This definition of adolescent was adopted by the World Health Organisation.

1.5 Outline of the Research Report

1.5.1 Chapter 1

The first chapter introduces this research study which focuses on adolescents' knowledge of climate change, perceived risk and their psychosocial wellbeing. This chapter briefly discusses the background of the study, the rationale, aims as well as key concepts that are mentioned throughout this study. Finally, the chapter gives an outline of the chapters within this research report.

1.5.2 Chapter 2

The second chapter focuses on reviewing the relevant body of literature pertaining to climate change, psychology, adolescents, knowledge of climate change, the perceived risk and the impact thereof on psychosocial wellbeing.

1.5.3 Chapter 3

The third chapter provides a detailed overview of the methods used to conduct this research study. The following methodologies are presented: the research aims, research questions and hypotheses, the research design, the sample and sampling, the instruments and procedure used, the data analysis as well as ethical considerations.

1.5.4 Chapter 4

The fourth chapter focuses on presenting the results obtained from the data collection and statistical analysis, which included descriptive and inferential statistics.

1.5.5 Chapter 5

The fifth chapter focuses on discussing and interpreting the results of this research study in relation to previous literature. In addition, this chapter places focus on the reasonings for the significant results that were obtained.

1.5.6 Chapter 6

The sixth chapter focuses on the strengths and limitations of the study. Lastly, this chapter concludes with possible recommendations for future research studies as well as for educational psychologists and other professionals working with adolescents.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Climate change is an environmental phenomenon which has a detrimental impact on the world and its entire population. Studies have found that climate change has a negative influence on the health and wellbeing of the human population, with children and adolescents being the most vulnerable group (Flora & Roser-Renouf, 2014; O'Brien et al., 2018; WHO, 2018). The detrimental effects children and adolescents are currently experiencing, will only exacerbate in the future. As a result, they will face the increasingly drastic effects of climate change in the long-term (Chersich et al., 2019). In addition, their awareness and knowledge of climate change, as well as the risk they associate with it, may lead to psychological challenges which in turn impact their overall wellbeing (Sanson et al., 2019). Therefore, it is of utmost importance to focus on how adolescents' knowledge of climate change influences their risk perception and psychosocial wellbeing. This chapter will further explore the concepts mentioned and defined in the previous chapter, specifically climate change, the link between climate change and psychology, knowledge of climate change, the perceived risk, psychosocial wellbeing, as well as the interrelationship between the three variables mentioned (knowledge of climate change, perceived risk, and psychosocial wellbeing).

2.2 Climate Change

Climate change is increasingly becoming an issue on a global scale. To gain a clearer understanding of climate change, it is important to begin by understanding the differences between the concepts of "weather" and "climate". Weather is the atmospheric state that fluctuates over short periods of time ranging from minutes to weeks (Ahlonsou et al., 2001). This state includes seasonal temperatures, wind patterns, rainfall and humidity of the atmosphere (Ahlonsou et al., 2001). Climate is defined as an average of conditions in the climate system (Parker, 2018). The climate system is composed of five components: atmosphere, hydrosphere (such as rivers, lakes, oceans and seas), cryosphere (such as ice sheets and glaciers), land surface and the biosphere (marine and terrestrial, where water and land interact) (Parker, 2018). The interaction of these components is a complex and influential process consisting of physical, chemical, and biological features. These interactions, for example the atmosphere and oceans, cause various cycles to occur, resulting in certain events such as condensation, cloud formation, precipitation and so forth (Pachauri et al., 2014).

The shifts which occur in the climate is known as climate change. These shifts are part of a natural process that occurs over a long period of time; usually more than a decade (Balbus et al., 2016). However, this rate of change has been rapidly increasing over time. Changes in the climate can be attributed to two mechanisms of variability – internal and external (Wallace et al., 2016). Internal variability occurs when natural components change within the climate system without any external interference (Pachauri et al., 2014; Stocker et al., 2013). Examples of internal variability include seasonal changes and oscillation; created through interactions between the atmosphere and ocean (WHO, 2003). External variability is defined as changes inflicted by factors outside of the climate system, which can be separated into natural and anthropogenic factors (Mitchell et al., 2001).

Anthropogenic factors refer to changes in the climate system caused by human activities. The Intergovernmental Panel on Climate Change (IPCC) has described human activities to be a dominant contributor towards climate change for the past five decades (Albritton & Meira Filho, 2001). It is believed that anthropogenic factors will continue to have a drastic effect on climate change, especially if minimal pro-environmental changes occur (Albritton & Meira Filho, 2001). A primary anthropogenic contributor of climate change is fossil fuel combustion; sources include transportation (vehicles, ships and airplanes), industrial facilities, and power plants (Reuss, 2015). Land surface variation is another contributing anthropogenic factor, which includes deforestation, agriculture and irrigation (Boden et al., 2009; Reuss, 2015).

The environmental effects of climate change include temperature increases, rising sea levels, an increase in the severity and occurrence of extreme weather events (such as droughts, hurricanes and heat waves), decreases in Arctic and Antarctic sea ice sheets, and glacial melting (Clayton & Manning, 2018). In turn, these environmental effects have projected effects on human society, which include agricultural systems, infrastructural damage and liveability (Clayton & Manning, 2018; Olesen & Bindi, 2002; Sliwa, 2017). An example of agricultural systems would be potential drought as a result of an increase in temperatures, which may cause water scarcity (McMichael et al., 2008).

Overall, climate change poses a significant threat to the world and its population, which have negative effects on the environment as well as the physical and mental health of the human population. Research suggests that the environmental changes caused by climate change can potentially impact the mental and physical health of humans of all ages (Clayton et al., 2017). The negative effects on mental health include: aggressive behaviours, anxiety, compounded

stress, depression, post-traumatic stress disorder and substance abuse among others (Cianconi et al., 2020; Clayton et al., 2017; Mah et al., 2020; Obradovich et al., 2018; Simpson et al., 2011). Furthermore, an increase in the level or extent of a mental illness can have an impact on physical health, such as a compromised immune system, memory loss, infectious diseases, heart disease, asthma, lung problems or changes in sleep and eating patterns (Clayton et al., 2017). Conversely, research has also indicated that a person's compromised physical health can negatively affect their mental health, either directly or indirectly (Clayton et al., 2017; Ohrnberger et al., 2017; Padhy et al., 2015).

Children and adolescents are however considered to be more susceptible than adults to the immediate and long lasting effects of climate change (Sanson et al., 2019). The effects of climate change on the physical health of children have been well researched, including heat-related illness or stress, poor air quality, food insecurity, environmental toxin exposure, infectious and respiratory diseases, immune dysfunction, and/or malnutrition (Ahdoot & Pacheco, 2015; Sanson et al., 2019; Sheffield & Landrigan, 2011; Xu et al., 2012). However, of importance to this study is the psychological impact of climate change on the mental health of humans, specifically adolescents. This will be explored further in the next section.

2.3 Climate Change and Psychology

Scientific research is primarily focused on the sciences of climate change, which includes the nature, causes and consequences both natural and anthropogenic (Clayton & Manning, 2018). However, in recent years, climate change has been studied in relation to the field of psychology. Therefore, it would be important to view climate change and the impact it has on humans from a psychological perspective.

Psychology is a discipline known for focusing on behaviours to gain a better understanding of why people behave in certain ways as well as focus on the cognitive, emotional, behavioural and social aspects of wellbeing (Clayton & Manning, 2018). The rapid acceleration of frequency and intensity of climate change has been attributed mainly to human activity (Clayton & Manning, 2018) and as mentioned, scientific research has focussed on the human factors which contribute to climate change. Albeit very important should we wish to address this matter, the focus of this study will fall on the impact that climate change has on people's, specifically adolescents' wellbeing. In this regard, three critical factors highlighted by Clayton and Manning (2018) will be investigated in more depth: knowledge, perceived risk, and

psychosocial wellbeing. These factors are important as ones knowledge is believed to influence ones perception, which in turn may have an impact on behaviour and psychosocial wellbeing (Stevenson et al., 2019).

This psychosocial focus will allow for meaning to be derived from an adolescents' perspective. Many adolescents have experienced climate change in various indirect forms; for example on an educational or social level, either through school or peer interactions, respectively (Swim et al., 2014). An individual's level of experience may influence their knowledge, understanding and risk associated with climate change. Furthermore, research suggests that the awareness and knowledge adolescents have will potentially impact their psychological response to climate change, which will influence their overall health, including their psychosocial wellbeing (Sanson et al., 2019). To understand this influence, the focus will shift towards defining the extent of an adolescent's knowledge of climate change, their self- perceived risk of climate change and psychosocial wellbeing.

2.4 Knowledge of Climate Change

Knowledge is defined as the theoretical and practical information a person has on a specific concept (Lea et al., 2014). Within the context of this research report knowledge, as it pertains to climate change, will focus on the theoretical and practical information that adolescents have of climate change, its known causes, and the impact thereof on the environment. Climate change is a complex and multi-faceted phenomenon. Scientific research has displayed the multi-faceted nature of climate change by reiterating the multiple characteristics, causes and consequences that go hand-in-hand with this phenomenon (Shi et al., 2016).

Human beings are contributing to climate change, which not only holds detrimental effects for the environment, but also for the physical and psychological wellbeing of humans. In certain instances, the environmental effects of climate change have a direct impact on the physical and mental wellbeing of people (Clayton et al., 2017; Ohrnberger et al., 2017; Padhy et al., 2015). Thus, in order to address the issue, it is important to study the human factors which contribute to climate change, including humans' knowledge and perceptions of climate change. These particular factors are important as it is hoped that greater consciousness and knowledge will lead to more pro-environmental behaviours (Fisher, 2016; Liobikienė & Juknys, 2016; O'Brien et al., 2018; Van Niekerk, 2018). However, we need to understand that an increase in

knowledge and an understanding of the risks associated with this phenomenon, can have a psychosocial impact.

In an attempt to increase their knowledge of climate change, and its causes and consequences, adolescents are increasingly being exposed to the phenomenon on an educational level. In this regard, the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2015) stated the importance of adolescents' learning about climate change in the school curriculum, as it will broaden their knowledge of climate change; enabling them to gain an understanding of the direct and indirect impacts on the population and environment. Climate change education is considered to be a key factor in bringing about sustainable behavioural changes (UNESCO, 2015). Therefore, the more knowledge adolescents have and the better they understand the risks, the more they will hopefully engage in pro-environmental behaviours. However, it is also important to understand the potential psychosocial impact of this knowledge so that adolescents can be better supported, and adaptations can be made to the curriculum that can empower them, which in turn will hopefully reduce their anxiety.

Bachofen et al. (2014) suggested the best means to allow children and adolescents to "access, understand and act on climate information" is through experiential learning, such as participatory games, which in turn can potentially develop psychosocial resilience towards climate change (Bachofen et al., 2014, p. 67). Psychosocial resilience can be defined as a person's ability to cope with and overcome adversity caused by climate change (Clayton et al., 2017; Hobfoll et al., 2015). The Red Cross Red Crescent Climate Centre facilitated such learning through designing games that focus on climate change, the impact thereof, preventative measures, decision making and risk management (Bachofen et al., 2014).

In South Africa, the South African Department of Environmental Affairs proposed the National Climate Change White Paper, which reiterated the importance of climate change knowledge on an educational level (Department of Environmental Affairs, 2011). In addition, the South African educational Curriculum Assessment Policy Statements (CAPS) introduce the concepts of climate and climate change in Grade 10 up until Grade 12 (Department of Basic Education, 2011). Most of the schools that use the CAPS system are public schools, who are governed and funded by the South African National Government (Independent Schools Association of Southern Africa [ISASA], 2020). South African private schools are however governed by an independent body and follow the Independent Examinations Board (IEB) system (ISASA, 2020). The IEB is an independent assessment agency who offer support to private schools

regarding curriculums, assessments and examinations according to the CAPS guidelines (George News, 2014). Although, private schools base their curriculum on CAPS, they employ different approaches to facilitate teaching their curriculum (George News, 2014). In addition, the IEB National Senior Certificate (NSC) is classified as an internationally benchmarked qualification and equivalent to the Cambridge Advance Subsidiary (AS) Level curriculum (ISASA, 2020).

Climate change education enables learners to enhance their understanding and knowledge relating to climate change (Vujovic, 2014). This is essential as adolescents will be able to utilise their knowledge and understanding to address the impacts of climate change as well as engage in pro-environmental behaviours to potentially increase mitigation. Teachers are viewed as important sources of information, in conjunction with textbooks, for adolescents to develop their understanding and knowledge (Oakes & Saunders, 2002). Therefore, teachers potentially have the ability to influence and shape adolescents' knowledge of climate change, which in turn impacts their perceptions, attitude and behaviours towards climate change. Research has however indicated that teachers' knowledge may be inaccurate, which potentially results in their learners developing misconceptions or a misunderstanding relating to climate change (Anyanwu et al., 2015; Bozdogan, 2011; Gooding & Metz, 2011). Regardless, education is seen as a tool for adolescents to develop their scientific knowledge as well as understanding of climate change and the direct and indirect impacts it has on their lives, society and the environment. As such education can also be used to create an awareness of climate change and possible mitigation strategies to reduce the impact and potential risks associated with climate change.

Research suggests that teaching learners about climate change at different levels in formal education is an attempted response to reduce potential misconceptions and apathy amongst adolescents (Anyanwu et al., 2015). Lekgeu and Davis (2017) found that Grade 11 South African learners' knowledge and perceptions of climate change are shaped by their interactions with the different levels of exposure and influence, such as formal education, their parents, peers and social media. It is believed that the awareness and understanding of climate change improves as adolescents are exposed more to the issue in formal education (Ojala, 2015b). Furthermore, education equips adolescents with the necessary knowledge and skills to engage with climate change effectively (O'Brien et al., 2018; Westheimer, 2008). The approaches used play an important role in enabling adolescents to critically engage with and understand climate

change, which may potentially bring about change. For example, Bachofen et al. (2014) focused on the importance of experiential learning, which allowed learners to engage in participatory games relating to climate change, and the mitigation and prevention thereof. The aim of such methods is to transform adolescents' thinking from traditional to more critical, which will empower them with the necessary knowledge and skills to develop their agency and engagement (Sanson et al., 2019; Vogel et al., 2015). This may potentially also build resiliency and a sense of hope towards climate change mitigation (Sanson et al., 2019; Vogel et al., 2015).

The level of exposure is viewed as an important factor for potential engagement and perception of climate change risks (Özden, 2008; Yilmaz et al., 2004). Therefore, adolescents with an increased awareness and understanding of climate change may potentially be able to promote sustainable development through mitigation strategies (Deeb et al., 2011). However, as mentioned here, this knowledge may also leave adolescents with a greater understanding of the risk that climate change holds. Sundblad et al. (2007) suggested for a person to be able to make a judgement on the perceived risk of climate change, they would first need to acquire a basic level of knowledge on the concept. However, as well as increasing their understanding of the risk that climate change holds, it can also have psychosocial consequences. The next section will first focus on the risk people associate with climate change.

2.5 Perceived Risk of Climate Change

Perceived risk can be defined as a person's mental construct that judges the probability and negative outcomes of climate change (Van Der Linden, 2017), which may pose as a threat to themselves or the greater population (Rosa, 2003). Research has highlighted the importance of cognitive and emotional influences on the formation of perception of risks. The formation of perceived risk is influenced by two processes: analytic and experiential processing (Van Der Linden, 2015). Analytic processing uses formal operations as a way of relating to the present situation – such as logical and abstract thinking, as well as probability (Marx et al., 2007). Therefore, risks would be perceived utilising abstract and logical thinking of the impact of climate change. Conversely, experiential processing uses concrete operations to relate to the present situation, which is associated with personal experience and emotions (Marx et al., 2007; Van Der Linden, 2015). The perception of risk would be associated with a person's direct or indirect experience of climate change and their associated feelings towards it. These dual processes are parallel and interactive systems which influence each other. For example, climate change is perceived as less of a risk when the analytic reasoning is not associated with an

experiential and affective process, therefore, creating a dissociation between the two processes (Swim et al., 2014).

Other researchers have suggested the formulation of perceived risk is more complex than the dual processes mentioned above. Van Der Linden (2015), for instance, proposed the Climate Change Risk Perception Model (CCPRM) which states that perceived risk is an integration of the following factors: cognitive, experiential, sociocultural and sociodemographic. The cognitive factors focus on the importance of knowledge of climate change, which is distinguished by the following aspects regarding climate change: causes, impacts and response (Van Der Linden, 2015). The notion is that people will identify climate change as a greater risk if they acquire the relevant knowledge of climate change. Experiential factors consider the experience of climate change and attached emotions to be an important contributor to the perceived risks of climate change – both personal and societal (Van Der Linden, 2015). Therefore, a person who has directly experienced climate change, such as drought or extreme weather, will be more likely to have a higher perceived risk than someone who had an indirect experience. Sociocultural factors focus on the social as well as cultural norms that influence the construction of perceived risk of climate change (Swim et al., 2014). The demographic factors relate to a person's gender and political positioning, which contribute to their perceived risk (Sundblad et al., 2007; Van Der Linden, 2015).

The Risk Information Seeking and Processing (RISP) Model focuses on an individual's level of knowledge and perceived risk status, as well as examines how they would seek and manage the information related to the perceived risk (Shi et al., 2020; Yang et al., 2014). This model suggests that various factors, such as demographics, have an influence on an individual's risk perception, which subsequently impact their knowledge and attitudes relating to climate change (Yang et al., 2014). Furthermore, it is suggested that their engagement with information regarding risks of climate change will thus impact their response to climate change, such as mitigation (Dunwoody & Griffin, 2015).

Research suggests that there are different influential factors that contribute to how climate change is perceived by adolescents, including "gender, class, social expectations, ethnicity, life course, values and education" (O'Brien et al., 2018, p. 2). Furthermore these factors also influence the types of engagement adolescents show, which may range from doing nothing to adopting pro-environmental behaviours (Fisher, 2016; O'Brien et al., 2018). UNICEF (2011a) conducted a research study in South Africa which focused on adolescents' (aged between 14

and 17 years of age) perception of climate change and the associated risks. This was achieved through discussions held in a focus group setting in KwaZulu Natal and Limpopo (UNICEF, 2011a). The children's level of awareness and knowledge of climate change was apparent, where they were able to identify the future impacts and possible mitigation strategies. It was noted however that the children's understanding and perceptions regarding climate change were somewhat distorted (Lekgeu & Davis, 2017). Vujovic (2014) found that such misconceptions are caused by an inconsistency and gap in the teacher's knowledge and perception of climate change, which would indicate that misinformed adolescents may develop distorted perceptions of climate change. Therefore, indicating a possible link between knowledge and the formation of perceptions. The next section will focus on psychosocial wellbeing and the potential impact of climate change knowledge and perceived risk on a person's psychosocial wellbeing.

2.6 Psychosocial Wellbeing

Psychosocial wellbeing is the state of positive functioning on various levels; cognitive, emotional, social and behavioural (Swim et al., 2014). Furthermore, the World Health Organization defined the state of psychosocial wellbeing as the physical, mental and social aspects of functioning (WHO, 2005). There is a vast amount of research focusing on the impact climate change has on an adult's psychosocial wellbeing; however, research is starting to shift its focus to adolescents' psychosocial wellbeing (Burke et al., 2018). Simpson et al. (2011) found that exposure to the adverse effects of extreme weather events, such as displacement, causes psychological distress on an individual, familial and community level, which was found to have an impact on children, adolescents and adults (Fritze et al., 2008). Furthermore, the psychological distress places the individual at further risk for the development of depression, anxiety disorders, panic disorders, post-traumatic stress disorder (PTSD), sleep disorders, phobias, and/or cognitive deficits (Dean & Stain, 2010; Garcia & Sheehan, 2016; Goldmann & Galea, 2014). Simpson et al. (2011) found that children and adolescents' are more likely to display aggression, anxiety and behavioural problems when compared to adults.

Research indicates that adolescents are mostly likely unaware of the impact that climate change has on them or society, or they feel a sense of helplessness to contribute towards mitigation and sustainability outcomes (Flora & Roser-Renouf, 2014). Adolescents' lack of awareness may be a result of the impact being more indirect in nature. Research has shown that there is a potential link between extreme climate change and aggression when exposed directly to the

effects of the climate and weather events (Van Susteren, 2018). Children were also reported to display signs of anxiety and depression when directly exposed to air pollution (Weir, 2012). However, research is focusing more on the potential indirect impacts that climate change has on children and adolescents' psychosocial wellbeing (Burke et al., 2018).

International research studies have found that adolescents associate their concerns and worries relating to their future with the impacts of climate change (Burke et al., 2018; Fritze et al., 2008). This sense of concern and worry may lead to feelings of anger, fear, anxiety, sadness and/or powerlessness (Ojala, 2016; Sanson et al., 2018; Strife, 2012). Moser (2007) found negative responses occurring when these emotions were suppressed; including denial, emotional numbness, apathy or risky behaviours. Climate change also places children and adolescents at risk of developing mental illnesses, such as PTSD, depression, anxiety, sleeping disorders, attachment disorders and substance abuse. Furthermore, these mental illnesses lead to cognitive, behavioural and educational difficulties, emotional dysregulation as well as problems with language development (Burke et al., 2018). The severity of such impacts are said to be dependent on the type of exposure, degree and timing of the exposure (Burke et al., 2018).

2.7 Interrelationship between Knowledge, Perceived Risk and Psychosocial Wellbeing

An important question to consider is: how do these three variables potentially relate to one another? In this regard, some research indicates there is a correlation between knowledge of climate change and the perceived risk of climate change. For instance, Tobler et al. (2012) found that high levels of knowledge of climate change correlates with higher perceived risk of climate change. Similarly, Lee et al. (2015) found that knowledge of climate change plays a role in influencing a person's perceived risk of climate change. However, in the research conducted by Lee et al. (2015), it was found that the type of knowledge differs globally. For example, the causes of climate change are stronger predictors of perceived risk in Latin America and Europe, whereas localised knowledge of climate change is important in Africa and Asia. Various studies have reiterated this finding; Shi et al. (2016) found different forms of knowledge of climate change significantly influence the perceived risk of climate change. The causes of climate change had the most significant impact; in addition this was also found in a study conducted by Sundblad et al. (2007). Thus, studies by Lee et al. (2015), Shi et al. (2016), Sundblad et al. (2007) and Tobler et al. (2012) found a correlation between a person's knowledge of climate change and the risk they associate with it.

However, conversely, a study by Osberghaus et al. (2010) found that knowledge of climate change has no significant influence on the perceived risk of climate change. In addition, Stevenson et al. (2014) found that knowledge of climate change has little influence on adults' perceived risk of climate change, as adults have already developed worldviews and ideologies (i.e. political), which have a greater influence on their risk perception (Stevenson et al., 2014). Adolescents on the other hand are still developing their worldviews and ideologies, which may not influence their perceived risk of climate change (Stevenson et al., 2014). This study concluded that adolescents' knowledge of climate change has an impact on their risk perception (Stevenson et al., 2014).

As far as the relationship between climate change knowledge and wellbeing is concerned, it is believed that the way in which individuals perceive climate change, either positively or negatively, influences their state of wellbeing (O'Brien et al., 2018; Ojala, 2015b; Schreiner & Sjøberg, 2005). Therefore, a positive perception invokes a sense of hope, engagement, and constructive coping strategies, whereas a negative perception leads to disillusion, apathy, inactivity and the belief of limited influence to bring about sustainability (O'Brien et al., 2018; Ojala, 2015b; Schreiner & Sjøberg, 2005). It is important to note that the studies mentioned have been conducted individually and have no relation to one another.

2.8 Conclusion

To summarise, research has been conducted on people's knowledge of climate change and their perceived risk thereof. Further, research has also been conducted on the relationship between people's perceptions of climate change and their wellbeing. However, to date, there appears to be no published research findings which explore the relation between psychosocial wellbeing and the other two variables (knowledge and perceived risk of climate change). Although research is available on the link between climate change and psychosocial wellbeing; specifically, the impacts of climate change, such as psychological distress, depression, anxiety, PTSD, sleep disorders, phobias and cognitive deficits, the relationships between knowledge, perceived risk and psychosocial wellbeing, requires further investigation. Furthermore, with children and adolescents considered to be part of the vulnerable population whom will be mostly impacted by climate change in the future, either directly or indirectly, it is important to study the relationship between these variables within this population. In turn, research with this population has the potential to not only raise awareness about the potential impact of climate change knowledge and perceived risk on the psychosocial wellbeing of this group, it may also

serve as a catalyst to bring about a positive change regarding preventing and mitigating climate change. In light of this, this study intended to examine the potential relationship between adolescents' climate change knowledge, perceived risk and psychosocial wellbeing. The following chapter will outline the research questions, hypotheses, research design and methods that were used to examine the variables mentioned and their potential relationship.

CHAPTER 3: METHODS

3.1 Introduction

This chapter will give an overview of the methods and methodology used to conduct this research study. The research aims and research questions will be outlined first, which will then be followed by a discussion regarding the research design, sample, and sampling methods. The focus will then be placed on the instruments and procedures used to collect the necessary data. This is followed by an overview of the data analysis methods which were used to answer the research questions. This section will be concluded with a discussion of the ethical considerations taken into account for this research study.

3.2 Research Aims

As noted in Chapter 1, the aim of this research study was to investigate the potential correlation between South African adolescents' knowledge of climate change, the perceived risk they associate with it, and the impact thereof on their psychosocial wellbeing.

3.3 Research Questions and Hypotheses

3.3.1 Research Questions

In line with the aim of the study, the following research questions were posed:

1. Is there a relationship between adolescents' knowledge of climate change and the risk they associated with it?
2. Is there a relationship between adolescents' knowledge of climate change and their psychosocial wellbeing?
3. Is there a relationship between the risk adolescents' associate with climate change and their psychosocial wellbeing?
4. To what extent does knowledge of climate change and the risk associated with it predict adolescents' psychosocial wellbeing?

3.3.2 Hypotheses

A hypothesis is defined as a predictable statement regarding a potential relationship between variables (Coolican, 2017). The hypotheses for this study were as follows:

1. H_0: There is no significant relationship between adolescents' knowledge of climate change and the risk they perceive to be associated with it.
   H_1: There is a significant relationship between adolescents' knowledge of climate change and the risk they perceive to be associated with it.
2. H_0: There no significant relationship between adolescents' knowledge of climate change and their psychosocial wellbeing.
   H_1: There is a significant relationship between adolescents' knowledge of climate change and their psychosocial wellbeing.
3. H_0: There no significant relationship between the risk adolescents perceive to be associated with climate change and their psychosocial wellbeing.
   H_1: There is a significant relationship between the risk adolescents perceive to be associated with climate change and their psychosocial wellbeing.
4. H_0: Knowledge of climate change and the risk they perceive to be associated with it are not a significant predictor of adolescents' psychosocial wellbeing.
   H_1: Knowledge of climate change and the risk they perceive to be associated with it is a significant predictor of adolescents' psychosocial wellbeing.

3.4 Research Design

This study was situated within a non-experimental, correlational research design, meaning variables are measured and assessed for a potential statistical relationship (Jhangiani et al., 2019). A non-experimental, correlational research study focuses on whether there is a correlation between the variables, which makes no attempt to manipulate nor determine causality (cause and effect) of the variables (Houghton et al., 2001; Jhangiani et al., 2019). The aim of this study was to observe the natural interaction process between the quantifying variables (Gravetter et al., 2020; Houghton et al., 2001). This method allowed the researcher to focus on the correlation or covariation of variables – also described as the correlational method (Gravetter et al., 2020).

The focus was on establishing and examining potential relationships between variables. This design looked further into the nature as well as degree of the relationship between the variables

(Houghton et al., 2001). In this case, the purpose of this research study was to determine the potential correlations between knowledge of climate change and the risk adolescents perceive to be associated with it; knowledge of climate change and adolescents' psychosocial wellbeing; as well as the associated perceived risk and psychosocial wellbeing.

This non-experimental approach was employed by using a questionnaire as a means of data collection. The purpose of a questionnaire was to gain information of specific factors regarding participants of a target population (Gravetter et al., 2020). The factors this study focused on included the demographics of the sample, knowledge of climate change, perceived risk, and psychosocial wellbeing.

A quantitative research approach was adopted for this study, which allowed the researcher to investigate specific variables for an existing correlation (Walliman, 2011). This approach is a form of collecting and analysing numerical data to be able to make predictions, find patterns, test causal relationships and/or generalise results to a wider population group (Jhangiani et al., 2019). This paradigm enabled an objective means to be utilized for observation, data collection, measurement and analysis of variables to be conducted using statistical techniques – which displayed variations (Check & Schutt, 2012). Furthermore, the quantitative nature of this study examined and described certain behaviours through quantifying variables.

Research indicates that the research design adopted for this study presents with various strengths and limitations. This type of research design allows for the exploration of different domains as well as a vast amount of information, in which the manipulation of variables is not required (Queirós et al., 2017; Stangor, 2011). In addition, the strength of the relationships between variables can be calculated (Stangor, 2011). The limitations for this research design include the inability to identify a causal relationship as the direct cause and effect cannot be determined. Furthermore, a conclusive reason for the correlation cannot be found between the two variables (Queirós et al., 2017).

3.5 Sample/Sampling

Given the aim, participants recruited for this study were adolescents between the ages of 15 and 18 years in Grades 10 and 11. Both males and females were included. As discussed in Chapter 2, the focus on this specific population is important as they are the generation which will potentially be most affected by climate change in the long-term. Furthermore, the focus on adolescents from Grades 10 and 11 is also considered important as these are the grades

where most South African children are introduced to the concepts of climate and climate change in more depth in the school curriculum (Department of Basic Education, 2011). Although it would have been preferrable to include Grade 12 learners, they were excluded from the sample due to the COVID-19 pandemic. The subsequent loss in teaching and contact time with Grade 12 learners and the fact that at the time when the pandemic allowed access to these learners, they were preparing for their final examinations meant there were no opportunities for data collection.

Initially it was understood that adolescents from both private and government schools could be included in the study; however, because of the COVID-19 pandemic and the move to a predominantly online learning platform, only adolescents from private schools who could access online platforms more readily, were included. At the time the use of an online platform to distribute the questionnaires limited face-to-face contact with the adolescents, which reduced the risk of infection during the pandemic. However, as will be discussed further below, given a poor response rate (approximately 20 learners) to the online questionnaires, paper-based questionnaires were later distributed when South Africa's national lockdown regulations and the schools' safety protocols allowed this. It should also be mentioned that even after the lockdown regulations and school safety protocols allowed for paper-based questionnaires to be distributed, the Gauteng Department of Education placed a moratorium on all research in government schools. Thus, these schools could not be accessed, and data collection was subsequently limited to private schools.

The participants were selected using a non-probability, purposive sampling technique, which focuses on non-randomised methods to gather the sample population (Jhangiani et al., 2019). The researcher uses a set of inclusion criteria to select the specific participants that are most representative for the research study (Coolican, 2017; Jhangiani et al., 2019). This sampling technique allowed for the participants to be selected based on the specific inclusion criteria (Gravetter et al., 2020). The inclusion criteria for this study were the specific age range (15 to 18 years of age), their educational level, specifically Grade 10 to 11, and the type of school, specifically Gauteng private schools. Participants who met the inclusion criteria were considered for the study and not excluded based on any other factors.

The sample consisted of 137 participants from two private high schools in Gauteng. Although three high schools were initially approached, there were unforeseen challenges faced with obtaining participants from the third school where the distribution and completion of online

questionnaires was a hindrance, and the distribution of paper-based questionnaires was not feasible at the time. Thus, participants from two high schools took part in the study.

As can be seen in Table 3.1, the majority of the participants were either 16 or 17 years old; where 45.3% of the sample were 16 years old and 43.1% were 17 years old. This was followed by 8% of the sample being 15 years old and 3.6% were 18 years old. The sample consisted of 74 females (54%), 62 males (45.3%) and 1 other (0.7%) specifically nonbinary. The participants were either completing Grade 10 or 11, where 54% were in Grade 10 and 46% in Grade 11.

Table 3.1

Demographic Information for the Sample

Variable	Category	Frequency	Percentage (%)
Age	15 years	11	8
	16 years	62	45.3
	17 years	59	43.1
	18 years	5	3.6
Gender	Male	62	45.3
	Female	74	54
	Other	1	0.7
Education Level	Grade 10	74	54
	Grade 11	63	46

3.6 Instruments

The data was obtained through a questionnaire consisting of four sections: demographics, knowledge of climate change, perceived risk, and psychosocial wellbeing (see Appendix A). As mentioned previously, the questionnaires were distributed through an online platform, SurveyMonkey, as COVID-19 initially prevented face-to-face interactions with the participants. However, a lack of responses to the online questionnaire resulted in the two schools distributing paper-based questionnaires to the participants. As mentioned above, the third school did not agree to the distribution of paper-based questionnaires. At that stage, it was near the end of the school year and given that not all the children would be required to attend school all the time, the third school did consider the distribution of paper-based questionnaires

to be a feasible alternative. With the distribution of paper-based questionnaires, the COVID-19 protocols of the schools were strictly adhered to and rather than allowing the researcher access to the premises, representatives from each school assisted in handing out and collecting the paper-based information and consent forms, as well as the questionnaires.

The demographic section included three variables – age, gender, and education level. The questionnaire was adapted by using various scale measures obtained from the PsycTests database of the American Psychological Association. The following four scale measures were combined: Climate Change Knowledge scale, Perceived Risk scale, Perceived Hazard Characteristics measure, and the Adolescent Functioning scale (Dittman et al., 2017; Kettle & Dow, 2016; Parant et al., 2017; Yang et al., 2014). Minor adaptations were made in the scale measures, for the purpose of making the items appropriate for South Africa and more specifically the Gauteng province.

As indicated, perceived risk of climate change was measured using two scales. The scales were interpreted separately to minimize the effect on the outcome. The first was the Perceived Climate Change Risk scale, which focuses on impact of environmental changes on the community (Kettle & Dow, 2016). The second scale, the Perceived Hazard measure, focuses on the individual in addition to their community and society (Yang et al., 2014). The international reliability of each scale will be discussed below which is applicable for international participants. Furthermore, the reliability obtained for this study's sample will be discussed in Chapter 4, which is more applicable for South Africa. The estimated completion time for the entire questionnaire, including all the subsections, was approximately five to ten minutes.

3.6.1 Climate Change Knowledge Scale:

The participants' knowledge of climate change was measured using an 11-item Climate Change Knowledge Scale (Parant et al., 2017). The original scale was referred to as the *Global Warming Knowledge Scale*, however, an adaptation from "global warming" to "climate change" was made. These concepts have been used interchangeably throughout literature. Global warming is focused specifically on an increase in temperatures (Withgott & Laposata, 2019). Whereas, climate change is defined as the changes in various components of the climate system, including the earth's temperature (Withgott & Laposata, 2019). Thus, making global warming a component of climate change (Withgott & Laposata, 2019). The change in concepts

was made to broaden the focus on knowledge; instead of focusing only on temperature changes, other factors were included.

Parant et al. (2017) developed the Global Warming Knowledge scale, to explore whether binding communication influences learners' awareness of climate change. The measure uses a dichotomous scale of "true" or "false" statements, which includes an "I don't know" response option. There were six correct items and five incorrect items; correct responses received a score of 1, and incorrect responses (including "I don't know") received a score of 0. The total score is the sum of each statement's score ranging from 0 to 11, which represented the participants' knowledge of climate change in the data analysis.

The reliability of this scale was determined using internal consistency by calculating Cronbach's Alpha Coefficients, which was conducted in France specifically. The results indicated sufficient internal consistency in both post- and pre-measures; scoring $\alpha = .726$ and $\alpha = .766$, respectively (Parant et al., 2017).

3.6.2 Perceived Climate Change Risk Scale:

A slightly adapted version of the Perceived Risk scale, developed by Kettle and Dow (2016), was used to measure adolescents' perceived risk of climate change. The scale which, for the purpose of this study is called the Perceived Climate Change Risk scale, uses a 14-item questionnaire, where participants respond on a 6-point Likert scale. The scale is divided into two subscales – the potential changes and impact of climate change. The participants are required to respond by indicating their level of concern for each item – ranging from "not concerned" to "extremely concerned" (Kettle & Dow, 2016). The total score was obtained by calculating the sum of the responses, which will indicate adolescents' perceived risk of climate change.

It is important to note that the scale was adapted to make it applicable for South African adolescents and specifically for the Gauteng province. For instance, in the first scale item the following changes were made: "sea level" to "drought", "the strength of hurricane and coastal storms" to "the strength of intense thunderstorms" and "permafrost melt" to "extreme water shortages". In addition, the seventh item ("Severe air pollution") has been added to the scale as it has relevance to the Gauteng province. The changes made in this scale were based on the notion of creating items that were related to the participants' living environment, which is specifically an inland province.

Cronbach's Alpha was used to measure the reliability of this scale, which was measured in the United States specifically. A high consistency for both perceived risk scales were found; respectively scoring α = .76 and α = .89 (Kettle & Dow, 2016). Both perceived risk scales were highly correlated, which was determined through Spearman's p (r = .89). The scales were then combined into a single scale, which resulted in a score of α = .90 (Kettle & Dow, 2016). The correlation between the perceived risk scales indicates criterion validity.

3.6.3 Perceived Hazard Characteristics Measure:

The Perceived Hazard Characteristics measure was used, in addition to the Perceived Climate Change Risk scale, to assess adolescents' perceived risk of climate change. This measure was developed by Yang et al. (2014) to assess risk perceptions related to climate change in China. The scale consists of 12 items divided into three subscales of measure, specifically focusing on the consequences, impact and interests related to climate change. The different subscales measured responses on a 6-point Likert scale (Yang et al., 2014). The first subscale, which includes 4-items, focuses on the likelihood of an event occurring, such as "My standard of living will decrease", due to climate change. The second subscale consists of 5 items, which views the participants' level of concern in relation to the potential impact climate change will have on various components – such as themselves, family, communities, or South Africa. The third item in this subscale (7th item overall) was adapted to make the item relevant to South Africa – "U.S. (China)" was changed to "South Africa". The last subscale consists of 3 items focusing on adolescents' perception of climate change, whether they perceive it to be of importance, interest, or relevance.

Reliability was again measured using Cronbach's Alpha for all three of the subscales. The following scores were for the measures used in the United States and China, respectively: for the first scale α = .84 α = .80, second scale α = .89 α = .81, and third scale α = .91 α = .84 (Yang et al., 2014). Criterion validity (specifically predictive validity) was supported by the correlation between variables.

3.6.4 Adolescent Functioning Scale:

The Adolescent Functioning Scale, developed by Dittman et al. (2017), was used to measure adolescents' psychosocial wellbeing. The items of this scale focus on the adjustment and wellbeing of an adolescent, by looking at their behaviour, positive development and emotions (Dittman et al., 2017). This scale is comprised of a 33-item questionnaire that measures

responses on a 6-point Likert scale, which ranges from "not at all true" to "true very much"; only 25 items were used for this study. There are four subscales in this scale, namely: oppositional defiant behaviour, positive development, antisocial behaviour, and emotional difficulties. Two questions from the first subscale were excluded from the questionnaire, specifically 'Refuses to do jobs around the house when asked' and 'Gets upset or angry when they don't get their own way'. The third subscale focusing on antisocial behaviours was also excluded, these questions included getting into trouble at school, substance abuse, engaging in risky behaviours, as well as truancy. These items were excluded as they are exclusive from the inclusion criteria of psychosocial wellbeing, which focuses on the state of positive functioning as mentioned above. The purpose of removing these items was to draw focus on whether adolescents were potentially experiencing difficulties emotionally or behaviourally, or rather experiencing a positive adjustment towards adverse situations.

Oppositional Defiant Behaviours focuses on possible behaviours the participants may engage in, which relate to themselves and others. *Positive Development* focuses on various aspects, such as the participants' involvement at school or the community, planning skills, schoolwork ethic, and personal reflections. *Emotional Difficulties* focuses on challenges the participants may be experiencing on an emotional level in relation to themselves. The Adolescent Functioning scale is a parent-self measure, which was adapted for adolescents to answer. The adaptations included changing and adding the relevant pronouns, such as "Loses *their* temper" to "*I* lose *my* temper".

The reliability was measured through internal consistency, which was found to be significantly high for each function measured (H = .82-.92). The scores measured were used in Australia specifically. In addition, test-retest reliability scores were high, scoring r = .77 and .86. Convergent validity was supported by the correlations between the variables; specifically Adolescent Functioning Scale and the measures of adolescent functioning parenting (Dittman et al., 2017). Discriminant validity was found due to no association between the two variables – Adolescent Functioning scale and the use of technology (Dittman et al., 2017).

3.7 Procedure

Permission was first obtained from the Human Research Ethics Committee (Protocol number: H20/06/39) to conduct this study, specifically the non-medical committee at the University of Witwatersrand. The principals of the respective schools were then contacted to obtain written

permission to conduct research with their learners and to access the schools. This was achieved by sending an email to the principals containing a school information sheet regarding the research study as well as requesting permission for their schools to partake in the research (see Appendix B). Once permission was obtained from the school principals, the parents/legal guardians were contacted by the school representative to obtain informed consent. This was achieved by sending an email containing the consent forms and a parent information sheet (refer to Appendix C and D) consisting of a description of the study and a request of consent for their child's participation in the study. The information sheet also explained that participation was completely voluntary with no foreseeable benefits or risks. The parents were given the option to either sign the document electronically which would be emailed to the researcher or school representative or reply to the email stating that they give informed consent for their child (stating their name and current grade) to participate. A reminder email was sent two weeks after the first email as the response rate was low. The school representative provided a class list of the learners to the researcher to keep track of the children whose parents have consented for them to participate. Once informed consent was obtained, the SurveyMonkey URL link was sent to the participants. The online questionnaire automatically displayed the participant information sheet and assent form once the participant followed the link (see Appendix E).

Initially, there were little to no responses from the participants from each of the schools. As a result, an alternative method was determined to potentially increase the response rate of the participants. At two of the schools, hard copies of the consent forms, information sheets and questionnaires were given to each participant by a school representative to complete at home or in class and return to the representative once completed. The representatives were informed that the data of the questionnaires were confidential, and as a result the completed questionnaires were placed in an enclosed box to ensure confidentiality was maintained. Once the completed questionnaires were returned to the school representatives, the researcher was contacted to collect the questionnaires and additional consent forms. Unfortunately, the third school was unable to make alternative arrangements as the learners were nearing the end of their year-end examinations and it was unlikely that all learners would be attending school as a large group until the following year. However, the response rate was substantially higher with the first two schools mentioned using paper-based consent and information forms and questionnaires.

The data from the questionnaires was then captured electronically. Once the data collection was completed, the data was analysed according to the relevant statistical techniques. During this process, the researcher ensured that the data was kept securely on a password protected laptop. As an additional safety precaution, the researcher and her supervisor had sole access to the data.

3.8 Data Analysis

The data collected was captured onto an Excel spreadsheet, which was then scored appropriately. The data was then exported and analysed using the Statistical Package for the Social Sciences (SPSS) version 25.

Firstly, the data analysis focused on determining the reliability of the Climate Change Knowledge scale, Perceived Climate Change Risk scale, Perceived Hazard Characteristics measure and the Adolescent Functioning scale. This was especially important since none of these scales have been used within the South African context and the reliability of the scales have thus not been calculated for use with a South African sample. Further, as mentioned, some of the scales and items were altered to make them appropriate for us in South Africa and in the Gauteng province specifically, and thus it was considered crucial to determine reliability.

Cronbach's Alpha was used to measure the reliability of the data, which established the internal consistency of the various scales. Internal consistency measures the level of homogeneity (similarity) of the participants responses across different items within a scale (Jhangiani et al., 2019). Therefore, focusing on how consistently a scale measures exactly what the researcher intends to measure. Cronbach's Alpha coefficients range from 0 to 1, where a higher Alpha value indicates a higher level of internal consistency (Howitt & Cramer, 2017). A Cronbach Alpha value of 0.7 or above is deemed as a satisfactory level of internal consistency, whereas an Alpha value below is considered unsatisfactory (Howitt & Cramer, 2017).

Descriptive statistics was used to provide information relating to the variables – categorical and continuous. The categorical variables were gender, age, and level of education. These variables were calculated using the frequency and percentage of the data scores. The frequency indicated the distribution of the variables measured (Salkind, 2007). The continuous variables include knowledge of climate change, perceived risk, and psychosocial wellbeing. These variables used measures of central tendency and variability (Howell, 2016). The average of the data was calculated using the central tendency known as the mean. Measures of variability

consisted of standard deviation and the range. Standard deviation displayed how far apart the data set is from the mean (Howell, 2016). Whereas the range looked at the minimum and maximum values of the data scores. Therefore, the measures of variability indicated the distribution of the values in the set of data scores (Wilson & Joye, 2017).

The skewness coefficient and kurtosis estimate coefficient were calculated to describe the data as well as determine the normality of the data. The data is considered to be normally distributed when the skewness coefficient lies between -1 and 1 and the kurtosis value falls between -3 and 3 (Howitt & Cramer, 2017). Additionally, a histogram was used to plot the data, to indicate the frequency amongst the numbers within the data set (Belhekar, 2016). The Central Limit Theorem was also applied to determine whether the data set displays a normal distribution. This theorem states that a sample size of 30 or more participants is considered to be normally distributed (Field, 2018). It may be assumed that the sampling for this research study is normally distributed (n = 137). These forms of measurements were used to determine whether the data collected met the parametric or nonparametric assumptions.

Inferential statistics were then run to answer the different research questions. The first, second and third research questions focused on the relationship between an adolescents' knowledge of climate change, the perceived risks and psychosocial wellbeing. As the parametric assumptions were met as according to the above techniques, the Pearson's correlation coefficient was calculated. This coefficient measured the strength, direction and significance of the relationship between knowledge of climate change, perceived risk and psychosocial wellbeing (Howell, 2016). Pearson's correlation coefficient is calculated to determine the nature of the relationship between two variables (Howell, 2016). The coefficient value (r) ranges between -1 and 1; where a value of 1 indicates a perfect relationship between the values, and a value of 0 means there is no significant relationship (Howitt & Cramer, 2017). Therefore, a relationship between two variables would be considered to be strong depending on how close the value is to 1 or weak if the value is closer to 0 (Howitt & Cramer, 2017). The direction of the relationship is determined by looking at whether the value is positive or negative, which would mean a positive relationship is indicated by a positive value and vice versa (Howitt & Cramer, 2017). A positive relationship indicates that when both variables' values change, the values change in the same direction, whereas a negative relationship indicates that the values change in the opposite direction.

The fourth research question was addressed by calculating a multiple regression, which focuses on determining the potential predictive relationship of knowledge of climate change and perceived risk on adolescents' psychosocial wellbeing. Multiple regression is calculated to establish how numerous independent variables are related to a dependent variable.

However, multicollinearity needs to be considered before calculating multiple regression. Multicollinearity occurs when an independent variable is highly correlated to another independent variable, which would affect the multiple regression analysis (Coolican, 2017). As a result, the variance inflation factor (VIF), condition index and tolerance values were used to detect whether the issue of multicollinearity was present between the independent variables. As such, the rule of thumb indicates that problematic levels of multicollinearity are present when the VIF value is greater than 5, the condition index value is greater than 30 and the tolerance value is less than or equal to 0.1 (Coolican, 2017; Ethington et al., 2002).

The multiple regression model was used to determine the extent to which adolescents' psychosocial wellbeing (determined by the adolescent functioning scale) was predicted by the different predictor variables, which is the variable used to make the prediction of the dependent variable (Jhangiani et al., 2019). The predictor variables in this study are knowledge of climate change and perceived risk. The perceived risk variable is broken down into two variables, namely Perceived Climate Change Risk Total subscale and Perceived Hazard Characteristics consequences, impact, and interests' subscales. As a result, four separate multiple regressions were calculated to determine the potential predictive relationship.

3.9 Ethical Considerations

Ethical approval was obtained from the Human Research Ethics Committee (HREC – non-medical) at the University of Witwatersrand (Protocol number: H20/06/39) (see Appendix F). Written consent was first obtained from the principals to gain access to the learners and school. Informed consent was then obtained from the participants' parents or legal guardians to allow their children to participate in the study. The submission of the completed questionnaire was regarded as the participants' assent to participate in this study.

The participants and parents were informed that participation is voluntary, and participants are given the right to withdraw at any given time prior to or during the study. However, once the questionnaires were submitted, participants were no longer able to withdraw as there were no identifying information on the questionnaires linking specific participants to specific

questionnaires. There were no consequences should they have chosen to participate or not. Additionally, all participants had the right to refrain from answering any questions they felt uncomfortable with. There were no benefits nor risks for the adolescents who chose to partake in this study.

Anonymity and confidentiality were guaranteed as no identifying details were requested from the participants. After the completion of the questionnaire, participants were reminded to separate the consent form from the completed questionnaire, to further ensure guaranteed anonymity and confidentiality. Furthermore, anonymity was ensured when the school representatives managed the questionnaires as no identifying information was included, and the participants placed their questionnaire in a box.

Although the researcher and her supervisor have knowledge of the names of the schools involved, these do not appear in the final research report or any further publications or presentations that may arise from it. Here, mention will only be made to private schools in the Gauteng province.

The captured data is stored on a password protected laptop as a safety precaution. Access to the data is limited to the researcher and her research supervisor. These precautions guaranteed the integrity of the data collected. The questionnaires have been stored in a securely locked cabinet of which the researcher has sole access.

The results will be used in a final research report and may potentially be published in a peer-reviewed journal article in the future. The report will be available on WiredSpace – an internal repository of the University of the Witwatersrand. The schools, participants and parents will be given access to a summary of the results once completed. Schools, participants, and parents were advised that the data will be kept indefinitely for research purposes and that in addition to the research results being published in the form of a research report and/or journal article, it may also be presented at a conference and/or published in the form of a book chapter.

3.10 Conclusion

The methods chapter has provided an overview of the methods and methodology used to conduct this research study. This chapter included an illustration of how the sample of participants was obtained, as well as how the data was collected and analysed. The following

chapter will focus on the findings of this research study, which will in turn inform the discussion chapter (Chapter 5).

CHAPTER 4: RESULTS

This chapter focuses on the results of the statistical analysis that were obtained from the data collected for this study. The statistics were analysed using the IBM SPSS Statistics 25 programme. The internal consistency reliabilities were calculated first to determine the reliability of the scales. This was then followed by calculating the descriptive statistics and normality estimates. Lastly, inferential statistics, specifically correlations and multiple regressions, were used to answer the specific research questions for this study.

4.1 Internal Consistency Reliability

Cronbach's Alpha Coefficients were used to calculate the internal consistency reliability of all the scales and the corresponding subscales used in this study. Table 4.1 below provides the Cronbach's Alpha values for each of the scales and their subscales.

Table 4.1

Cronbach's Alpha Coefficients for Scales and Subscales.

	Cronbach's Alpha	Item
Climate Change Knowledge	.562	11
Perceived Climate Change Risk (PCR) Scale		
PCR Total	.920	15
PCR Changes	.869	7
PCR Impacts	.857	8
Perceived Hazard Characteristics (PHC) Measure		
PHC Consequences	.804	4
PHC Impact	.837	5
PHC Interests	.747	3
Adolescent Functioning (AF) Scale		
AF Oppositional Defiant Behaviour	.795	10
AF Positive Development	.753	9
AF Emotional Difficulty	.770	6
AF Total	.789	25

Table 4.1 indicates that the majority of the scales and subscales fall within a moderate to high level of internal consistency. Therefore, these scales would be regarded as reliable. The

subscale found in the Perceived Climate Change Risk (PCR) scale had the highest level of internal consistency (α = .92), specifically the PCR Total subscale. From those regarded as reliable, the subscale with the lowest internal consistency (α = .75) was the Perceived Hazard Characteristics Interests subscale, from the Perceived Hazard Characteristics (PHC) measure.

Furthermore, Table 4.1 shows that the Climate Change Knowledge scale has a low level of internal consistency (α = .56), which indicates this scale is found not to be reliable for the population of this study. As a result, this scale was analysed further by removing various items within the scale to identify whether the reliability could be improved. Unfortunately, there were no improvements in the level of internal consistency. Consequently, the Split-Half Reliability was used as an additional internal consistency reliability measure. This method consists of splitting the scale into two halves to compare the consistency of each half with the other (Frey, 2018). The calculation for internal consistency was achieved by using the Spearman-Brown coefficient and the Guttman Split-half coefficient.

Table 4.2

Split-Half Coefficients for the Climate Change Scale

	Cronbach's Alpha
Spearman-Brown Coefficient	.618
Guttman Split-Half Coefficient	.612

As shown in Table 4.2, a slight improvement in the level of internal consistency for the Climate Change Knowledge scale was found, although the coefficient is still below the acceptable value of 0.7. It is important to note that any results or discussion related to this specific scale will therefore be interpreted with caution. However, as the scale focuses on the participants' knowledge of climate change, which requires simple answers (correct, incorrect or don't know), the scale is going to be used as is.

4.2 Descriptive Statistics and Normality

Descriptive statistics (mean, standard deviation, and range) were calculated to describe the levels of climate change knowledge, perceived risks, and the psychosocial wellbeing of the participants in the sample. This is presented below in Table 4.3.

Table 4.3

Descriptive Statistics and Normality for the Scales and Subscales

Variable	N	Mean	Standard Deviation	Min.	Max.	Skewness	Kurtosis
Climate Change Knowledge	137	7.17	1.908	0	12	-.605	1.177
Perceived Climate Change Risk (PCR) Scale							
PCR Total	137	60.31	14.451	15	90	-.521	.100
PCR Changes	137	28.53	7.043	7	42	-.605	.188
PCR Impacts	137	31.79	8.224	8	48	-.415	-.213
Perceived Hazard Characteristics (PHC) Measure							
PHC Consequences	137	14.74	4.332	0	24	-.401	.163
PHC Impact	137	21.77	5.545	7	30	-.483	-.372
PHC Interests	137	14.02	3.189	5	18	-.777	-.187
Adolescent Functioning (AF) Scale							
AF Oppositional Defiant Behaviour	137	24.44	7.210	11	46	.645	.113
AF Positive Development	137	24.36	7.248	8	42	.304	-.409
AF Emotional Difficulty	137	18.74	6.126	6	33	.047	-.367
AF Total	137	67.54	13.874	35	109	.550	.602

Normality was first determined to ascertain whether parametric or nonparametric statistical techniques should be used, in order to be able to answer the research questions appropriately. The Skewness and Kurtosis coefficients was used to determine the normality of the data, in

addition to the descriptive statistics. As evident in Table 4.3 above, the data is normally distributed as all Skewness values fall between -1 and 1, and Kurtosis values between -3 and 3 (Verma & Abdel-Salam, 2019). In addition, the histograms (refer to Appendix G) were analysed, which indicated that the data from the scales and subscales were normally distributed. Furthermore, according to the Central Limit Theorem normality would apply as the sample size is larger than 30. Therefore, the normality of the dataset indicated that the parametric assumption of normal distribution was appropriately met to use the relevant statistical techniques (Verma & Abdel-Salam, 2019).

4.3 Inferential Statistics

4.3.1 Correlations

Pearson's Correlation Coefficients were calculated to address the first three research questions. These focused on establishing the nature of the relationship between the adolescents' Knowledge of Climate Change, Perceived Risk and Psychosocial Wellbeing. It is important to reiterate that any relationship found between Climate Change Knowledge and either of the other scales or subscales were interpreted with caution due to the low reliability of the scale for this specific population group.

Table 4.4

Correlation between Climate Change Knowledge and Perceived Climate Change Risk

	PCR Total	PCR Change	PCR Impacts
Climate Change Knowledge Total	-.024 .780	.015 .859	-.055 .521

As illustrated in Table 4.4 above, Climate Change Knowledge was found to have no significant relationship with the Perceived Climate Change Risk scale – PCR Total ($r = -.024$; $p = .780$), Change ($r = .015$; $p = .859$) or Impacts ($r = -.055$; $p = .521$).

Table 4.5

Correlation between Climate Change Knowledge and Perceived Hazard Characteristics

	PHC Consequences	PHC Impact	PHC Interests
Climate Change	.039	.147	.340**
Knowledge Total	.649	.087	.000

**. Correlation is significant at the 0.01 level.

As shown in Table 4.5, Climate Change Knowledge was found to only have one significant relationship with the Perceived Hazard Characteristic (PHC) Interests subscale (r = .340; p = .000). This correlation can be defined as positive and moderately significant. This positive relationship indicates that the more climate change knowledge an adolescent has, the higher their interests in climate change. Whereas the PHC Consequences (r = .039; p = .649) and Impact (r = .147; p = .087) was found to have no significant relationship with an adolescent's knowledge of climate change.

Table 4.6

Correlation between Climate Change Knowledge and Adolescent Functioning

	AF Oppositional Defiant Behaviour	AF Positive Development	AF Emotional Difficulties	AF Total
Climate Change	-.189*	-.110	-.077	-.190*
Knowledge Total	.027	.200	.372	.027

*. Correlation is significant at the 0.05 level

As illustrated in Table 4.6, Climate Change Knowledge was significantly correlated with two of the subscales in the Adolescent Functioning (AF) scale, specifically the AF Oppositional Defiant Behaviour (r = -.189; p = .027) and AF Total. (r = -.190; p = .027). The relationship between climate change knowledge and AF oppositional defiant behaviour can be defined as negative, which indicates that the more climate change knowledge an adolescent has, the less they will engage in oppositional defiant behaviours. Conversely, the less climate change knowledge they acquire, the more they engage in oppositional defiant behaviours. The relationship between Climate Change Knowledge and AF Total was negative, which indicates that the more climate change knowledge an adolescent has, the less an adolescent's Total Adolescent Functioning may be impacted. There was no significant relationship found between

Climate Change Knowledge and AF Positive Development (r = -.110; p = .200) as well as AF Emotional Difficulties (r = -.077; p = .372).

Table 4.7

Correlation between Perceived Climate Change Risk and Perceived Hazard Characteristics

Perceived Climate Change Risk	PHC Consequences	PHC Impact	PHC Interests
PCR Total	.499**	.686**	.379**
	.000	.000	.000
PCR Change	.489**	.654**	.392**
	.000	.000	.000
PCR Impacts	.458**	.645**	.330**
	.000	.000	.000

**. Correlation is significant at the 0.01 level.

Table 4.7 above illustrates numerous significant correlations between Perceived Climate Change Risk (PCR) and Perceived Hazard Characteristics (PHC), which are either weakly, moderately or strongly correlated. The PHC Interests were found to be weakly and positively correlated with PCR Total (r = .379; p = .000), PCR Change (r = .392; p = .000) and PCR Impacts (r = .330; p = .000). Whereas the PHC Consequences were moderately and positively correlated with PCR Total (r = .499; p = .000), PCR Change (r = .489; p = .000) and PCR Impacts (r = .458; p = .000). Lastly, the PHC Impacts were strongly and positively correlated with PCR Total (r = .686; p = .000), PCR Change (r = .654; p = .000) and PCR Impacts (r = .645; p = .000). The positive relationships found between the subscales indicates that the higher the level of concern regarding the perceived risk of climate change, the more interest shown to the topic. Furthermore, the higher the level of concern regarding the perceived risk, the more concerned an adolescent is about the direct impact climate change has on their lives.

Table 4.8

Correlation between Perceived Climate Change Risk and Adolescent Functioning

Perceived Climate Change Risk	AF Oppositional Defiant Behaviour	AF Positive Development	AF Emotional Difficulties	AF Total
PCR Total	.156	-.207*	.260**	.088
	.068	.015	.002	.306
PCR Change	.151	-.206*	.217*	.067
	.079	.016	.011	.439
PCR Impacts	.145	-.187*	.271**	.098
	.090	.029	.001	.257

*. Correlation is significant at the 0.05 level

**. Correlation is significant at the 0.01 level.

As shown in Table 4.8, Perceived Climate Change Risk (PCR) was significantly correlated with Adolescent Functioning (AF), specifically Positive Development and Emotional Difficulties. The relationship between AF Positive Development and PCR Total (r = -.207; p = .015), PCR Change (r = -.206; p = .016) and PCR Impacts (r = -.187; p = .029) was negatively related. The negative relationship indicates that the higher the level of concern regarding the perceived risks of climate change, the lower an adolescent's positive development. Contrastingly, AF Emotional Difficulties was found to have a positive relationship with PCR Total (r = .260; p = .002), PCR Change (r = .217; p = .011) and PCR Impacts (r = .271; p = .001). The positive relationship indicates that the higher the level of concern an adolescent has regarding the perceived risks of climate change, the more emotional difficulties they may experience. However, no significant relationship was found between the Perceived Climate Change Risk subscales and Oppositional Defiant Behaviour – PCR Total (r = .156; p = .068), Change (r = .151; p = .079) and Impacts (r = .145; p = .090). Adolescent Functioning Total and the Perceived Climate Change Risk subscales also resulted in no significant relationship – PCR Total (r = .088; p = .306), Change (r = .067; p = .439) and Impacts (r = .098; p = .257).

Table 4.9

Correlation between Adolescent Functioning and Perceived Hazard Characteristics

Adolescent Functioning	PHC Consequences	PHC Impact	PHC Interests
Oppositional Defiant	.163	.132	.109
Behaviours	.057	.124	.204
Positive	-.169*	-.337**	-.212*
Development	.048	.000	.013
Emotional	.281**	.267**	.144
Difficulties	.001	.002	.093
Total Function	.120	.010	.010
	.161	.903	.912

*. Correlation is significant at the 0.05 level

**. Correlation is significant at the 0.01 level.

As illustrated in Table 4.9, Adolescent Functioning (AF) was significantly correlated with some of the subscales in the Perceived Hazard Characteristics (PHC) scale. The AF Positive Development negatively correlated with the PHC Consequences (r = -.169; p = .048), PHC Impact (r = -.337; p = .000) and PHC Interests (r = -.212; p = .013). This negative relationship indicates that the higher level of concern relating specifically to the consequences, impact and interests of perceived risks, the lower an adolescent's positive development will be. Whereas AF Emotional Difficulties positively correlated with PHC Consequences (r = .281; p = .001) and PHC Impact (r = .267; p = .002). This positive relationship indicates that the higher level of concern regarding the consequences and impact of perceived risks, the more emotional difficulties adolescents will experience. There was no significant correlation between AF Emotional Difficulties and PHC Interest (r = .144; p = .093). Furthermore, there was no significant correlation found between with the Perceived Hazard Characteristics and AF Oppositional Defiant Behaviours, specifically PHC Consequences (r = .163; p = .057), Impact (r = .132; p = .124) and Interests (r = .109; p = .204), as well as Total Function – PHC Consequences (r = .120; p = .161), Impact (r = .010; p = .903) and Interests (r = .010; p = .912).

4.3.2 Multiple Regression

The multiple regression analysis was used to answer the fourth research question which focuses on whether there is a predictive relationship between climate change knowledge and perceived risk with an adolescent's psychosocial wellbeing. The multiple regression models were divided into four different regression models, which consisted of the following independent variables: The Climate Change Knowledge Total (CCK_Total), the Perceived Climate Change Risk Total (PCR_Total) and lastly, the Perceived Hazard Characteristics Consequence (PHC_Consequence), Impact (PHC_Impact) and Interest (PHC_Interest). The dependent variables were based on the Adolescent Functioning Scale (AFS) which measures an adolescent's psychosocial wellbeing, which was broken down into Oppositional Defiant Behaviours (AFS_ODB), Positive Development (AFS_PD), Emotional Difficulty (AFS_ED) and Total Functioning (AFS_TOT).

4.3.2.1 Oppositional Defiant Behaviour

The first regression model included the five independent variables (CCK_Total, PCR_Total, PHC_Consequence, PHC_Impact and PHC_Interest) as the predictor variables and oppositional defiant behaviour as the dependent variable. The model summary is shown in Table 4.10 below.

Table 4.10

Model 1 Summary

Model 1	R	R^2	Adjusted R^2	Std. Error	Sig.
	.297	.088	.053	7.016	.032

a. Predictors: (Constant), PHC_INT, PHC_CS, CCK_TOT, PCR_TOT, PHC_IMP

b. Dependent Variable: AFS_ODB

Table 4.11

Coefficients and Collinearity Diagnostics for Model 1

	Unstandardised		Standardised			Collinearity Diagnosis		
	B	Std. Error	Beta	t	Sig.	Tol.	VIF	CI/Cond. Ind.
(Constant)	22.274	3.705		6.012	.000			1.000
CCK_Total	-.928	.342	-.246	-2.714	.008	.850	1.176	8.338
PCR_Total	.013	.060	.026	.215	.830	.478	2.094	11.466
PHC_Consequence	.202	.166	.122	1.219	.225	.701	1.427	15.129
PHC_Impact	.012	.169	.009	.073	.942	.413	2.423	15.708
PHC_Interest	.341	.236	.151	1.449	.150	.641	1.561	19.925

The findings for the first multiple regression model (Model 1) are illustrated in Tables 4.10 and 4.11 above. As shown in Table 4.11, there is an absence of multicollinearity as the tolerance values are greater than to 0.1, the VIF values are less than 5 and the condition index values are less than 30.

As shown in Table 4.10, the first model was significant ($p = .032$) and 8.8% ($R^2 = .088$) of the variation in oppositional defiant behaviour is explained by the independent variables. Furthermore, the total climate change knowledge is the only predictor that is found to be significant ($t = -2.714$; $p = .008$) as illustrated in Table 4.11. The standardised Beta value for this predictor was negative ($\beta = -.928$), which indicates a negative relationship between oppositional defiant behaviour and climate change knowledge total. It is, however, important to note that this finding is interpreted with caution due to the reliability of the Climate Change Knowledge scale discussed above.

4.3.2.2 Positive Development

The second regression model included the five independent variables (CCK_Total, PCR_Total, PHC_Consequence, PHC_Impact and PHC_Interest) as the predictor variables and positive development (AFS_PD) as the dependent variable. The model summary is shown in Table 4.12 below.

Table 4.12

Model 2 Summary

Model 2	R	R^2	Adjusted R^2	Std. Error	Sig.
	.344[a]	.119	.085	6.933	.005

a. Predictors: (Constant), PHC_INT, PHC_CS, CCK_TOT, PCR_TOT, PHC_IMP

b. Dependent Variable: AFS_PSD

Table 4.13

Coefficients and Collinearity Diagnostics for Model 2

	Unstandardised		Standardised			Collinearity Diagnosis		
	B	Std. Error	Beta	t	Sig.	Tol.	VIF	CI/Cond. Ind.
(Constant)	35.311	3.661		9.644	.000			1.000
CCK_Total	-.187	.338	-.049	-.554	.580	.850	1.176	8.338
PCR_Total	.020	.060	.040	.336	.738	.478	2.094	11.466
PHC_Consequence	-.023	.164	-.014	-.138	.891	.701	1.427	15.129
PHC_Impact	-.437	.167	-.334	-2.620	.010	.413	2.423	15.708
PHC_Interest	-.069	.233	-.030	-.295	.768	.641	1.561	19.925

The findings for the second multiple regression model (Model 2) are illustrated in Table 4.12 and 4.13 above. As shown in Table 4.13, the tolerance values, VIF values and condition index values indicate that there is an absence of multicollinearity.

The second regression model was found to be significant (p = 00.5) as shown in Table 4.13. This model explains 11.9% (R^2 = .119) of the variation in positive development. As illustrated in Table 4.13, there was only one independent variable that was found to be a significant predictor, namely Perceived Hazard Characteristics Impact (t = -2.620; p = .010). The Beta value for the perceived hazard characteristics impact (PHC Impact) predictor was negative (β = -.334), which indicates there is a negative relationship between positive development and PHC Impact.

4.3.2.3 Emotional Difficulty

The third regression model included the five independent variables (CCK_Total, PCR_Total, PHC_Consequence, PHC_Impact and PHC_Interest) as the predictor variables and emotional difficulties (AFS_ED) as the dependent variable. The model summary is shown in Table 15 below.

Table 4.14

Model 3 Summary

Model 3	R	R^2	Adjusted R^2	Std. Error	Sig.
	.342[a]	.117	.083	5.866	.006

a. Predictors: (Constant), PHC_INT, PHC_CS, CCK_TOT, PCR_TOT, PHC_IMP

b. Dependent Variable: AFS_EDF

Table 4.15

Coefficients and Collinearity Diagnostics for Model 3

	Unstandardised		Standardised			Collinearity Diagnosis		
	B	Std. Error	Beta	t	Sig.	Tol.	VIF	CI/Cond. Ind.
(Constant)	11.686	3.098		3.772	.000			1.000
CCK_Total	-.384	.286	-.120	-1.343	.182	.850	1.176	8.338
PCR_Total	.026	.050	.061	.517	.606	.478	2.094	11.466
PHC_Consequence	.256	.139	.181	1.849	.067	.701	1.427	15.129
PHC_Impact	.135	.141	.122	.956	.341	.413	2.423	15.708
PHC_Interest	.108	.197	.056	.550	.583	.641	1.561	19.925

The findings for the third multiple regression model (Model 3) are illustrated in Tables 4.14 and 4.15 above. There is no level of multicollinearity when considering the tolerance values, VIF value and condition shown in Table 4.15.

As illustrated in Table 4.14, the third regression model was found to be a significant model ($p = .006$), where 11.7% ($R^2 = .117$) of the variation in emotional difficulty is explained by this

model. It is evident, as shown in Table 4.15, there were no significant predictors found amongst the individual independent variables.

4.3.2.4 Total Functioning

The fourth regression model (Model 4) included the five independent variables (CCK_Total, PCR_Total, PHC_Consequence, PHC_Impact and PHC_Interest) as the predictor variables and total functioning (AFS_TOT) as the dependent variable. The model summary is shown in Table 17 below.

Table 4.16

Model 4 Summary

Model 4	R	R^2	Adjusted R^2	Std. Error	Sig.
	.246[a]	.060	.025	13.703	.142

a. Predictors: (Constant), PHC_INT, PHC_CS, CCK_TOT, PCR_TOT, PHC_IMP

b. Dependent Variable: AFS_TOT

Table 4.17

Coefficients and Collinearity Diagnostics for Model 4

	Unstandardised		Standardised			Collinearity Diagnosis		
	B	Std. Error	Beta	t	Sig.	Tol.	VIF	CI/Cond. Ind.
(Constant)	69.271	7.236		9.573	.000			1.000
CCK_Total	-1.499	.668	-.206	-2.245	.026	.850	1.176	8.338
PCR_Total	.059	.118	.061	.501	.617	.478	2.094	11.466
PHC_Consequence	.436	.324	.136	1.346	.181	.701	1.427	15.129
PHC_Impact	-.290	.330	-.116	-.879	.381	.413	2.423	15.708
PHC_Interest	.381	.460	.088	.828	.409	.641	1.561	19.925

The findings for the fourth multiple regression model (Model 4) are illustrated in Table 4.16 and 4.17 above. As shown in Table 4.17, there is an absence of multicollinearity when monitoring the tolerance values, VIF value and condition.

As shown in Table 4.16, this model was not found to be significant (p = .142) as the p value was above the level of significance of 0.05. Although, there was one independent variable which was significant, namely climate change knowledge total (t = -2.245; p = .026). The Beta value (β = -.206) illustrated a negative relationship between adolescent functioning total and climate change knowledge total. As mentioned above, this independent variable should be interpreted with caution due to the internal consistency of the scale.

4.4 Conclusion

The results chapter provided an overview of the various significant correlations between the variables measuring climate change knowledge, perceived risk and psychosocial wellbeing. Although, the Climate Change Knowledge scale was found to have low reliability, there were correlations with Perceived Risk Interests, Adolescent Functioning (AF), Oppositional Defiant Behaviour and AF Total. Furthermore, Perceived Risk negatively correlated with AF Positive Development, and positively correlated with AF Emotional Difficulties. The multiple regression of this data set indicated that Climate Change Knowledge and the Perceived Risk, specifically the impacts, were the only two significant predictors of Adolescent Functioning.

CHAPTER 5: DISCUSSION

5.1 Introduction

A substantial amount of research regarding climate change in relation to psychology and the potential direct and indirect impact it may have on the global population has been emerging. Furthermore, it appears that empirical research conducted in South Africa is gradually emerging. There, however, seems to be no published research findings on the potential relationship between adolescents' knowledge of climate change, the perceived risk, and their psychosocial wellbeing.

The primary aim of this research study was to develop a greater understanding of the potential relationship between adolescents' knowledge of climate change, the perceived risk and their psychosocial wellbeing. Furthermore, it sought to investigate whether adolescents' psychosocial wellbeing could be predicted by their knowledge of climate change and the perceived risk. The total sample consisted of 137 participants from two private schools in South Africa from Grades 10 and 11. The participants of this study were obtained through a non-probability, purposive sampling approach.

The majority of the scales used in this research study, specifically Perceived Climate Change Risk, Perceived Hazard Characteristics measure and Adolescent Functioning scale, yielded relatively strong to moderate levels of internal consistency as the Cronbach's Alpha coefficients were between 0.747 and 0.920. However, the Climate Change Knowledge scale was the exception as the Cronbach's Alpha coefficient was below 0.7 ($\alpha = .56$). Furthermore, the Spearman-Brown coefficient and the Guttman Split-half coefficient showed slight improvements to the Climate Change Knowledge scale's level of internal consistency ($\alpha = .618$; $\alpha = .612$ respectively). As a result the Climate Change Knowledge scale was used with caution, as this scale was still deemed useful for this study. This scale gave an indication of the participants level of climate change knowledge, which is believed to potentially impact their perceived risk of climate change, as well as their psychosocial wellbeing. Furthermore, the findings between the scales will be discussed below, in which the nonsignificant findings will be briefly mentioned, and the significant findings will be discussed in more depth.

5.2 The Relationship between Knowledge of Climate Change, the Perceived Risk and Psychosocial Wellbeing

This research study aimed to investigate the potential nature of the relationship between adolescents' knowledge of climate change and the different aspects of the perceived risk of climate change (perceived climate change risk total, change and impacts as well as perceived hazard characteristics consequences, impact and interests) and their psychosocial wellbeing (oppositional defiant behaviour, positive development, emotional difficulties and total adolescent functioning). As mentioned above any relationship found between Climate Change Knowledge and either of the other scales or subscales were interpreted with caution due to the low reliability of the scale for this specific population group. The Pearson's correlation coefficients indicated that there were relationships between the variables (climate change knowledge, perceived risk and psychosocial wellbeing) that were either significantly or not significantly correlated. Furthermore, the significant correlations were either strongly, moderately or weakly correlated.

5.2.1 Climate Change Knowledge and Perceived Climate Change Risk

The first research question sought to establish whether there is a relationship between adolescents' knowledge of climate change and the risk they associate with it. The results indicated no significant relationship between adolescents' climate change knowledge and perceived risk, specifically the perceived risk total, change, impact, and consequences. This meant that adolescents' knowledge of climate change, regardless of the amount or level, does not have a significant impact on whether they view climate change as a risk. This finding supports the first alternative hypothesis (H_1) which indicated that there would be no significant relationship between the two variables mentioned above.

Other research studies conducted showed similar findings. For instance, Brody et al. (2008) also indicated that there is no significant relationship between climate change knowledge and the perceived risk people associate with it. Sullivan and White (2019, p. 451) further indicated that climate change knowledge deficits do not appear to impact the public's perception of the risk of climate change, which is rather impacted by their "diverging values".

In juxtaposition to the above, other research studies have suggested that climate change knowledge and risk perception are significantly correlated. Yu et al. (2020) found a significant correlation between risk perception and knowledge of climate change, which indicated the

higher the level of knowledge, the higher people would view climate change as a risk. The risk perception was specifically in relation to biodiversity threats (Yu et al., 2020). This finding is congruent with the study conducted by Van Der Linden (2015), where climate change knowledge was divided into the causes, impacts and responses to climate change. Furthermore, some studies have found there to be a significant relationship depending on the specific groups of people, where increased climate change knowledge led to higher concern for certain people in society, such as people who classify themselves as liberal (Malka et al., 2009; Menny et al., 2011). Other research studies, such as Kellstedt et al. (2008), have found climate change knowledge and risk perception to be negatively correlated. Therefore, the more climate change knowledge a person has, the less concern shown regarding the risks of climate change. In addition, Kellstedt et al. (2008) found that participants that were younger showed more concern regarding the risks of climate change compared to older participants. It is apparent that there are mixed findings regarding whether the relationship between climate change knowledge and risk perception is significant.

Interestingly, the findings of this study also indicated that there is a correlation between adolescents' climate change knowledge and the interest they show towards it and the risks associated with it. The correlation between these two variables was found to be positive. Therefore, this suggests that the more climate change knowledge an adolescent has the more interest they display regarding climate change and the associated risk. This meant that the more interest adolescents' display towards climate change and the associated risk, the more likely they are to expand on their climate change knowledge. This finding correlates with the traditional view of research, which proposes that interest is seen as an antecedent for the acquisition of knowledge (Laine et al., 2020). In juxtaposition, research has found that interest may rather be a by-product of knowledge acquisition, in which knowledge is described as the cause of the development of interest in a particular topic (Laine et al., 2020; Rotgans & Schmidt, 2017). Research has however placed more focus on the directionality of the relationship between interest and knowledge acquisition, in which a reciprocal relationship has been proposed (Laine et al., 2020; Rotgans & Schmidt, 2017). The reciprocal hypothesis states that interest and knowledge interact with each other as well as have an impact on the development of the other variable (Laine et al., 2020). This means that knowledge increases the amount of interest in a topic, and in turn interest causes the act of gaining more knowledge of a specific topic (Rotgans & Schmidt, 2017).

5.2.2 Climate Change Knowledge and Psychosocial Wellbeing

The second research question aimed to establish a potential significant relationship between adolescents' climate change knowledge and their psychosocial wellbeing. In this study the Adolescent Functioning scale was used to measure the adolescents' psychosocial wellbeing, which has been divided into oppositional defiant behaviour, positive development, emotional development and total functioning. In terms of the second hypothesis, the results support both of the proposed hypotheses (H_0 and H_1), as specific areas of functioning were found to either correlate, or not significantly correlate with climate change knowledge, which will be discussed below. It appears that the relationship between adolescents' knowledge of climate change and psychosocial wellbeing is dependent on the specific area of wellbeing which is focused on.

5.2.2.1 Oppositional Defiant Behaviour

Oppositional defiant behaviours are disruptive behaviours in which adolescents' engage in, such as: aggression, argumentativeness or disobedience (Dittman et al., 2017). The results of this indicated that there was a significant correlation between climate change knowledge and adolescent functioning (AF) as measured by the oppositional defiant behaviour section. Furthermore, the correlation between climate change knowledge and AF oppositional defiant behaviour was negative. This finding supports the second alternative hypothesis, specifically H_1, which stated that there is a significant relationship between adolescents' knowledge of climate change and their psychosocial wellbeing. Therefore, this meant that the more climate change knowledge an adolescent has, the less they would engage in oppositional defiant behaviours. Alternatively, this also suggested that adolescents engage in more oppositional defiant behaviours when they have lower levels of climate change knowledge or tend to display lower levels of climate change knowledge. Published research findings that demonstrate a potential relationship between climate change knowledge and oppositional defiant behaviours, also defined as disruptive behaviours, could not be found.

Research studies have however focused on how climate change knowledge and risk perceptions influences certain behaviours which may address and mitigate climate change, such as using public transport, energy conservation or recycling (Valdez et al., 2018). Stevenson et al. (2014) found that adolescents with lower levels of climate change knowledge were more likely to adopt climate change scepticism. It would therefore be expected that adolescents with higher levels of scepticism to engage less in pro-environmental behaviours to mitigate climate change. Whereas, Taber and Taylor (2009) found that adolescents perceived risk of climate change was

a driving force for engagement in climate change behaviours. These findings were supported by the research study of Harker-Schuch and Bugge-Henrikensen (2013), in which climate change knowledge was found to be a motivator of behavioural changes towards climate change mitigation. Further research is required to investigate this relationship between knowledge of climate change and oppositional defiant behaviours or disruptive behaviours.

5.2.2.2 Positive Development

Positive development can be defined as a broad range of skills which adolescents develop to function in society. This refers to behaviours which are associated with effective social skills, resilience, coping skills, decision-making, self-regulation and positive engagement with family, friends and society (Dittman et al., 2017). The results of this study found that there was no significant relationship between adolescents' climate change knowledge and positive development. This meant that adolescents' level of acquired knowledge of climate change has no meaningful impact on their positive development. This finding supports the second null hypothesis (H_0) which states that there is no relationship between adolescents' knowledge of climate change and their psychosocial wellbeing. Conversely, Ojala (2013) found a possible correlation between climate change knowledge and problem-focused coping used by adolescents. Another study by Ojala (2012b) however, found that problem-focused coping leads to negative emotions, such as depression and anxiety. This type of coping focuses on addressing the stressor or issue, such as creating an action plan or searching for information to find a possible solution (Ojala, 2012b). Whereas adolescents who engaged in meaning-focused coping, were more likely to experience positive affect, optimism and a higher level of satisfaction in their lives (Ojala, 2012b). Meaning-focused coping involves reappraisal, acknowledging the stressor, identifying one's values and beliefs as well as creating a long-term action plan (Ojala, 2012b, 2013).

5.2.2.3 Emotional Difficulties

Emotional difficulties focus on possible internalised experiences related to mental health problems which adolescents experience, such as anxiety and depression (Dittman et al., 2017). This study indicated that there is no significant relationship between adolescents' knowledge of climate change and their emotional difficulties. Therefore, indicating that adolescents' level of acquired knowledge relating to climate change has no influence on the development of emotional difficulties. This is supported by the second null hypothesis, specifically H_0, which states that there is no significant relationship between the two variables mentioned.

5.2.2.4 Total Functioning

Despite these findings, climate change knowledge was found to be significantly correlated to the adolescents' total functioning. The results indicated that there was a negative correlation between climate change knowledge and total adolescent functioning. In addition, this finding is supported by the second alternative hypothesis, H_1, as there is a significant relationship. This meant that the more climate change knowledge adolescents' have, the less impacted their overall functioning would be. Alternatively, this would mean their overall functioning would be more impacted, if they were to have less knowledge relating to climate change.

This was an interesting finding, because, research studies have suggested that knowledge of climate change may cause psychological distress (Gibson et al., 2020). Gibson et al. (2020) found that the knowledge of climate specifically related to the threats, causes psychological or emotional distress for society, which impacts their mental health. Researchers have anticipated that knowledge of climate change may cause various emotional responses such as stress, anxiety, depression, guilt and grief (Clayton, 2019). Conversely, the findings from this study suggest that when adolescents have a sufficient level of climate change knowledge, their overall functioning is less likely to be negatively affected. One explanation might be found in the work of Geiger et al. (2019) which stated that the more climate change knowledge a person has, they more they are likely to engage in pro-environmental behaviours, which in turn may ease possible negative emotional responses, such as stress or anxiety (Geiger et al., 2019).

5.2.3 Perceived Climate Change Risk and Psychosocial Wellbeing

The third research question sought to determine whether there is a potential relationship between adolescents' perceived climate change risk and their psychosocial wellbeing. It would appear there is limited empirical research conducted on the potential correlations between adolescents' risk perception and psychosocial functioning. In this study, there were only two adolescent functioning (AF) subscales, specifically positive development and emotional difficulties, that were found to significantly correlate with the other scales. The correlations were between either AF positive development or emotional difficulties and the perceived climate change risk (PCR) scale (total, impacts and change) as well as the perceived hazard characteristics (PHC) measure (consequences, impact and interests).

5.2.3.1 Oppositional Defiant Behaviour

The results of this study showed that there was no significant relationship between adolescents' perceived risk and their engagement in oppositional defiant behaviours. This illustrates that adolescents' risk perception of climate change has no impact on their engagement in oppositional defiant behaviours, also referred to as disruptive behaviours. This finding is in alignment with the third null hypothesis (H_0) which stipulates that there is no significant relationship between the risk adolescents' associate with climate change and their psychosocial wellbeing.

5.2.3.2 Positive Development

This study found that positive development was correlated with all PCR (Perceived Climate Change Risk) subscales – total, impacts and change. The correlation between these variables was found to be negative. This suggests that the more an adolescent perceives the total risk, impact or change of climate change, the less positive developmental behaviours they will engage in. Conversely, the less an adolescent perceived the risk of climate change (total risk, impact or change), the more they will engage in positive developmental behaviours. Furthermore, the findings also indicated that positive development was negatively related to PHC (Perceived Hazard Characteristics) consequences, impact and interests. This indicates that the more positive development an adolescent shows, the less likely they are to perceive climate change and its consequences and impact as a potential risk, and they are less likely to show interests in it. Alternatively, the more adolescents perceive the characteristics (consequences, impacts and their interests) of climate change as risky, the less likely they will engage in positive developmental behaviours. These findings are in support of the third hypothesis (H_1) which states that there is a significant relationship between the risk adolescents' associate with climate change and their psychosocial wellbeing.

In contrast, Yang et al. (2014) found that risk perceptions may potentially elicit a negative emotional response, which in turn leads to the intention of engaging in pro-environmental behaviours. Additionally, this finding is supported by various studies, such as Liobikienė and Juknys (2016) suggesting that university students who better understand the perceived risk of climate change, engage in pro-environmental behaviours. Whereas, Kellstedt et al. (2008) suggested that the risk of climate change is considered to be a higher level of concern when an individual has a higher perceived personal efficacy and acceptance of climate change. Furthermore, they are also more likely to act on these perceived risks (Kellstedt et al., 2008).

Research suggests that the link between perceived risk and climate change behaviour is an individual's ability to cope with the impact of climate change (Clayton, 2020). Research illustrated that a person has a higher level of willingness to behavioural change to mitigate climate change when they perceive the risk of climate change to effect themselves or their family (Brody et al., 2012).

5.2.3.3 Emotional Difficulties

This study found a positive correlation between emotional difficulties and the PCR total, impacts and change subscales. Thus, indicating the more adolescents perceive climate change to be a risk to them and to impact them negatively, the more emotional difficulties they are likely to experience. Therefore, higher levels of risk perception relating to climate change results in adolescents experiencing higher levels of emotional difficulties such as: concern, anxiety and depression. In addition, emotional difficulties were also found to be positively related to the PHC consequences and impact. This indicates that the more adolescents perceive the consequences and impact of climate change as a risk, the more emotional difficulties they may experience. Both findings support the third hypothesis (H_1) which stipulates that there is a relationship between the risk adolescents' associate with climate change and their psychosocial wellbeing.

Research indicates that people are more likely to have an immediate emotional response to climate change when they have personally experienced the consequences of climate change (Helgeson et al., 2012; Van Der Linden, 2014; Weber, 2010). Furthermore, Van Der Linden (2014) suggests that the negative emotional responses experienced will impact the risk perception one forms regarding climate change.

On the other hand, Ejelöv et al. (2018) in their research study focused more on how the consequences of climate change impact one's emotional response and emotional regulation strategies, such as psychological distance. Psychological distance was described to be employed as a strategy to avoid the emotional intensity attached to the perception of potential climate change consequences. Furthermore, Ejelöv et al. (2018) found that the perception of climate change consequences elicits self-conscious emotions (such as shame or guilt) more than basic emotions (such as anger or fear). In addition, they found that there was no significant relationship between the perception of climate change consequences and intense basic emotions, indicating that the perceived consequences do not elicit basic emotions (Ejelöv et

al., 2018). Whereas, other studies have found the emotions of a person cause little variance in their risk perception, which potentially indicates that there is no significant relationship between the two variables (Sjöberg, 2006). Furthermore, Sjöberg (2006) suggested that one should rather focus on the measure of attitude, which appears to be an important determinant of risk perception.

5.2.3.4 Total Functioning

Finally, the results indicated that there was no significant relationship between adolescents' risk perception and their total functioning. Therefore, adolescents' overall functioning is not impacted by their perceived risk of climate change. This is supported by the third null hypothesis (H_0) which states that there is no relationship between the risk adolescents' associate with climate change and their psychosocial wellbeing.

5.3 Factors predicting an adolescent's psychosocial wellbeing

Multicollinearity was first tested for and ruled out as there were various relationships found between climate change knowledge, perceived climate change risk, perceived hazard characteristics measure, adolescent functioning, and the various subscales. Consequently, four regression models were calculated to determine whether there was a predictive relationship between the scales and an adolescent's psychosocial wellbeing. The regression models all consisted of five independent variables: The Climate Change Knowledge Total (CCK_Total), the Perceived Climate Change Risk Total (PCR_Total) and lastly, the Perceived Hazard Characteristics Consequence (PHC_Consequence), impact (PHC_Impact) and Interest (PHC_Interest). Whereas the dependent variable was based on the Adolescent Functioning Scale (AFS) which measured an adolescent's psychosocial wellbeing, which was divided into Oppositional Defiant Behaviours (AFS_ODB), Positive Development (AFS_PD), Emotional Difficulty (AFS_ED) and Total functioning (AFS_TOT).

There was one out of the three models that was not significant, specifically AF total functioning. The coefficients of determination (R^2) ranged between 6 and 11.9 percent, indicating that 6 to 11.9 percent of the variation of the predictor variables are explained by the independent variables. There were only three negative predictive relationships that were found in three of the models. The first regression model illustrated that the total climate change knowledge is a significant, negative predictor of AF oppositional defiant behaviour. The second regression model found perceived hazard characteristics impact to be a significant,

negative predictor of AF positive development. Whereas the third regression model was found to be significant, there were however no significant predictors found for AF emotional difficulties. Furthermore, the last regression model was not found to be significant. However, climate change knowledge was found to be a significant, negative predicator of total adolescent functioning.

Research shows that there are various types of predictive relationships when looking at climate change knowledge, perceived risk, emotions, affect and overall functioning. Research is continuously emerging which illustrates the important role that emotions and affect have on shaping climate change risk perceptions, which earlier research deemed as less important (van Eck et al., 2020). Van Eck et al. (2020) found that emotions and affect was in fact the strongest predictor of risk perception of climate change. This finding was reiterated by a study conducted by Xie et al. (2019), who also found that affect to be a strong predictor of risk perception as well as behavioural willingness – the likelihood of a person performing a certain behaviour. This study found that the risk perception relating to the impact of climate change negatively predicts an adolescent's positive development. This finding suggests that an adolescent's positive development is negatively impacted when there is a higher level of perceived risk regarding the impact of climate change. Furthermore, Brody et al. (2012) found that personal efficacy is a strong predictor of the perceived risk associated with climate change – suggesting that a person is more likely to view climate change as a great risk or concern if their perceived personal efficacy is high. Whereas Van Der Linden (2015) illustrated that higher affect negative emotions or affect, relating to climate change, was found to be a significant predictor of increased risk perception. In addition, risk perception was also found to negatively predict emotions and affect (Van Der Linden, 2014).

A study conducted by Sundblad et al. (2007) found climate change knowledge to be a strong predictor of affective risk judgement, specifically worry about climate. Furthermore, the findings revealed that there were specific aspects of climate change that impacted affective risk judgements in different ways (Sundblad et al., 2007). Climate change knowledge of the causes and consequences were found to have more of an effect than other aspects of climate change (Sundblad et al., 2007).

Previous studies investigated the possible predictive relationship between the perceived risk of climate change and the behavioural willingness. Leiserowitz (2006) found risk perception to be a strong and important predictor of the willingness to help reduce the effects of climate

change. Whereas the present study found no significant predictive relationship between risk perception and oppositional defiant behaviour, which may inform research by suggesting that a person's perceived risk is uninfluential of engagement in negative behaviours. Furthermore, research has indicated that the perceived risk of climate change is suggested to be an influential factor of climate change behaviour amongst adolescents (Ojala, 2012a; Taber & Taylor, 2009).

It is important to note that various research studies have investigated the potential predictive relationship between climate change knowledge and risk perception, which indicated that climate change knowledge is a strong predictor for risk perception (Aksit et al., 2018; van Eck et al., 2020; Yu et al., 2020). There were various research studies that indicated the higher an individual's knowledge of climate change, the higher level of perceived risk regarding climate change (Aksit et al., 2018; Sundblad et al., 2007; Tobler et al., 2012). Tobler et al. (2012) found that a person's climate change knowledge about the causes and consequences impacts the person's level of concern regarding climate change. The climate change knowledge scale however was found to have a low level of internal consistency in this study as aforementioned. As a result, a multiple regression model was not calculated with climate change knowledge as the dependent variable, as caution was used whenever making interpretations with this specific scale.

5.4 Conclusion

This study sought to gain a greater understanding of the potential relationship between adolescents' knowledge of climate change, the perceived risk and their psychosocial wellbeing. The discussion revealed that adolescents' climate change knowledge has an impact on their perceived risk of climate change, which is either negatively or positively associated with their psychosocial wellbeing. In addition, adolescents' psychosocial wellbeing was found to be predicted by climate change knowledge and the impacts of the perceived risks impacts. The following chapter will focus on the final conclusions of the research findings, which specifically focus on the strengths, limitations and recommendations for future research as well as educational psychologists.

CHAPTER 6: CONCLUSION, LIMITATION AND RECOMMENDATIONS FOR FUTURE RESEARCH AND EDUCATIONAL PSYCHOLOGISTS

This study aimed to investigate the potential relationship between adolescents' knowledge of climate change, the associated perceived risks, and their psychosocial wellbeing. The findings indicated that there is a significant and positive relationship between climate change knowledge and adolescents' interests regarding the perceived risks. Therefore, suggesting that the more climate change knowledge an adolescent has the more interest they display regarding climate change and the associated risk. Furthermore, adolescents' climate change knowledge was found to negatively correlate with oppositional defiant behaviour, which meant the more climate change knowledge an adolescent has, the less they would engage in oppositional defiant behaviours. Climate change knowledge was also found to negatively correlate with adolescents' total functioning. Therefore, the more climate change knowledge adolescents' have, the less impacted their overall functioning would be. Additionally, a negatively significant relationship was found to exist between positive development and the perceived climate change risk, which indicates that the more an adolescent perceives the total risk, impact or change of climate change, the less positive development they will engage in. Whereas a positive correlation was found between adolescents' emotional difficulties and their perceived climate change risks, which meant the more an adolescent perceives the total risk, impact and change of climate change, the more emotional difficulties they may experience.

Lastly, this study illustrated the potential predictive relationship between the variables and the adolescents' psychosocial wellbeing. There were however only three negative predictive relationships that were found within two significant models and one model that was not significant. Climate change knowledge was found to be a significant predictor of adolescents' oppositional defiant behaviour. The impacts of perceived hazard characteristics were found to be a significant predictor of adolescents' positive development. Whereas the last model was not found to be significant, although it indicated that climate change knowledge is a negative predictor of adolescents' total functioning.

The results indicate that further research within the South African context and across different school settings is important, to establish richer data which will potentially enhance the results of this study.

6.1 Strengths

This study proved useful in determining whether there is a relationship between adolescents' climate change knowledge, the perceived risks of climate change and their psychosocial wellbeing. Furthermore, the nature of the potential relationship between these variables was established. The following strengths can be elicited when taking into account the findings of this study.

This study is contributing to the body of research and literature which focuses on climate change and psychology specifically in South Africa, which appears to be slowly emerging. Furthermore, this specific topic is one of the first to focus on the interrelationship between adolescents' knowledge of climate change, the perceived risk and their associated psychosocial wellbeing as well as the nature of the relationship. This research study has demonstrated the importance of adolescents' knowledge of climate change as well as the effect it has on their psychosocial wellbeing, such as whether they are more or less likely engage in oppositional defiant behaviours, which is dependent on their level of climate change knowledge.

These findings potentially show the importance of implementing climate change education in school curriculums as this will contribute to the development and enhancement of adolescents' knowledge of climate change. This will possibly reduce the engagement in oppositional defiant behaviours and increase total adolescent functioning. Furthermore, adolescents' climate change knowledge was also found to predict oppositional defiant behaviour. The findings have also shown how adolescent's interest in climate change is linked to their knowledge, which in turn potentially leads to pro-environmental behaviours. In addition, the findings revealed that adolescents' psychosocial wellbeing, specifically positive development and emotional difficulties, are influenced by their perceived risks of climate change. Adolescents' risk perception was also found to be a predictor of positive development.

6.2 Limitations

Although this study provided important findings that potentially contribute to the body of research focusing on climate change and psychology in South Africa, there were a few limitations. The first limitation was the fact that the questionnaire was self-reported, which may contribute to social desirability bias (Caputo, 2017). This meant that the participants may have provided socially desirable answers to appear as if their experience or wellbeing is worse or better compared to their reality (Larson, 2019). This may have been the case with the non-

significant relationships found between climate change knowledge and psychosocial wellbeing, specifically positive development and emotional difficulties, in addition to the non-significant relationship between adolescents' perceived risk and oppositional defiant behaviours as well as total functioning.

The second limitation would be the climate change knowledge scale which was found to have low reliability. This meant that the findings associated with this scale were always interpreted with caution as the scale was unsuitable for the target group. Therefore, it would be important for future studies to ensure that all scales used for collecting data are reliable. It would be recommended for future studies to consider using alternative instruments to measure climate change knowledge. Furthermore, these future studies would first need to pilot the instruments to avoid using an instrument with a low reliability level. Unfortunately, the researcher for this research study was unable to conduct a pilot study due the COVID-19 pandemic and the limited time available to have contact with an appropriate sample group.

The initial methods used for data collection can be classified as an additional limitation, specifically the online SurveyMonkey questionnaire. The online questionnaire was used to gain access to participants with the aim to limit face-to-face contact due to the circumstances of COVID-19. Unfortunately, this method was unsuccessful as none of the participants responded to the URL link. Therefore, the online method had to be entirely changed which resulted in a further delay.

The use of private schools further limits the generalisability of the findings as the population group is narrowed down to a specific area and demographic. Therefore, the non-probability, purposive sampling technique only allows for certain individuals to be selected to participate in the study, in which an unknown proportion is excluded (McEwan, 2020). This would mean the findings of the study may not be a true or accurate representation of the population, specifically all adolescents in South Africa.

Another limitation was the inability to make any comparative analyses of the interrelationship between adolescents' knowledge of climate change, the perceived risk and associated psychosocial wellbeing, as there is no research which focuses specifically on all three variables – internationally or locally. Therefore, this made it difficult to evaluate the findings across settings or within a South African context.

6.3 Recommendations for future studies

Firstly, it would be recommended for future research studies to focus on replicating this topic in a South African context. It is suggested for a larger sample size to be obtained which will ensure that the adolescent sample is more representative of a greater adolescent population in South Africa. This should include exploring differences in demographics, including gender, ethnicity and home language. Furthermore, it would be essential for the sample to be obtained from different regions, urban and rural areas, as this will provide valuable insight into how adolescents' climate change knowledge potentially impacts their perceived risk and psychosocial wellbeing. The sample should also be obtained from both private and government schools, which may focus on the different types and levels of education; this will improve the quality of the sample population. Therefore, allowing for the generalisability to be increased within the South African context.

A second recommendation would be for researchers to find or adapt a scale measuring climate change knowledge that is suitable for the South African adolescent population. This will allow for more of an accurate and representative interpretation to be made based on the possible findings. This may be achieved by conducting a pilot study prior to data collection, where the scales are analysed through the SPSS to determine reliability.

6.4 Recommendations for educational psychologists and others working with adolescents

As such, it would be important for educational psychologists to consider working on different systematic levels to create an awareness of climate change and possible mitigation strategies. Educational psychologists can work collectively with the Department of Education to plan, create and implement climate change policies. At a school level, it would be recommended for educational psychologists to work with schools and the learners collaboratively and practically. This may include conducting a needs analysis with learners which will focus on potential strategies that can potentially be implemented at their school, which may include mitigation and prevention. The school, learners and educational psychologist would then work together to implement the different strategies which focus on prevention, mitigation or creating an awareness. This will provide learners with the opportunity to participate meaningfully with their schools and teachers to help encourage pro-environmental behaviours. This may in turn enhance their knowledge of climate change and the perceived risks as well as help reduce climate change.

It would also be recommended for educational psychologist to work within communities to create an awareness of climate change and mitigation strategies. Educational psychologists should adopt more of a participatory action approach when facilitating collaboration with the adolescents within communities. The focus of such work should be on community members, with adolescents and educational psychologists working together as collaborative agents of change within that specific community. This will provide them the opportunity as a team to plan and implement possible mitigation strategies which are relevant for them as a community. Furthermore, this may create an awareness and enhance their knowledge of climate change, the associated risks and ways in which they engage in pro-environmental behaviours in ways which are manageable and relevant.

6.5 Conclusion

This chapter has provided a conclusion of the research findings with particular focus on the strengths and limitations of the study, as well as recommendations for future research, educational psychologists and other professionals working with adolescents. The findings indicated that further research in the South African context and across various school settings is required to gather richer data. This will therefore contribute to the climate change literature as well as enhance the understanding of the potential impact adolescents' climate change knowledge and perceived risk has on their psychosocial wellbeing.

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APPENDICES

Appendix A - Questionnaire

The Relationship Between Adolescents' Knowledge of Climate Change, Perceived Risks and Psychosocial Wellbeing.

Demographic Information

Age (Please tick [x] as appropriate)	14 years		
	15 years		
	16 years		
	17 years		
	18 years		
	19 years		
	Other (please specify)		
Gender (Please tick [x] as appropriate)	Male	Female	Other
Grade (Please tick [x] as appropriate)	Grade 10		
	Grade 11		
	Grade 12		
	Other (please specify)		

Climate Change Knowledge Scale:
Mark the appropriate box with X.

		True	False	I don't know
1.	The Earth's temperature has not increased since 1990.			
2.	The Earth's temperature has increased by at least 0.8 °C since 1900.			
3.	The Earth's temperature has increased by 2 °C since 1900.			
4.	Climate change is a hoax (trick) invented by scientists to collect funds for research.			
5.	Scientists generally agree about the reality of climate change.			
6.	The Earth has always had warmer and colder cycles, which is what is happening now.			
7.	Greenhouse gases, from human activities, are responsible for climate change.			
8.	The heat coming out of the exhaust pipe is what is warming the atmosphere.			
9.	The most common form of fossil fuel is coal.			
10.	Carbon dioxide (CO_2) comes from the combustion of fossil fuels.			
11.	Carbon dioxide (CO_2) is a greenhouse gas, so more CO_2 means higher temperatures.			

Perceived Climate Change Risk Scale:
Please rate your level of concern that the following environmental changes will occur in your community over the next 15-20 years (approximately 2030).

A local increase in:		**Not concerned**	**Slightly concerned**	**Somewhat concerned**	**Moderately concerned**	**Very concerned**	**Extremely concerned**
a.	Drought						
b.	Land subsidence/ collapsing						
c.	The number of extreme weather events						
d.	The strength of intense thunderstorms						
e.	Extreme temperature levels						
f.	Extreme water shortages						
g.	Severe air pollution						

Please rate your level of concern that the following climate change impacts will occur in your community over the next 15-20 years (approximately 2030).

		Not concerned	**Slightly concerned**	**Somewhat concerned**	**Moderately concerned**	**Very concerned**	**Extremely concerned**
a.	An increase in the intensity of flooding events						
b.	An increase in the number of flooding events						
c.	Public and health safety issues (asthma, allergies, diseases etc.)						
d.	Sodium chloride affecting freshwater						
e.	Economic losses (jobs, businesses, tourism)						
f.	Loss of inhabitable land						

g.	Loss of wetland habitat (lakes or rivers)						
h.	Infrastructure and property damage						

Perceived Hazard Characteristics Measure:
Answer the following questions by marking the appropriate box(es) with an X.

How likely is it that the following will occur as a result of climate change:

		Extremely unlikely	**Unlikely**	**Probably unlikely**	**Probably likely**	**Likely**	**Extremely likely**
a.	My standard of living will decrease.						
b.	Water shortages will occur where I live.						
c.	I will be hurt/suffer financially.						
d.	My chances of getting a disease will increase.						

I am concerned about the impact climate change has on:

		Not concerned	**Slightly concerned**	**Somewhat concerned**	**Moderately concerned**	**Very concerned**	**Extremely concerned**
a.	Me and my family.						
b.	My local community.						
c.	South Africa as a whole.						
d.	People all over the world.						
e.	Nature (not including people).						

To me, the topic of climate change is:

		Not	**Slightly**	**Somewhat**	**Moderately**	**Very**	**Extremely**
a.	Important						
b.	Interesting						
c.	Relevant						

Appendix B – Information form for schools

University of the Witwatersrand,
School of Human and Community Development
Tel: (011) 717-4500
Fax: (011) 7174599

Dear Sir/Madam,

Re: Permission to conduct research

My name is Tayla Rosslee. I am a student at the University of Witwatersrand studying Master of Education in Educational Psychology in the School of Human and Community Development. I am seeking permission to do research at your school (school's name).

I am conducting research as part of the requirements for my master's degree. My research study aims to investigate the potential relationship between an adolescent's knowledge of climate change, perceived risk and psychosocial wellbeing (cognitive, emotional, behavioural and social factors). Climate change is becoming a concern on a global scale. Furthermore, adolescents are a vulnerable population due to their ongoing development. Therefore, it is important to gain an understanding of the factors, such as climate change, that may have a detrimental impact on an adolescent's psychosocial wellbeing. This study will be assessing an adolescent's understanding of the potential impacts on their psychosocial wellbeing.

The research will entail collecting data from pupils ranging from Grade 10-12. Participation is completely voluntary, and participants are given the right to withdraw at any given point prior to, during or after the study. The pupils will be asked to complete a paper-based questionnaire, which will take approximately 15 minutes. The completion of the questionnaire would take place on the school premises during school hours. Refreshments will be available for the pupils who participate.

The parents will be asked to give their informed consent for their child to participate before the research begins. Their responses will be treated confidentially, and identities (their names and the school's name) will be anonymous. Individual privacy will be maintained in all published and written data resulting from the study.

A summary of the results will be forwarded to you once the research report has been completed. The results may potentially be published as a journal article in the future.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this study without any penalty. There are no foreseeable risks in participating in this study.

I therefore request permission in writing to conduct my research at your school. The permission letter should be on your school's headed paper, signed and dated, and specifically referring to myself by name and the title of my study.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,

Tayla Rosslee

Tayla Rosslee
+27 60 500 6188
847321@students.wits.ac.za

Ms Adri Vorster
Adri.Vorster@wits.ac.za

Appendix C – Information form for parents

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT
PSYCHOLOGY

University of the Witwatersrand,
School of Human and Community Development/Department of Psychology
Tel: (011) 717-4500
Fax: (011) 717-4599

THE RELATIONSHIP BETWEEN ADOLESCENTS' KNOWLEDGE OF CLIMATE CHANGE, PERCEIVED RISK AND PSYCHOSOCIAL WELLBEING: PARENT/LEGAL GUARDIAN INFORMATION LETTER

Dear Sir/Madam,

My name is Tayla Rosslee and I am a student at the University of Witwatersrand studying Master of Education in Educational Psychology in the School of Human and Community Development. As part of my studies, I must complete a research project under the supervision of Ms. Adri Vorster. The title of the research is "The Relationship between Adolescents' Knowledge of Climate Change, Perceived Risk and Psychosocial Wellbeing". The focus of this research study is on the relationship between adolescents' knowledge of climate change, perceived risks, and the impact thereof on their psychosocial wellbeing (cognitive, emotional, behavioural and social factors). Globally, climate change is becoming a great concern. Furthermore, adolescents are a vulnerable population due to their ongoing development. Therefore, it is important to gain an understanding of the factors, such as climate change, that may have a detrimental impact on an adolescent's psychosocial wellbeing. To conduct my research, I will need a group of participants from various mainstream private schools in Johannesburg. Taking this into consideration, I would like to invite your child to partake in my research.

Should you give consent for your child to participate, they will be given a URL link to an online questionnaire on SurveyMonkey, which will take approximately 10-15 minutes to complete. The questionnaire consists of true or false questions related to basic knowledge of climate, a level of concern on the risk of climate change and questions relating to the adolescents' thoughts, emotions and behaviours.

Participation in this study is completely voluntary. I do not foresee any risks to your child partaking in this research and should you and/or your child choose not to participate, there will be no disadvantages or penalties. Additionally, there will be no benefits to partaking in this study and you and/or your child will not be remunerated in any manner.

The details of all participating schools, all participating children and their parents/legal guardians, as well as all responses to the research questionnaire, will be treated confidentially, with all identities and responses kept anonymous. No identifying information will be requested as part of the questionnaire; hence, children will be able to remain anonymous. Should children include any identifying information, this will be removed once data is transferred to an Excel spreadsheet for analysis; ensuring anonymity and confidentiality. All IP addresses will also be removed.

Prior to the submission of the online questionnaires, all parents/legal guardians, children and schools have the right to withdraw from the study without any penalty. However, please note that once children have submitted their responses, they will no longer be able to withdraw from the study as these will be submitted anonymously and the researcher will not be able to link a particular child to particular

responses or a particular school. Children have the right not to answer any questions which they do not feel comfortable with.

The results of the study will be compiled into a master's research report, which will be available online on the University of Witwatersrand Repository on WIReDSpace. The results may potentially be published as a journal article in the future and/or presented at a conference. Data will be kept for 5 years on a password protected laptop with all identifying features removed and might be used as part of other research projects in future. An executive summary of the research findings will be made available to all participating schools. Should you wish to access this summary, please contact me via email in March 2021 when the study should be completed. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non- Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Should you consent for your child to be approached to partake my research, please read and sign the attached consent form electronically. Please email this back to me at your earliest convenience. Should you wish you can also email me written consent once reading the attached consent form. Only once I receive written electronic consent from you will I post the stated link to your children. Your child will be informed that once he/she submits his/her responses, this will be considered assent for participation in this study.

If you require any further information, please contact me directly on the contact details provided.

Thank you.

Tayla Rosslee
Researcher and M.Ed Student
+27 60 500 6188
847321@students.wits.ac.za

Adri Vorster
Research Supervisor
011 717 4554
adri.vorster@wits.ac.za

Appendix D – Consent form

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT
PSYCHOLOGY

THE RELATIONSHIP BETWEEN ADOLESCENTS' KNOWLEDGE OF CLIMATE CHANGE, PERCEIVED RISK AND PSYCHOSOCIAL WELLBEING: PARENT/LEGAL GUARDIAN CONSENT FORM

I, _____, parent/legal guardian of _____, currently in Grade ____, hereby give consent for Tayla Rosslee to include my child in her research on the relationship between adolescents' knowledge of climate change, perceived risk, and impact thereof on their psychosocial wellbeing.

I understand that:

- My child will be asked to complete an online questionnaire on SurveyMonkey consisting of true or false questions related to basic knowledge of climate, a level of concern on the risk of climate change and questions relating to my child's thoughts, emotions and behaviours.
- Participation is completely voluntary and there are no foreseeable risks or benefits for partaking in the research study. My child and I will not be remunerated in any way for partaking in this study.
- My child and I can choose not to partake in this research without any consequence.
- The research does not expose my child or his/her school to any foreseeable risk.
- Prior to the submission of the online questionnaires, my child, his/her school, and I have the right to withdraw from the study without any penalty. However, I understand that once my child has submitted his/her responses, we will no longer be able to withdraw from the study as these will be submitted anonymously and the researcher will not be able to link a particular child to particular responses or a particular school.
- My child does not have to answer any questions they do not feel comfortable with.
- My child's and the school's information will be treated as confidential. Anonymity and confidentiality will be ensured in the final research report as nothing that can identify my child, or the school will be included in this report and/or any further publications or presentations that may arise from the study.
- My child is not required to include any identifying information in his/her responses, and should he/she accidently do this, the researcher will delete it once data is transferred onto an Excel spreadsheet for analysis. IP addresses will also be deleted.
- The results of the study will be compiled into a master's dissertation, which will be available online on the WITS Institutional Repository environment on WIReDSpace.
- Data will be kept for 5 years on a password protected laptop with all identifying features removed and might be used as part of other research projects in future.

- ☐ Results of the study may potentially be published as a journal article and/or presented at a conference.
- ☐ The school will be provided with an executive summary of the research results. Should I wish to access this, I can contact the researcher in March 2021.
- ☐ Once I send this electronically signed consent form or an email indicating my consent back to the researcher, my child will receive a link to complete the questionnaire online. My child will be informed that once he/she submits his/her responses, this will be considered as assent for participation in this study.

_____ _____

Parent/Legal Guardian's Signature Researcher's Signature

Date: _____

Appendix E – Information form for participants

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT
PSYCHOLOGY

University of the Witwatersrand,
School of Human and Community Development
Tel: (011) 717-4500
Fax: (011) 7174599

THE RELATIONSHIP BETWEEN ADOLESCENTS' KNOWLEDGE OF CLIMATE CHANGE, PERCEIVED RISK AND PSYCHOSOCIAL WELLBEING: PARTICIPANT INFORMATION SHEET

Dear Learner,

My name is Tayla Rosslee and I am a Masters student in Educational Psychology at the University of Witwatersrand. As part of my studies, I am required to complete a research project, and I am investigating the relationship between adolescents' knowledge of climate change, perceived risks, and the impact on their psychosocial wellbeing (thoughts, behaviours, emotions and social factors). The title of my research project is *The Relationship between Adolescents' Knowledge of Climate Change, Perceived Risk and Psychosocial Wellbeing.* I am completing it under the supervision of my research supervisor, Adri Vorster.

As part of this project, I would like to invite you to take part in answering an online questionnaire on SurveyMonkey. You will be required to follow the URL link provided to complete the questionnaire. The questionnaire will take approximately 10-15 minutes to complete. The questions will be focusing on climate change, the risk of climate change and your psychosocial wellbeing.

Participation is completely voluntary and if you do not wish to take part in this study, you are allowed to say no. There are no penalties or disadvantages if you choose not to participate or withdraw from the questionnaire. You may withdraw at any time prior to submitting the questionnaire, or not answer any question if you do not want to. Once you submit the questionnaire, you will no longer be able to withdraw as I cannot link your responses to you. The questionnaire will be completely anonymous and confidential as I will not be asking for your name or any identifying information. Should you include any identifying information on the questionnaire, I will delete this when I load the result onto an Excel spreadsheet. I will also delete any IP addresses that appear as part of the responses.

If you have any questions during or after the questionnaire, feel free to contact me on the details provided below. This research will be written up as a report which will be available online through the university library website. The results may potentially be published as a journal article in the future or I may present it at a conference. The data collected will be safely stored on a password protected laptop with all identifying information removed. I will keep the data for 5 years and it might be used for other research projects.

If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non- Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Please note; once you submit your responses to the online questionnaire, this is seen as you assenting/agreeing to participate in this research.

Thank you.

Tayla Rosslee
Researcher and M.Ed Student
+27 60 500 6188
847321@students.wits.ac.za

Adri Vorster
Research Supervisor
011 717 4554
adri.vorster@wits.ac.za

Appendix F – Ethics Approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Rosslee

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H20/06/39**
PROJECT TITLE	The Relationship between Adolescents' Knowledge of Climate Change, Perceived Risk and Psychosocial Wellbeing
INVESTIGATOR(S)	Miss T Rosslee
SCHOOL/DEPARTMENT	Human and Community Development/
DATE CONSIDERED	19 June 2020
DECISION OF THE COMMITTEE	Approved Risk Level: Low
EXPIRY DATE	13 July 2023

DATE 14 July 2020 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Dr A Vorster

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ 20 / 07 / 2021
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix G – Histograms

Figure G1

Climate Change Knowledge Scale

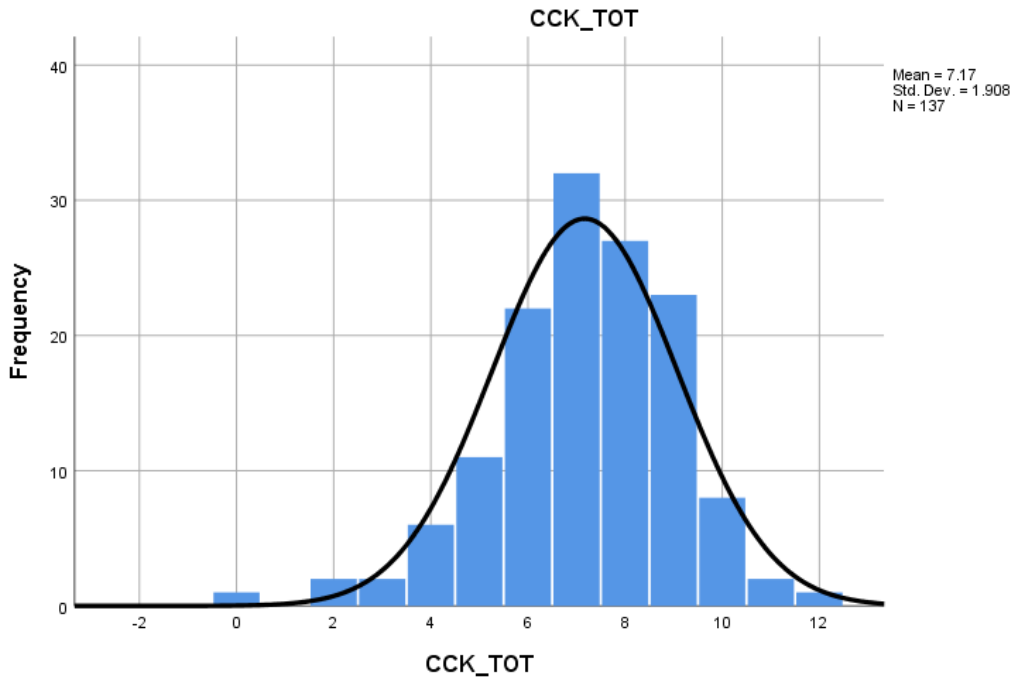


Figure G2

Perceived Climate Change Risk Total

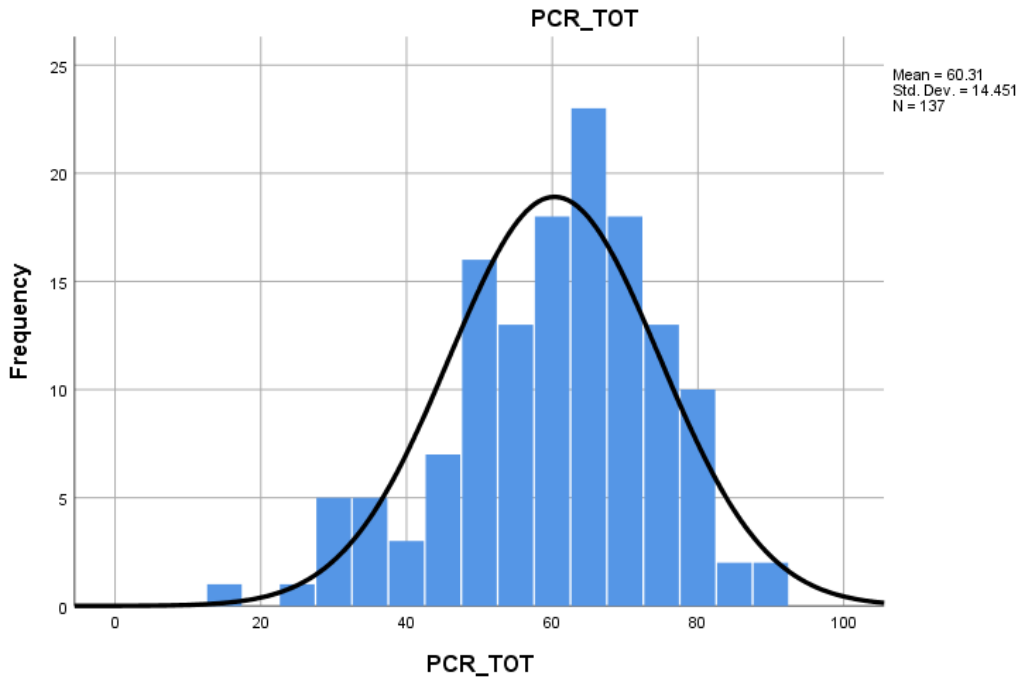


Figure G3

Perceived Climate Change Risk Changes

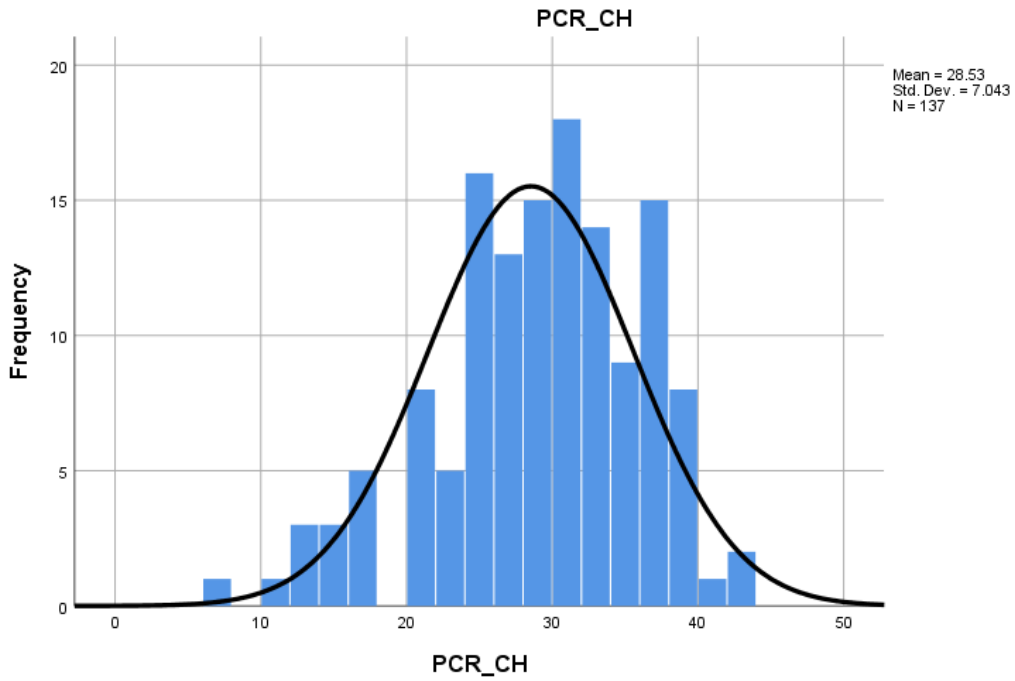


Figure G4

Perceived Climate Change Risk Impacts

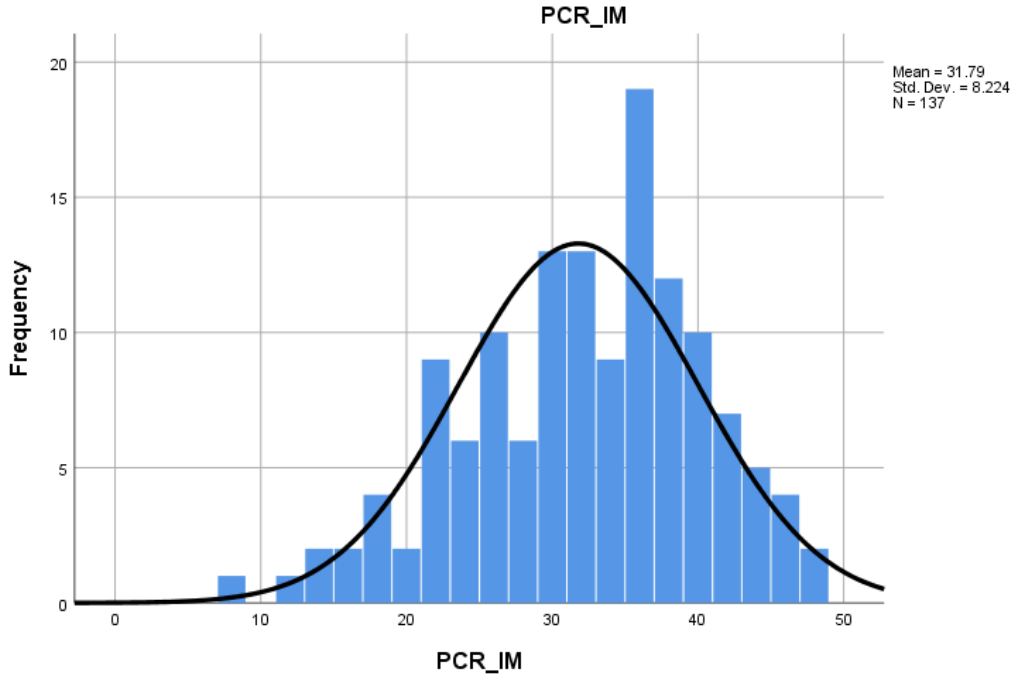


Figure G5

Perceived Hazard Characteristics Consequences

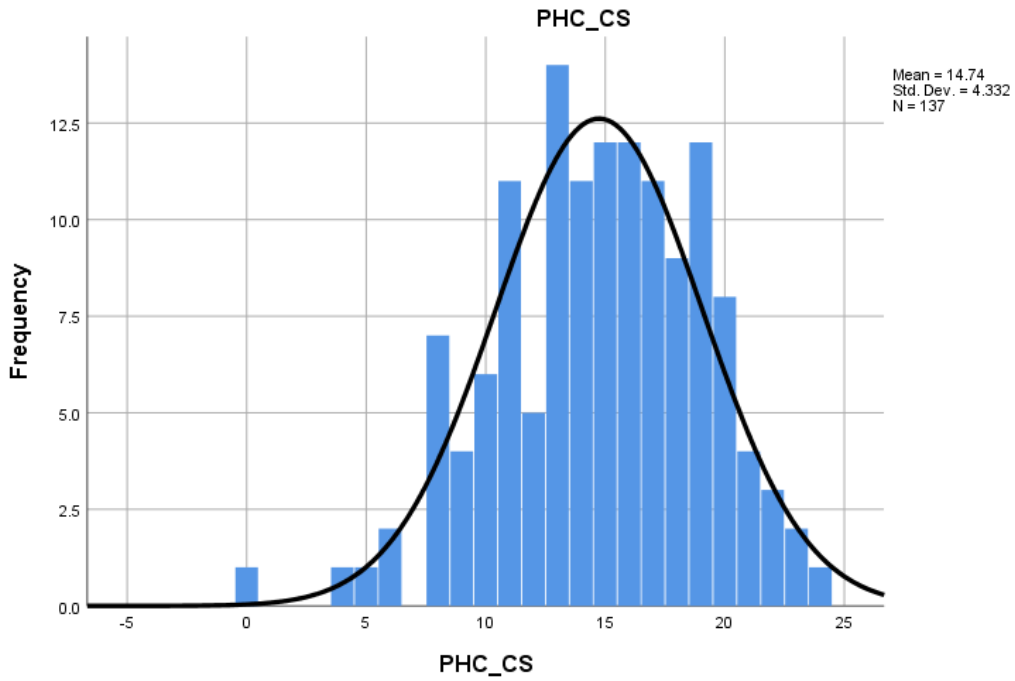


Figure G6

Perceived Hazard Characteristics Impact

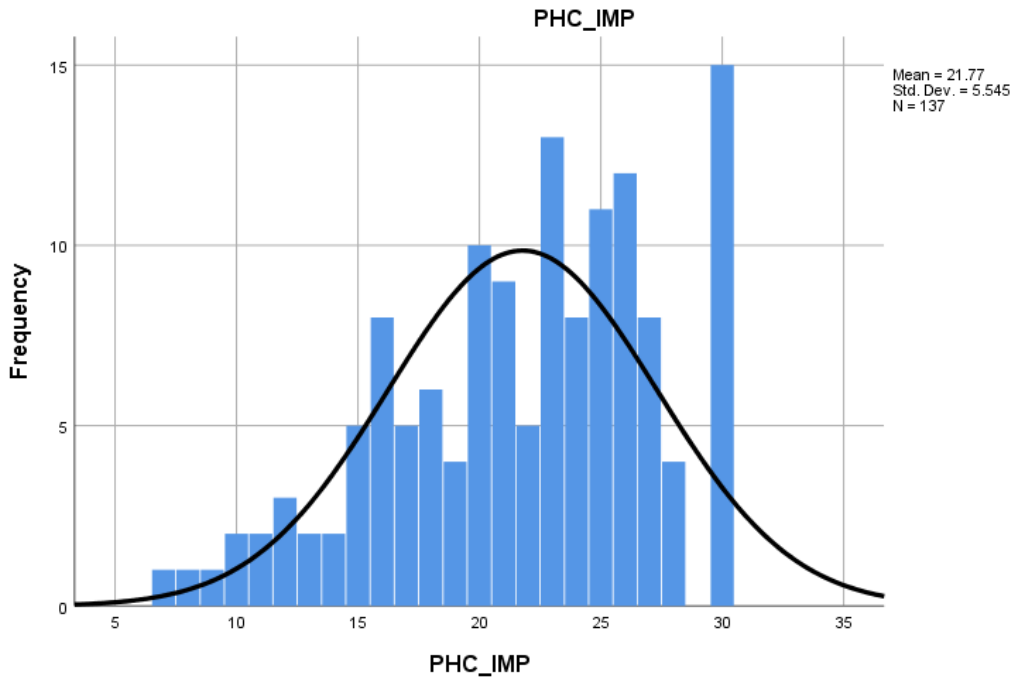


Figure G7

Perceived Hazard Characteristics Interests

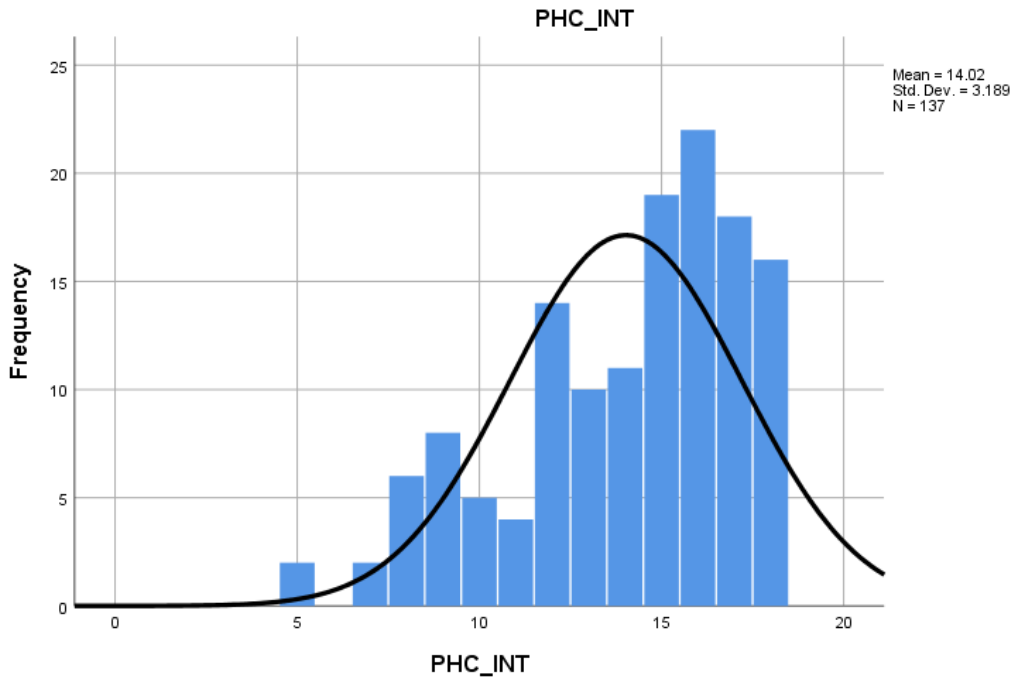


Figure G8

Adolescent Functioning Scale Oppositional Defiant Behaviour

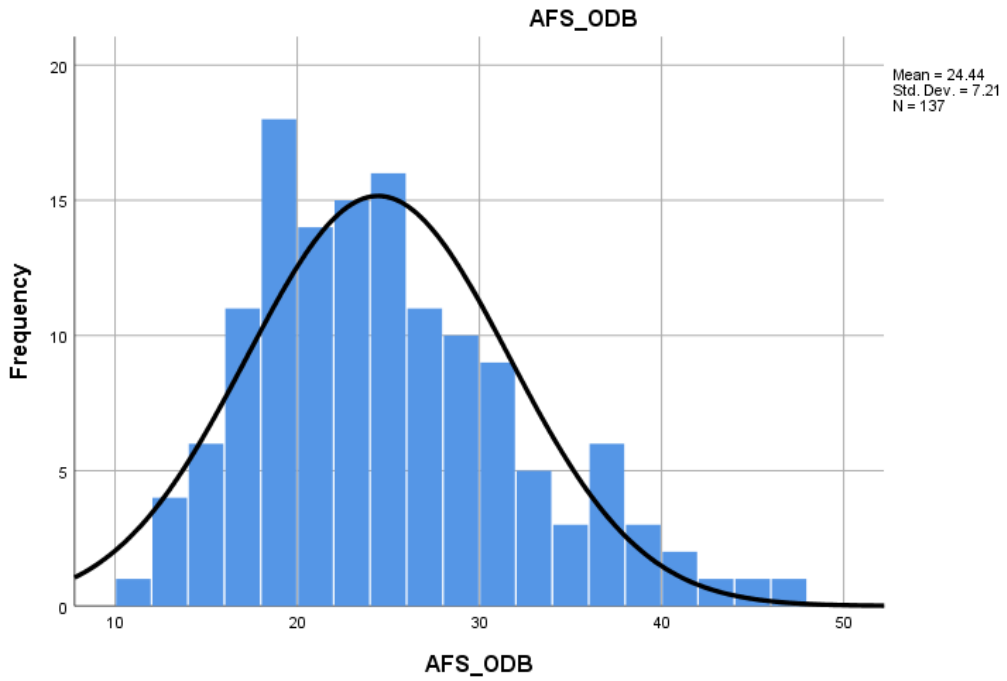


Figure G9

Adolescent Functioning Scale Positive Development

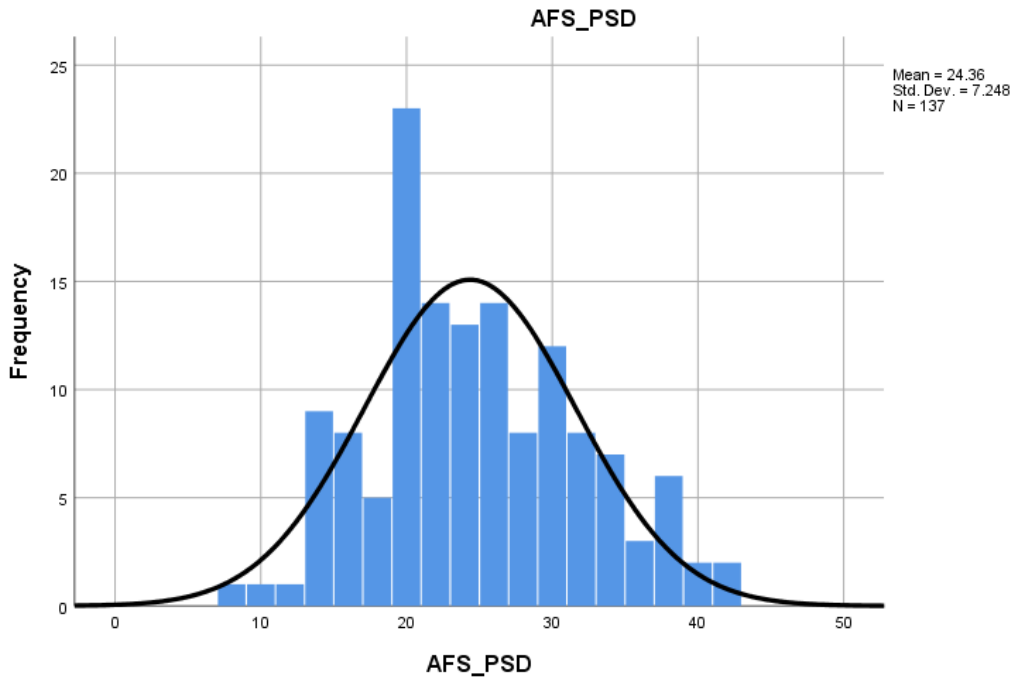


Figure G10

Adolescent Functioning Scale Emotional Difficulty

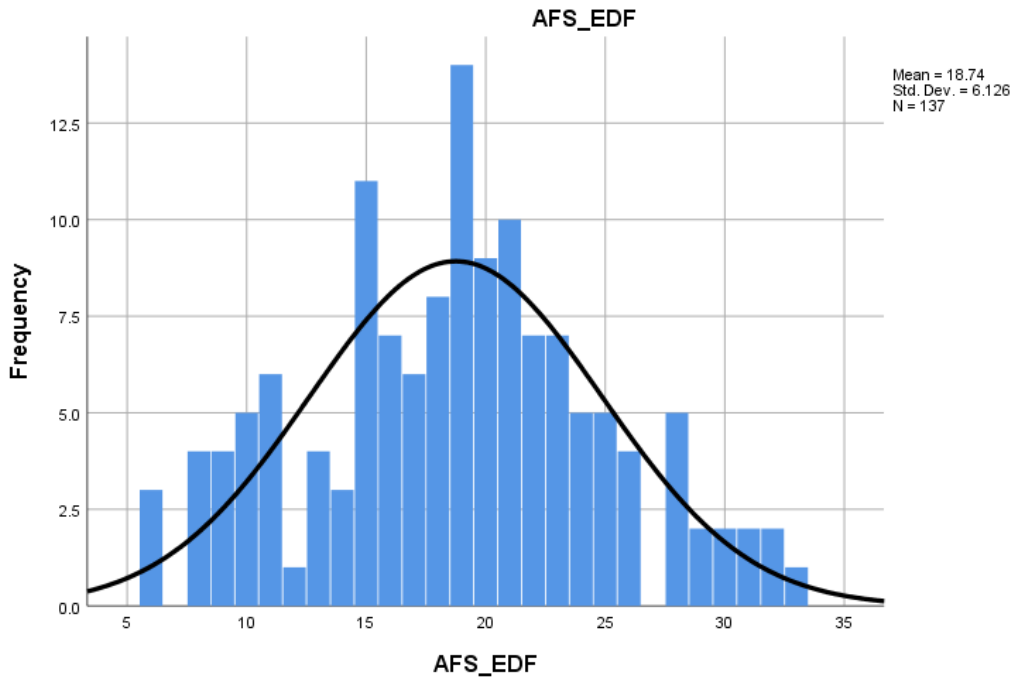
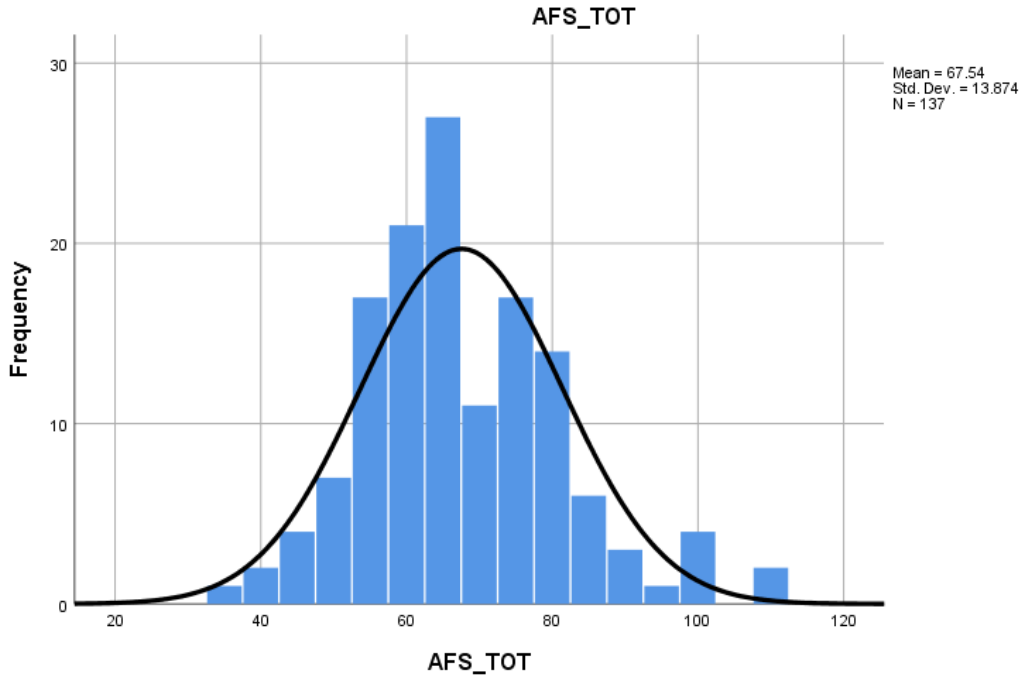


Figure G11

Adolescent Functioning Scale Total



16. STATEMENT OF PRINCIPLES FOR POSTGRADUATE SUPERVISION

IN A CONTEXT OF ACADEMIC FREEDOM AND WITHIN A FRAMEWORK OF INDIVIDUAL AUTONOMY AND THE PURSUIT OF KNOWLEDGE THIS AGREEMENT IS WRITTEN IN THE BELIEF THAT THERE IS A RECIPROCAL RELATIONSHIP AND MUTUAL ACCOUNTABILITY BETWEEN SUPERVISOR AND STUDENT.

THE SUPERVISOR AND THE STUDENT:

1. Will establish agreed roles and clear processes to be maintained by both parties. In the case of joint supervision everyone's role needs to be clarified.
2. Will meet regularly and as frequently as is reasonable to ensure steady progress towards the completion of the proposal, research report, or dissertation or thesis. This time varies but the normal minimum requirement for face-to- face contact, spread across each year of registration is: 10 contact hours for an Honours project, 15 contact hours for a Masters by research report and 24 contact hours for a Masters by dissertation and a PhD.
3. Will keep appointments, be punctual and respond timeously to messages.
4. Will keep one another informed of any planned vacations or absences as well as changes in his or her personal circumstances that might impact on the work schedule. Unplanned absences or delays should be discussed as soon as possible and arrangements should be made to catch up lost time.
5. Will ensure that research on animal or human subjects is conducted according to the procedures and the requirements of the relevant University Ethics committee.
6. Will together complete progress reports on the research project, as requested by each Faculty Graduate Studies Committee.

THE SUPERVISOR:

1. Undertakes to provide guidance for the student's research project in relation to the design and scope of the project, the relevant literature and information sources, research methods and techniques and methods of data analysis.
2. Has a responsibility to be accessible to the student.
3. Will be prepared for meetings with the student. This includes being up-to-date on the latest work in his/her area of expertise.
4. Will expect written work as jointly agreed, and will return that work with constructive criticism within a timeframe (a suggestion of 2-4 weeks) jointly agreed at the outset of the research.
5. Will provide advice that can help the student to improve his/her writing. This may include referrals for language training and academic writing. The supervisor will provide guidance on technical aspects of writing such as referencing as well as on discipline specific requirements. Detailed correction of drafts and instruction in aspects of language and style are not the responsibility of the supervisor.
6. Will support the student in the production of a research report, dissertation or thesis. Provision should be allowed for adequate, mutually respectful, discussion around recommendations made.
7. Will assist with the construction of a written time schedule which outlines the expected completion dates of successive stages of the work.
8. Will ensure the student has the opportunity to present work at postgraduate/ staff seminars/national/international conferences as appropriate.
9. Will assist with the publication of research articles as appropriate.
10. Will discuss the ownership of research conducted by the student in accordance with the University guidelines and rules on intellectual property, co-authorship and copyright.
11. Will ensure that the research is conducted in accordance with the University's policy on plagiarism.
12. Will ensure that the student is made aware in writing of the inadequacy of progress and/or of any work where the standard is below par. Acceptability will be according to criteria previously supplied to the student.
13. Has a duty to refuse to allow the submission of sub-standard work for examination, regardless of the circumstances. If the student chooses to submit without the consent of the supervisor, then this should be clearly recorded and the appropriate procedures followed.

THE STUDENT:

1. Undertakes to work independently under the guidance of the supervisor. This includes reading widely to ensure that the literature pertinent to his/her chosen topic has been identified and consulted.
2. Is obliged to make appointments to see the supervisor and will arrange meeting times well in advance.
3. Will think carefully about how to derive maximum benefit from these contact sessions by planning what he/she wants in these sessions.
4. Should submit written work for discussion with the supervisor well in advance of a scheduled meeting. The kind and frequency of written work should be agreed with the supervisor at the outset of the research.
5. Undertakes to submit written work that is relatively free of basic spelling mistakes, incorrect punctuation and grammatical errors. Responsibility for the accuracy of language, the overall structure and coherence of the final research report, dissertation or thesis rests with the student.
6. Undertakes to heed the advice given by the supervisor and to engage in discussion around suggestions made. Ultimately the student has to take responsibility for the quality and presentation of the work.
7. Should strive, within reasonable bounds, to maintain a focus on his/her research area and to work within the agreed time schedule.
8. Will prepare material for presentations at seminars and conferences.
9. Undertakes to submit papers for publication.
10. Agrees to honour agreements about ownership of the research and in accordance with the University's guidelines and rules in relation to co-authorship, copyright and intellectual property.
11. Will ensure that the work contains no instances of plagiarism and that all citations are properly referenced and that the list of references is accurate, complete and consistent.
12. Agrees to work in accordance with the criteria of acceptability as supplied by the supervisor.
13. Undertakes not to place the supervisor under undue pressure to submit work for examination until the supervisor is satisfied that it has reached an acceptable level of quality.

I confirm that I have read and understood this statement and agree to be guided by its principles

Name of student : Tayla Rosslee

Student's signature : T.Rosslee

Name of Supervisor : Adri Vorster

Supervisor's signature : AC Vorster

Name of Co-Supervisor :

Co-Supervisor's signature :

The broad area of study is : Climate change and adolescents

Provisional submission date is:

Degree : MEd in Educational Psychology

School : Human and Community Development

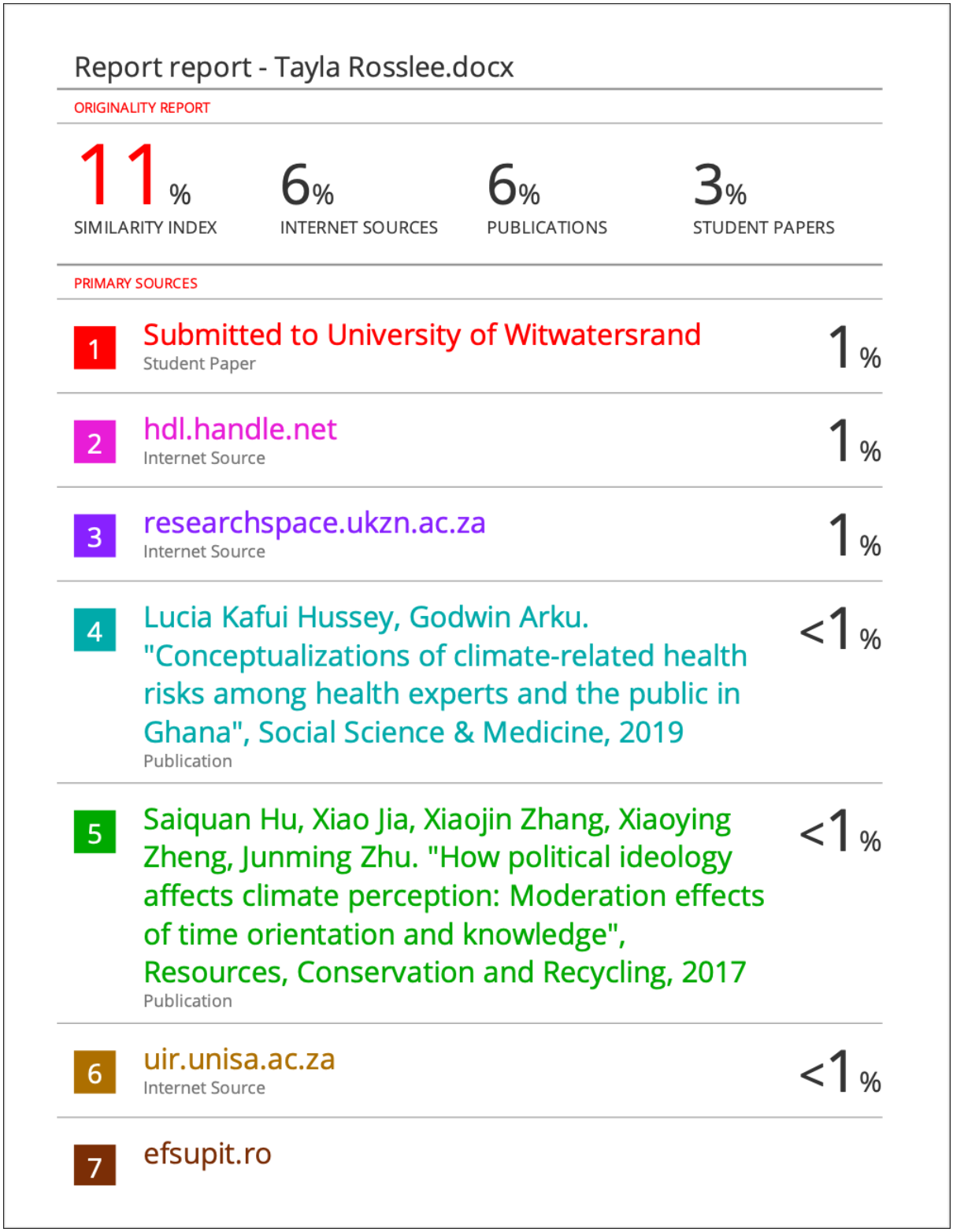
Faculty : Humanities

Date : 5 March 2020

Specific agreements pertaining to: ownership and joint publication, funding, etc. may be attached and signed.

GRIEVANCE PROCEDURES. It should be acknowledged that during the course of the research, both students and supervisors can feel aggrieved. In this event, matters should be dealt with as swiftly as possible by the parties involved and, if necessary, the appropriate Postgraduate Coordinators and Committees. There is, in addition, a University Grievance Policy to help guide deliberations. It is available on www.wits.ac.za/prospective/postgraduate.

Appendix I – Turnitin Report



Report report - Tayla Rosslee.docx

ORIGINALITY REPORT

11%	6%	6%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Witwatersrand Student Paper	1%
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3	researchspace.ukzn.ac.za Internet Source	1%
4	Lucia Kafui Hussey, Godwin Arku. "Conceptualizations of climate-related health risks among health experts and the public in Ghana", Social Science & Medicine, 2019 Publication	<1%
5	Saiquan Hu, Xiao Jia, Xiaojin Zhang, Xiaoying Zheng, Junming Zhu. "How political ideology affects climate perception: Moderation effects of time orientation and knowledge", Resources, Conservation and Recycling, 2017 Publication	<1%
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