# CLIMATE CHANGE'S EFFECT ON FOUNDATION PHASE LEARNERS' BEHAVIOUR AND ACADEMIC PERFORMANCE IN THE CLASSROOM

by

**MIA JENNA KREUSCH**

submitted in accordance with requirements for

the degree of

**MASTERS OF EDUCATION**

**In the subject**

**PSYCHOLOGY OF EDUCATION**

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: **PROF SB MSEZANE**

JANUARY 2024

**DECLARATION**

Name: Mia Jenna Kreusch

Student number: 63900963

Degree: Master's in Psychology Education

**CLIMATE CHANGE'S EFFECT ON FOUNDATION PHASE LEARNERS' BEHAVIOUR AND ACADEMIC PERFORMANCE IN THE CLASSROOM.**

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

13 December 2023

SIGNATURE DATE

## DEDICATION

This work is dedicated to all the hard-working teachers who give their all for the learners in their class to be successful. I hope the information gathered helps each and every one of you to take your learners from strength to strength. Furthermore, to my colleagues, family and friends who has shown me the greatest support throughout this journey. Lastly, to my late uncle, Richard Stretch, who told me to reach for the stars and go as far as I possibly can in my academic career.

**ACKNOWLEDGEMENTS**

I wish to extend my sincere appreciation to the following people for their assistance and support during the duration of this study:

- The principals, teachers and learners at the three schools in Graaff-Reinet for their eagerness towards my study and allowing me to do my research at their schools.
- The three teachers who took part in this study, for your dedication and willingness to participate. Taking time out of your busy schedule to collect the necessary data is truly appreciated.
- My special Mom and Dad for always believing in me, your love and support throughout this study and throughout my life. I am eternally grateful.
- My amazing fiancé, Floris Steenkamp, thank you for the endless support, love, advice and being a listening ear whenever I need one. I am extremely thankful.
- All my friends and family for their support and believing in me.
- Lastly, my supervisor, Prof SB Msezane, for his remarkable patience, mentoring, supervision and encouragement during this study. Without you, my development would have been possible.

**ABSTRACT**

Climate change is a global crisis, but younger children are exceptionally vulnerable to the impacts. Teachers constantly experience many challenges, but the challenge mentioned the most, is related to negative behaviour traits and the learners' ability to stay focused. The theoretical framework followed was The Theory of Planned Behaviour and the Social Change theory. A qualitative case study was conducted using an interpretivist paradigm and convenience sampling was used to identify three schools and one teacher from each school. Data was generated from 3 teachers from 3 different schools through face-to-face interviews, non-participant observations and document analysis. The findings discovered a relationship does exist and in extreme heat, learners are lethargic and cannot concentrate for long, also, cold weather has a negative impact on the learners. Lastly, findings showed how learners' absenteeism is increasing as well. The study recommended that teachers need to do more research about the topic and teachers must have contingency plans in place to give learners the same effect as what break time does.

**KEYWORDS:**

Climate change, weather, behaviour, Foundation Phase learner, academic performance.

**OPSOMMING**

Klimaatsverandering is 'n wêreldwye krisis, maar jonger kinders is buitengewoon kwesbaar vir die impakte. Onderwysers ervaar voortdurend baie uitdagings, maar die uitdaging wat die meeste genoem word, hou verband met negatiewe gedragseienskappe en die leerders se vermoë om gefokus te bly. Die teoretiese raamwerk wat gevolg is, was The Theory of Planned Behavior and the Social Change theory. 'n Kwalitatiewe gevallestudie is uitgevoer met behulp van 'n interpretivistiese paradigma en geriefsteekproefneming is gebruik om drie skole en een onderwyser van elke skool te identifiseer. Data is gegenereer van 3 onderwysers van 3 verskillende skole deur middel van aangesig-tot-aangesig onderhoude, nie-deelnemer waarnemings en dokumentontleding. Die bevindinge het ontdek 'n verwantskap bestaan wel en in uiterste hitte is leerders lusteloos en kan hulle nie lank konsentreer nie, ook het koue weer 'n negatiewe impak op die leerders. Laastens het bevindinge getoon hoe leerders se afwesigheid ook toeneem. Die studie het aanbeveel dat onderwysers meer navorsing oor die onderwerp moet doen en onderwysers moet gebeurlikheidsplanne in plek hê om leerders dieselfde effek te gee as wat pousetyd doen.

**SLEUTELWOORDE:**

Klimaatsverandering, weer, gedrag, grondslagfase-leerder, akademiese prestasie.

**UMXHOLO**

Ukutshintsha kwemozulu yingxaki yehlabathi, kodwa abantwana abancinci basengozini kakhulu kwiimpembelelo. Ootitshala bahlala befumana imingeni emininzi, kodwa owona mceli-mngeni ukhankanywe kakhulu, unxulumene neempawu zokuziphatha ezingalunganga kunye nokukwazi kwabafundi ukuhlala begxile. Isakhelo sethiyori esalandelwa yiTheory of Planned Behavior kunye nethiyori yoTshintsho lweNtlalo. Kwaqhutywa i-qualitative case study kusetyenziswa i-paradigm yokutolika kwaza kwasetyenziswa isampuli ezilula ukuqaphela izikolo ezithathu notitshala omnye kwisikolo ngasinye. Idatha yenziwe ngootitshala aba-3 abaphuma kwizikolo ezi-3 ezahlukeneyo ngodliwano-ndlebe lobuso ngobuso, ngemigqaliselo yabantu abangathabathi nxaxheba nocazululo lwamaxwebhu. Iziphumo ezifunyenweyo zifumanise ukuba ubudlelwane bukhona kwaye kubushushu obugqithisileyo, abafundi bayonwaba kwaye abakwazi kugxininisa ixesha elide, kananjalo, imozulu ebandayo inefuthe elibi kubafundi. Okokugqibela, iziphumo zibonise indlela okwanda ngayo ukungabikho kwabafundi esikolweni. Uphononongo lucebise ukuba ootitshala kufuneka benze uphando oluthe kratya malunga nesihloko kwaye ootitshala mababe nezicwangciso zokuqulela okungenzeka ukunika abafundi ifuthe elifanayo nelo lenziwa lixesha lekhefu.

**AMAGAMA ENGQONDO:**

Ukutshintsha kwemozulu, imozulu, indlela yokuziphatha, umfundi wesigaba sesiseko, indlela aqhuba ngayo ezifundweni.

TABLE OF CONTENTS

**LIST OF FIGURES**

## LIST OF TABLES

## LIST OF ACRONYMS AND ABBREVIATIONS

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| ADHD | Attention-Deficit/Hyperactivity Disorder |
| CAPS | Curriculum Assessment Policy Statements |
| CEDU | College of Education |
| $CO_2$ | Carbon dioxide |
| COVID-19 | Coronavirus |
| DBE | Department of Basic Education |
| DHET | Department of Higher Education |
| Eskom | Electricity Supply Commission |
| GOTG | Gift of the Givers |
| HRDSSA | Human Resource Development Strategy for South Africa |
| MW | Megawatt |
| NASA | The National Aeronautics and Space Administration |
| PTSD | Post-traumatic stress disorder |
| RSA | Republic of South Africa |
| SA | South Africa |
| SABC | South African Broadcasting Corporation SOC Limited |
| SAD | Seasonal Affective Disorder |
| SAMRC | The South African Medical Research Council |
| SAWS | The South African Weather Service |
| SGB | School Governing Body |
| TPB | The Theory of Planned Behaviour |
| UNESCO: | The United Nations Education, Scientific and Cultural Organization |
| UNICEF | United Nations Children's Fund |
| US | United States |
| UV | Ultraviolet |

# CHAPTER 1: INTRODUCTION

## 1.1 INTRODUCTION

The purpose of this study was to investigate the effect that climate change variations have on Foundation Phase learners' behaviour and academic performance at school which took place in an Eastern Cape town, Graaff-Reinet. I am a Foundation Phase teacher and there has been a noticeable pattern, for me, when it comes to learners' behaviour and academic performance and the climate change variations. by means of observation, on a hot day, it seems that learners do not have much energy in the class and they seem to work slower while, in winter, they seemed to be more disruptive and louder. This sparked an interest and after a few discussions with my Foundation Phase colleagues at my school and other Foundation Phase teachers, it was clear to me that other teachers also noticed this. I then took a step back and started thinking that if we, as teachers, had a better understanding of this perception, we could have a better understanding of how the learners learn and react in a specific situation. We could gain a better understanding of the child's situation to make learning successful in the classroom.

From what I had noticed and discussed with teachers, poor behaviour was something that is a common topic between teachers although the list of reasons differs from teacher to teacher. I would like to pose an idea that is being discussed by teachers during their break times, namely, that weather and climate change impact the learner's behaviour and academic performance (McGill, 2015). Climate change has become a very popular topic to discuss when the temperature starts to rise or when it starts becoming cold very quickly (Santos & Bakhshoodeh, 2021). There are many instances where climate is mistaken for weather although there is a difference between these two. The main difference is that climate is measured over a long period of time, while weather is focused more on a day-to-day basis (Brown, 2022). Climate specifically focuses on seasonal temperatures, average rainfall and different wind patterns for a specific area or the planet as a whole (Brown, 2022). United Nations (2022) explained that, all in all, climate change can be defined as a long-term change in temperatures and weather patterns. Everything on earth works like a system which means that everything is connected, and changes in one aspect influence everything else. Changes in climate will influence the weather in a specific area (United Nations, 2022).

Weather is the state of the atmosphere conditions such as hot, cold, rainy, sunny or windy (Chan, n.d.). “Weather is the condition of the atmosphere at a particular place and time, such as the temperature and if there is wind, rain, sun, etc.” (University of Oxford, 2022). What we choose to wear, what we choose to buy, where we want to live and what activities we want to part take in are all affected by the weather. If it is cold outside, a person will choose warm clothes, not a swimming costume and flipflops (Ciucci et al., 2010). How learners experience changes and various situations out of their control differ. Sometimes the change is something that happens without their realising they are reacting to it; for example, when it is cold outside or windy, they automatically would want to go inside. At times, when there is a change in the weather, their behaviour would change (Javid, 2019). Zhang et al. (2024) explained how the increase in weather over the last eight years in China, were associated with the learners exam marks dropping.

Behaviour is defined as “the way that someone behaves, especially toward other people good or bad behaviour” (Online Oxford Dictionary, 2022). Behaviour is something that can be positive or negative. Teachers experience different behaviour from their learners. Furthermore, the discussion around behaviour is something that is spoken about on a regular basis by teachers, namely, the struggles that they experience with behaviour (Online Oxford Dictionary, 2022). When the weather is bad, for example, when the wind blows or it is cold or rainy, the learners do not run around at break times as often which means they do not burn off excess energy which is also a reason that they do not stay focused or sit still in the classroom (Barkin et al., 2021).

When looking at the learner, it makes sense to look at their academic performance as well. Woolfolk (2014) reported that academic performance is directly linked to learning. She explained that learning happens when there has been a change in a learner’s knowledge of a topic or behaviour which may be conscious or unconscious. Climate change is something that the learners have no control over but influences how they learn (Woolfolk, 2014).

According to Briones et al. (2022) the learners’ academic achievement is an essential element used when learners seek employment. There are many factors that influence the learners’ academic achievement, for example, mood. If a learner’s mood is off, it will result their feeling less motivated to do their work. Alfredsson et al. (2020) showed

that if people do not get enough sunlight, which provides Vitamin D, it can have a negative impact on a person's health. Research has revealed that during winter, the absence of sunlight has detrimental effects on people's health, contributing to conditions such as metabolic syndrome, asthma, and type 1 diabetes, among others.

I believe that climate change is a disruptive factor for learners' academic performance. Education is such a crucial part in a learner's life and in a country's economic growth so the more teachers understand how climate change affects the learners' performance, the better it will be for the learner, the economic and employment growth. Distraction will always be present when the weather is bad as learners seem to look outside the window more and do not listen to the teacher which affects their learning. When this happens, their behaviour becomes more disruptive (Park et al., 2020). In Sudan, temperatures rose to over 45 degree Celsius resulting in schools having to close and learners missing out on school work and development due to a result of climate change (Prentice et al., 2024).

My opinion, as a Foundation Phase teacher, is that the learners go to school every day and spend most of their day with their teacher each year. These teachers get to know their learners well. You could say that teachers in the Foundation Phase quickly pick up when there is something wrong with one of their leaners. They noticed when their learners act out a little more on a specific day or if something is bothering them. Climate change is going to affect everyone in negative ways for a long time. We need to change our mindset and see how we, as teachers, can actively change how we are dealing with the consequences of climate change on the learners. We, as teachers, can learn and be prepared for the impact that climate change has on learners.

For example, individuals who work with learners daily, particularly teachers, have reported many times how learners are louder on some days when the sun is shining, have less energy when it is overcast or, when it is cold, the learners do not seem to speak as often (Javid, 2019). In a study done in Johannesburg, Mabuza (2019) showed that learners were struggling in schools because of many different factors such as overcrowded classrooms, classrooms which were not properly ventilated, sicknesses, poverty and home circumstances. Climate change goes hand-in-hand with some of these issues. Climate change is not the only problem in South Africa for academic performance, but it seems to exacerbate these problems.

In this study, the researcher adds to the body of knowledge that is already available, but is limited, when focusing on the relationship between climate change and Foundation Phase learners' behaviour and academic performance. The research took place in Graaff-Reinet in the Eastern Cape, South Africa. Through this research, teachers will acquire an improved comprehension of the learner, including factors that disrupt a learner's approach to learning. Using this data, teachers can appropriately address situations and better grasp the challenges learners face, especially in adverse climatic conditions.

## 1.2. THEORETICAL FRAMEWORK

Ajzen (2021) defines a theoretical framework as a formal theory that a study uses to help a researcher understand a topic. This study used two theoretical frameworks, namely, the theory of planned behaviour (TPB) and the social change theory (SCT).

### 1.2.1 The Theory of Planned Behaviour

The TPB helps people understand how individuals can change their behaviour in specific situations; for example, how people can reduce addiction and stop smoking (Alhamad & Donyai, 2021). TPB consists of three main components, namely, attitudes, subjective norms and perceived behavioural control. These three components makes up an individual's behaviour intention which all come together for the desired behaviour to occur (Janse, 2023). The individual could be thinking of doing a specific task, but may procrastinate which shows that there is a gap between what the person wants to do and the actual behaviour. This could be fixed by simply making a plan for the action to take place and letting the plan come to life (Ajzen, 2005). In the school setup, a learner could be thinking about doing homework to improve their marks, but they never get to actually completing the task but, by having a plan and routine, they can complete the task and start improving academically. By examining both the learners' conduct and academic achievements alongside climate change through the Theory of Planned Behavior (TPB), the researcher aimed to predict how learners would react to alterations in weather patterns. Additionally, the researcher aimed to influence learners' perceptions of their behaviour when faced with challenges outside their control. This study focused on children's conduct and academic progress, employing TPB as it sought to establish connections between these aspects and changing climate patterns. This research fell under TPB theory but there were also

some aspects that did not align with the research topic, so this theory was combined with the SCT.

### 1.2.2. Social Change Theory

De La Sablonnière (2017) explained that social change is something that not everyone understands. Change is constantly happening, and nothing ever remains exactly the same. Sociologists explain social change as a change in human communications and relationships that change cultural and social establishments (De La Sablonnière, 2017).

In the Social Cognitive Theory (SCT), various theories exist, such as functionalist theory. Functionalist sociology posits that society shapes individuals and comprises structures such as family and education, which impart values (Parsons, 2018). Functionalism provides a framework for understanding how different parts of society work together to maintain stability and order, focusing on the interrelationship between social institutions and their functions in the larger social system (Parsons, 2018). Examining schools, teachers have direct interaction with students, spending a substantial portion of the day in their company. Consequently, they play a pivotal role in influencing students' behaviour and shaping their social context beliefs. Observing how students respond to climate change and its impact on their learning, teachers need to collaborate with parents (home environment) to disrupt the cycle where students struggle to function effectively when negatively affected by these climate changes. The researcher examined the learners' reactions (behavioural and academic) to climate change over the four seasons for a month and investigated if there were any relationships between the two. This theory was used as an interpretative tool when the data was analysed.

## 1.3 PROBLEM STATEMENT

Climate change has a damaging effect on learners and their wellbeing (Hellden et al., 2021). The World Health Organisation (2021) explained that climate change is the largest health threat that faces humanity. There are many different factors that contribute to different health risks in humans, namely, injury from extreme climate change events, heat-related illness, respiratory illness, various waterborne diseases, vector-borne diseases, malnutrition, non-communicable diseases, mental and

psychosocial health. There will be more deaths per year as climate change will keep on affecting the social and environmental factors such as clean air, water, food and shelter (World Health Organisation, 2021).

Climate change and weather are linked to one another. When the weather changes over a long period of time, the climate pattern changes as well. Increased temperatures over a particular duration may lead to a drought in that specific area, posing challenges within the community residing there (Clarke et al., 2022). Considering the impact of climate change on an individual, I find it particularly intriguing when examining how it influences a learner's behaviour and performance.

Phillips (2022) reported in the Mail & Guardian about the huge amount of rain that fell in 2022 in South Africa but more specifically in KwaZulu-Natal. He reported that 630 schools had been affected by the floods of which 124 were severely damaged. Added to this, 101 were not accessible to be able to report on the degree of damages. Ngcoya (2022) reported that schools were not able to open when the holidays were over because of this damage which meant that learners missed out on lessons and would fall behind. In addition to the schools that were damaged, roads and bridges were washed away which meant that even if the schools were open, learners would not have had access to the schools (Ngcoya, 2022). Not only were schools damaged by floods, but learners were also missing, some passed away, and a teacher and a food handler died which added to the trauma of this natural disaster (Ngcoya, 2022). My point of view is that this is something that is out of the teachers' and learners' control yet has a direct influence on their teaching and learning.

Climate change is something we cannot control but it affects our lives. Teachers have mentioned that there seems to be a connection between the weather (too hot, rainy, too cold, snowy, windy, warm) and learner's behaviour at school (restless, loud, calm, energetic). In addition, teachers spoke about how the learners struggled to stay focused on their work on some days more than on other days where the learners seemed to be more focused. Teachers shared these thoughts with each other in different settings at school which resulted that the teachers try to come up with a conclusion about the relationship between climate change, the learners' behaviour and the academic performance (Javid, 2019).

My research increased teachers' knowledge of what different situations and occurrences affect their learners' behaviour and academic performance and then helps teachers work out how they can help and deal with their learners when these type of weather change occur.

## 1.4 RATIONALE FOR THE STUDY

As a Foundation Phase teacher who is in contact with Foundation Phase learners daily, this research topic was something that arisen many times. There are days when I have observed learners being more active and disruptive and there are other days where the learners are more passive and diligent. It seems to me that the main topic of discussion between teachers is about the learners' behaviour. With regard to climate change and learners' behaviour and academic performance there has been some research that has found a connection between the learner behaviour and academic performance (Ciucci et al., 2010).

Cianconi et al. (2020) explained that climate change is one of the world's greatest challenges and has many different consequences in many different facets. The changes in temperatures, heat waves, floods, droughts and fires all have a direct or indirect impact on human physical and mental health. Randell (2019) mentioned that different weather phenomena can also impact a learner who walks to school in the scorching heat or pouring rain. Changes in the weather may also result in school buildings being damaged or destroyed (e.g., by floods or tornados) which in turn results in schools having to close for a period with learners missing out on academic work. As the weather changes over a long period of time, climate patterns also change. In rural areas, climate variations may result in learners missing school because they must collect water or move closer to water sources which may result in the learners dropping out of school altogether (Randell, 2019).

## 1.5 PURPOSE OF THE STUDY

Teachers have mentioned that one of the biggest challenges they are facing is the learners behaviour and keeping learners actively involved in their academic journey. The learners struggle to keep up with the work required and the teachers can not get through all the work because they have to deal with these challenges out of their

control. It has been mentioned that that when the weather changes, the learners react differently and the classroom dynamics change. The research will help teachers, parents and other stakeholders who deal with learners daily, to understand how learners' behaviour and academic performance is affected by climate change and have a greater understanding when the learners act out of character. In addition, it gives teachers a greater understanding of the learner as a whole and the learners' performance in the classroom.

The following questions should be considered: What is the problem? Why or how is it a problem? Who or what causes the problem? When and how did the problem begin? Who or what perpetuates the problem? Who or what is affected by the problem? In other words, convince readers that the study is necessary and researchable.

The aim of this study was to investigate and evaluate the effects of changes in climate change patterns on learners' behaviour and their academic performance in schools.

The objectives of this study are to assess the relationship between the learners behaviour and academic performance and climate change. Furthermore, to identify different challenges teachers are facing due to climate change and to suggest different teaching strategies that can be used in adverse weather conditions.

### 1.6 RESEARCH QUESTION AND SUB-QUESTIONS

The main research question for this study articulated the following:

How does climate change affect the Foundation Phase learners' behaviour and academic performance?

The sub-questions were:

- What patterns in behaviour and academic performance are shown by learners as a result of climate change?
- What are the main challenges faced by teachers in the classroom as a result of climate change?
- Which teaching strategies are used by teachers during adverse weather conditions?

## 1.7 CONTEXT OF THE STUDY

This study took place in Graaff-Reinet which is situated in the Eastern Cape in South Africa. Graaff-Reinet, which is also the fourth oldest town in the country, is situated in the area of the Great Karoo and is surrounded by the Camdeboo National Park (Atkinson & Ingle, 2009). Graaff-Reinet is a small town which is known as a tourist town as it has more heritage sites (220) than any other town in South Africa (Graaff-Reinet Tourism, 2023). There are many different sites and attractions that one can visit such as the Dutch Reformed church, The Valley of Desolation, Reinet House Museum and Cape Dutch buildings (Graaff-Reinet Tourism, 2023).

The census done in 2011 calculated the population of Graaff-Reinet at 35 672 (Stats SA, 2011) which includes 8 393 households consisting of 62.2% coloured, 28.2% Black African and 8.7% white (Stats SA, 2011). The dominant language is Afrikaans (76%) followed by Xhosa (18.9%) and then English (3.6%) (Stats SA, 2011). The primary economic activities in Graaff-Reinet encompass agricultural produce, the mohair industry, sheep farming and tourism (Atkinson & Ingle, 2009). The town's heritage significantly contributes to Graaff-Reinet's economic advancement, drawing continuous visits from individuals hailing from various provinces and countries. These visitors explore the town's tourist attractions, its surrounding farms, contribute to wool and mohair imports, and support local businesses run by the town's residents (Donaldson & Marais, 2012).

I chose to do this research in Graaff-Reinet because I currently live in this town, so it was easier to do the interviews and to visit the schools that had been chosen to take part in the research. Graaff-Reinet has 15 schools (primary schools and high schools combined) from which I chose three. Graaff-Reinet's weather is also diverse, as in summer, it is extremely hot; in autumn the weather starts cooling down; in winter, it is extremely cold and spring is relatively warm (Graaff-Reinet Tourism, 2023). The study of weather patterns gives the research falls into the research topic.

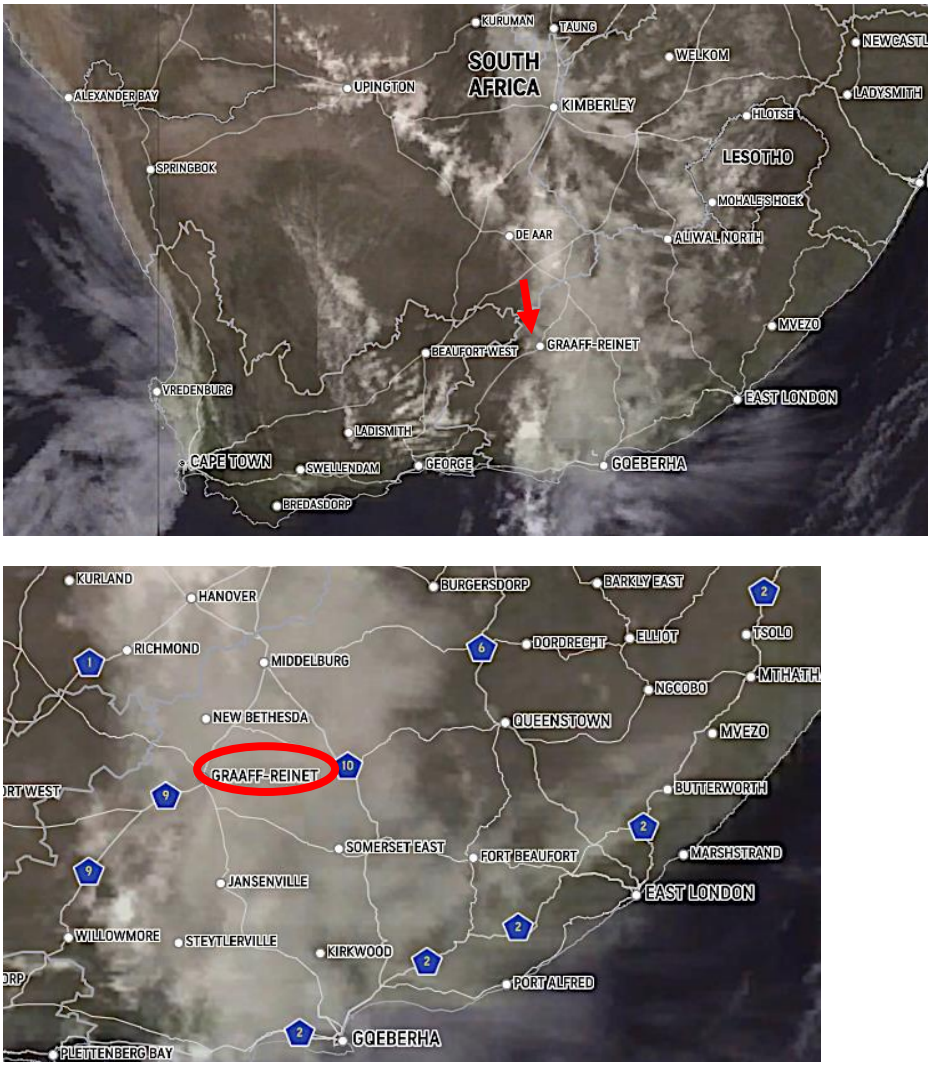



**Figure 1.1: Graaff-Reinet Map**

Source: Accuweather(2024)

## 1.8 RESEARCH PARADIGM

A paradigm is a specific way of looking at the world, a framework of assumptions and philosophies on how research will be conducted (Creswell, 2022). Interpretivist paradigm is used to acquire an understanding of an individual perception (Santosh, 2021). Interviews and observations are used to gather the information needed resulting in the research being seen through different people's eyes which allows different viewpoints of reality (Santosh, 2021). The researcher becomes fully involved with the participants, the data that is collected guides the research and the reason for the research is driven by the interest of an individual.

Therefore, this research used an interpretivist paradigm as the participants were all actively involved in the process from start to finish. The reason for using this paradigm was to be able to research learners' behaviour and interaction and academic performance in line with what the weather was over that specific time.

## 1.9 RESEARCH APPROACH

This research followed the qualitative research approach. Creswell (2022) described qualitative research as an approach to explore and understand the meaning individuals or groups ascribe to a social or human problem. McMillan and Schumacher (2009) wrote that there are nine characteristics of qualitative research which are the following: natural setting, context sensitivity, direct data collection, rich narrative description, process orientation, inductive data analysis, participant perspectives, emergent design and complexity of understanding and explanation. These characterises are related to this research in the following way:

- Natural setting: The research took place in the town where the researcher and teachers lived and the teachers gathered the information in their classrooms which is their place of work.
- Context sensitivity: The learners personal information is not mentioned and needed to be specified in this research. The teachers are not isolating any learners, rather looking at their learners behaviour and academic behaviour traits as a whole. The teachers personal observation and experiences are what needed. The teachers results stay anonymous and they are aware that they can stop their involvement at anytime.
- Direct data collection: The researcher conducted face-to-face interviews with all the teachers. The data collected personally from the teachers by the researcher.
- Rich narrative description: The teachers have an open space to make sure that what they have observed and experienced is brought across to the researcher. The researcher also had a face-to-face interview with each teacher to get their true feelings across and there is direct communication between the teachers and the research throughout the study.
- Process orientation: Face-to-face interviews are conducted and the observations from each teacher each month of every season are collected.

- Inductive data analysis: The researcher transcribed each interview that took place and found different themes and similarities that occurred. The data was collected by each teacher and the researcher would analyse each teachers check list and looked for similarities and differences between the teachers responses and the weather that occurred.
- Participant perspectives: This research solely relies on the teachers observations and what they experienced. They have been chosen as they are in the field and they are in close contact with the learners. The participant perspectives are the crux of the research data.
- Emergent design: The data that is collected by the teachers will change as the weather changes daily. The learners behaviour and academic performance will also change throughout the study, even throughout the day.
- Complexity of understanding and explanation: The data is collected over a specific amount of time and from three different teachers. The data was analysed and put into context where all the different factors that affect the results were taken into consideration when looking at the results and finding conclusions by looking at the bigger picture.

In this research, the behaviour and academic performance of the learners were observed directly by the teachers using their personal experience and observations in their classrooms. The teachers reported back on the learners' behaviour, academic performance and climate change.

## 1.10 RESEARCH DESIGN

The research design used for this research was a case study. Yin (2013) explained that a case study is involves an in-depth examination and analysis of a specific subject, situation, or individual within its real-life context to gain comprehensive insights and understanding. The researcher collected rich information using various data collection procedures which transpired over a sustained period of time (Creswell, 2022). McMillan and Schumacher (2009) reported that there are different types of case studies specifically intrinsic case, instrumental case and collective case. This research was a collective case study as there were more than two cases (schools) included in the research and the teachers involved documented their findings which allowed the researcher to compare the different data received from the participants. Schoepf and

Klimow (2022) defined a collective case study when several cases are explored that will provide specific explanations of a particular situation. It provided elaborate data by means of comparing cases and data which allowed for a greater understanding of the research.

## 1.11 RESEARCH METHODS

The methods used to obtain the information needed for the research included observations, face-to-face interviews and document analysis

### 1.11.1 Observation

Observation is used when the researcher wants to understand what is happening in the natural setting of the phenomenon and observation gets done in a way that there is the least disruption to the normal way of life (Kumar, 2022). Teachers first took part in a face-to-face interview where they answered questions which allowed them to give their personal point of view on the topic being researched and their experiences as a teacher. After the interviews were completed, all the necessary permission had been granted, the teachers were given a questionnaire/check list that they filled in daily for the month. This questionnaire/check list had the necessary information about climate change, behaviour and academic performance on that specific day. These forms were collected monthly by the researcher for further processing, or the teachers communicated the results via WhatsApp to the researcher. The researcher was a non-participatory observer for the whole week in each school.

Three teachers were part of this study, i.e., one teacher per school. The proximity of the schools was about 5km. This resulted in the climate change conditions being almost similar. This study was conducted for a month in each season namely summer, autumn, winter and spring. In Grade 3, the teacher teaches all subjects, these subjects are Mathematics, Home Language (English or Afrikaans), First Additional Language (English or Afrikaans) and Life Skills. The teachers observed the learners' behaviour and academic performance in all these subjects The researcher analysed the data using an Excel database.

The teacher in each classroom was the observer. The teacher was the individual who was in close contact with the learners and was able to pick up on the learners' traits more easily than a third-party observer. The learners were too young to fill in a

questionnaire on their own; therefore, the teacher used their observations and checklists and answered the questions based on their experience in the class. The data was collected by means of check lists being filled in daily by teachers for a month. The teachers marked off what the learners' behaviour and academic performance was on the specific day.

Non-participant observation is when the participants are observed but the researcher does not actively take part. The researcher regularly visits the place where the research is taking place but takes on a more distant role (Hofmeister, 2021). The researcher took on the role of a non-participant observer as she observed at the three different schools five days per month per school. She observed the Grade 3 classroom and all four subjects taught at this level (Mathematics, Home Language, First Additional Language and Life Skills). This was chosen to make it easy and simple for the teacher so that the teacher marked off the specific column that described the weather on specific day and how the learners behaved. There was also space for the teacher to leave comments if necessary.

### 1.11.2 Face-To-Face Interviews

In-depth interviews provide a deeper understanding of how a participant sees the topic being researched and allows the researcher to gain a better understanding and insight as to how the participant is feeling (McMillan & Schumacher, 2009). In a face-to-face interview, the researcher asks the participants questions and gets a response. The researcher can discern indications such as body language and social cues, fostering a deeper understanding and trust-building during the interview process (Creswell, 2022). The interviews were completed with the teachers involved and the researcher found out what the teachers' point of view was on the negative effects of climate change and the learners' behaviour and academic performance.

### 1.11.3 Document Analysis

Bowen (2019) defined document analysis as the interpretation of public records, personal documents and physical evidence relevant to the subject. O'Leary (2014) highlighted its significance, enabling researchers to comprehend pertinent resources for their study. The researcher thoroughly examined all journal and newspaper articles,

alongside documents, ensuring their relevance and meaningful contribution to the research topic.

## 1.12 POPULATION AND SAMPLING

Convenience sampling is used when the subjects that are taking part in the research are available and easily accessible by the researcher for data collection purposes (Stratton, 2021). In this study, the observed subjects were selected based on the close proximity of schools and teachers to the researcher, facilitating smooth data collection (Stratton, 2021). From the 15 schools in Graaff-Reinet, three were specifically selected, targeting Grade 3, with one teacher chosen per grade for the study. The reason for these teachers only being female is that there were only females teaching Grade 3 at these schools. There are 9 primary schools which are a mixture of quantile 3 to 5 schools. The schools are close to each other in town which made it easier for the researcher to collect the data and visit the schools when needed. The researcher chose two quantile 3 and one quantile 5 school to get different learner circumstances and school dynamics. Out of the three schools, two of the schools has three different Grade 3 classes and one has 4 classes.

## 1.13 DATA ANALYSIS AND INTERPRETATION

Data analysis is when a researcher attempts to make summaries of the data that has been collected in an acceptable and accurate manner. The data analysis was inductive where the study began by collecting data about climate change, learners' behaviour and academic performance. Upon gathering the data, the researcher proceeded to analyze emerging patterns and correlate them with relevant theories. This analytical shift involved transitioning from the accumulated data to its alignment with an appropriate theory (Bingham & Witkowsky, 2022). Initially, data collection focused on gathering information from Grade 3 teachers about their learners. Following this, the researcher meticulously scrutinised the collected data, identifying developed patterns, making deductions and exploring the reasons underlying these observed patterns. Bingham and Witkowsky (2022) emphasise that inductive analysis aids in deriving meaning from collected data by identifying patterns, summarising information and generating themes and findings, thus enabling a deeper comprehension of the gathered information to answer the research questions. Ultimately, this process leads

to explaining the findings by integrating relevant theories or literature, thereby lending significance and coherence to the researcher's work

Analysing data in qualitative research requires the researcher to be patient and constantly reflecting on the findings, making many field notes and transcripts from the interviews and observations that have taken place (Girod, 2008). When looking at the data that has been collected, there were a few steps that the researcher could use, namely, making sure all the dates (month, day, year) were written on all notes, arranged in the correct sequence and photocopied to preserve the original copies. Files were kept safe on the computer according to the data that had been collected, make sure everything was backed up, ensuring that all notes and data were legible and arranging the notes into different themes and patterns that arose (Girod, 2008).

McMillan and Schumacher (2009) stated that there are different steps that will be followed once the research has taken place and the data needs to be analysed. These steps include collecting the data, organising the data, transcribing the data into segments, coding the data, describing the data, categorising the data and developing patterns. In more detail the steps are described as:

- The data need to be organised into different categories. Predetermined categories should be used to guide the researcher.

- Data need to be transcribed. There are three different kinds of data which are notes that have been taken during interviews, audio-recorded interviews and visual images. This research used notes that were taken during the interviews. The notes were typed out after the interviews.

- The next step is data coding. This step includes identifying segments that can stand on their own. Codes include setting/context, participants' perspectives, participants' thinking about people and objects, process, activities, events, relationships and social structures and strategies.

- Forming categories is the next step. This is where categories or themes are entities included of group codes.

- Discovering patterns is the ultimate goal of qualitative research. The researcher tried to understand the various links among the peoples' situations, mental process, beliefs and actions.

- Different techniques of pattern-seeking are gauging data trustworthiness, using triangulation, evaluating discrepant and negative evidence and ordering categories for patterns, sorting categories for patterns, constructing visual representations and doing logical cross-analyses.

The data analysis proceeded as follow:

1. Teachers received a checklist in the beginning of the month each season (summer, autumn, winter and spring). The data was collected by the teachers every school day for one month during every season resulting in four months of data that was collected throughout the year. The researcher would collect the checklist from the teacher at the end of the month. The researcher analysed the data from each school.

2. Notes were taken when the researcher did the interviews and the interviews were audio-recorded. Furthermore, after the interviews, the notes were transcribed which allowed the researcher to find common topics that arose.

3. Observation notes were taken when the researcher went to the classrooms and the time, date and behaviour was recorded.

4. The data was collected by the researcher, grouped into different categories namely different behaviours, weather, academic achievements and the teachers' notes.

5. Patterns in the data were organised into themes.

6. An Excel spreadsheet was used to record the data from the teachers. After this data had been recorded, the different types of climate change and learners' behaviour and academic performance were evaluated and reported on.

Data interpretation is used to find meaning in the data which is based on connections, common aspects and linkages. When looking at the data, a few questions can be asked, namely what the important part of the data is, why is it important and what can be learnt from it (Girod, 2008). A researcher needs to share the interpretations wisely;

for example, by avoiding making general statements or using stereotypes that already exist. The researcher needs to monitor the data closely and make a connection between the data and the topic.

## 1.14 LIMITATIONS AND DELIMITATIONS

Limitations can be described as something that the researcher has no control over in their study (Simon & Goes, 2020). Limitations are also there so that the researcher can identify likely weaknesses in the research method that the researcher has no control over (Miles, 2019). This study used interviews and observations as the source of gathering data. One cannot control what other people are going to do, say or how they see something which may result in findings being different or the findings being too general.

Questionnaires/checklists were used to gather the information. The information was gathered by the teacher in each Grade 3 class about the learners in their class. This could be problematic if the participants (teachers) do not take the time to fill these in properly and daily. In addition, the participants do not have the opportunity to freely explain themselves and their responses (Simon & Goes, 2020). Using different peoples' unpredictable observations and experiences is a limitation on its own. People are very unpredictable and each interpretation can be different. The actual climate change and weather can be unpredictable which may have an effect on the results. The schools that were chosen in the study were in one town which might not reflect all climate variations. The research focused on Grade 3 learners and not all grades.

Delimitations can be defined as boundaries that the researcher sets for the thesis (Simon & Goes, 2020). Delimitations are chosen restrictions to your study to restrict the scope of the study (Miles, 2019). This research was chosen because I am a Foundation Phase teacher and from my observation and experience, this research challenges me. The research topic focuses on Grade 3 learners which made conducting the research easier as it focused on one age group. The number of teachers being used in the research (one per school) narrowed down the data collection process.

## 1.15 ETHICAL CONSIDERATIONS

There are a few ethical considerations to take into consideration for this study to be successful. Some of these go hand-in-hand but it is important to mention them separately to understand what is expected from the researcher. (Fleming & Zegwaard, 2018). Fleming & Zegwaard (2018) mentions the following considerations:

- Voluntary participation: The teachers who took part in the study were free to decide to stop taking part in the study at any time.
- Informed consent: The school and the teachers all needed to be aware what exactly was expected from them before they decided to agree to take part in the study.
- Anonymity: I did not know the identity of the learners that took part in the study. I knew the teachers who took part but the learners stayed anonymous.
- Confidentiality: I was the only one who knew who the teachers were and none of this information provided could be tied back to them as individuals.
- Potential for harm: The mental, physical, social and psychological harm were not present or kept to a bare minimum.
- Results communication: The results were reported accurately, plagiarism was avoided by acknowledgement of all sources used or applying the ethical guidelines of the university.

When doing the study, the following took place to make sure that all the necessary requirements were met.

- The required consent forms were handed to the principals of the schools.
- The consent forms were given to the teachers who participated in the study.
- There was a signed agreement from the school where they agreed to allow the research to be done at the school.
- There was a signed agreement from the teachers that took part in the study.

- It was made clear that full confidentiality would be maintained at all times and that no child was reported on individually.
- The teachers were informed that there were no right or wrong answers and that they could decide to stop taking part in the study at any time.
- The researcher applied to the College of Education (CEDU) ethics committee for an ethical clearance certificate for this study to take place.

## 1.16 DEFINITION OF KEY CONCEPTS

### 1.16.1 Weather

Everyone experiences weather. “Weather is the state of the atmosphere with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness” (University of Oxford, 2022). When we experience different weather elements, it depends on what is happening in the earth’s atmosphere. Different weather examples are sunshine, cold, rain, wind, clouds, fog, snow, hail, sleet, thunder and lightning. These elements will be focused on when the teacher looks at the weather. Each one was defined for the teachers.

### 1.16.2 Behaviour

Behaviour is how someone conducts themselves. Generally, we can say that it is what someone does. It is all about the way the person acts, reacts and functions in everyday circumstances (Popescu, 2014). If a person shows challenging behaviour, it is a reaction in a situation that hinders daily life (Popescu, 2014). Behaviour is the actions of a learner when they experience a situation and reacting to a stimulus (Popescu, 2014). Learners’ behaviour, which also includes rebellious behaviour, is a learner’s way of expressing what they want or that something is bothering them (Morin, 2020). Learners may exhibit various behaviours, such as being energetic, strong-willed, quiet, deceitful, defiant, loud or disrespectful, with each behaviour being accompanied by underlying reasons that influence the learner’s reactions. (Morin, 2020).

It is important to know what behaviour it is as it is the main component of the study. We learnt about the different behaviour traits that the learners portray in the classroom.

### 1.16.3 Foundation Phase Learner

“The term Foundation Phase refers to Grades R to 3 and includes learners from 6 to 9 years of age” (Department of Education, 1997). The learners that were observed were in Grade 3.

### 1.16.4 Academic Performance

Academic performance is the measurement of student achievement across various academic subjects. There are different ways that this can be determined by using classroom performance or results of different types of tests used in the classrooms (Limeri et al., 2020).

### 1.16.5 Climate Change

Climate specifically focuses on seasonal temperature, average rainfall and different wind patterns for a specific area or the planet as a whole (Brown, 2022). Climate change can be seen as the worlds ultimate challenge (Cianconi & Janiri, 2020). When the temperature gradually increases, it changes the weather patterns over time (Kemp et al., 2022). The greenhouse effect is a natural process in which certain gases in the earth’s atmosphere trap and retain heat from the sun. What is happening with climate change is that more gases are being trapped in the earth’s atmosphere resulting in the earth heating up (Romm, 2022). Many of the gases that are being released are from humans burning and using fossil fuels which has led to increasing the earth’s temperature (Romm, 2022).

## 1.17 OUTLINE OF THE THESIS

This study consisted of five chapters. There are sub-sections and headings under each chapter.

Chapter 1: Introduction and background: The introduction and background covered what the study was about and what this study covered. The information that was covered in this chapter explained the problem and the reason why this study is necessary and told the reader exactly what to expect in this study.

Chapter 2: Chapter 2 is the literature review on the effect of climate change on Foundation Phase learners’ behaviour and academic performance at school. This

chapter looks at the research that is available about climate change, the different characteristics of climate change, biometeorology, learners' behaviour and academic performance. This chapter provides the reader with a broad knowledge of the research and theories on the phenomenon and identifies the gap in research on this topic.

Chapter 3: Research methods and design: This chapter explains the specific research design, the reasons for the approach, how the data was gathered and how the researcher analysed the data. It explains the research approach, the population chosen, how the data was collected and how the data was analysed and interpreted. It also included the reliability and validity of the study.

Chapter 4: Results and discussion: After all the data was processed and gathered, this chapter presents the findings and results.

Chapter 5: Conclusion, recommendations and limitations of the study: Once everything was analysed and the results was processed, this chapter summed everything up. Various recommendations was also documented here. The limitations and delimitations of the study was presented in this chapter.

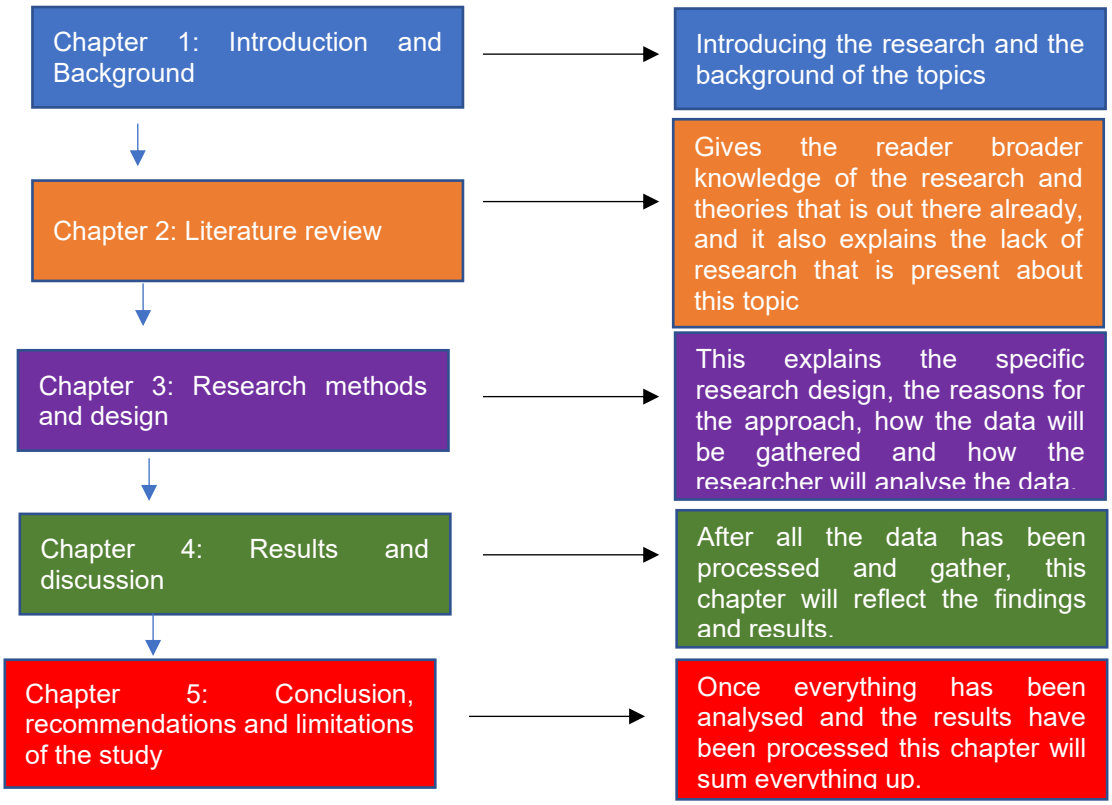



**Figure 1.2: Chapter Outline**

## 1.18 CONCLUSION

This chapter offered the background to the research that took place. It explained the reason for the research, the two theoretical frameworks that were followed namely the TPB and the SCT, the rationale of the study, the purpose of the study, where the study took place, the problem statement, the aims and objectives and most aspects of research which included the research question and sub-questions, the research paradigm which was the interpretivist paradigm, the research approach which was qualitative and the research design which was a case study. The research methodology which is the plan that the researcher followed included observations, face-to-face interviews with a conveniently selected sample of participants. The manner in which documents were analysed and interpreted was stated. The limitations and delimitations were stated and the ethical considerations were defined. The key concepts were explained and defined. The chapter outline was described. Chapter 2 explores the literature that is relevant to climate change and the impact it has on learners' behaviour and academic performance.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 INTRODUCTION

The main purpose for doing a literature review is to gain a better understanding of the research that has already been conducted on the phenomenon under study (Snyder, 2019). A literature review allows further light to be shed on existing research, to examine the legitimacy or accuracy of specific theories and find and scrutinise the effect of relationships on a topic. It allows researchers to find gaps in previous research or to add to research that has already been done (Snyder, 2019).

The purpose of this literature review is to provide the reader with information about how climate change affects learners' behaviour and academic performance. It starts by explaining the South African education system and the psychological effects of climate change in education. Climate change and the greenhouse effect are defined with various images showing the effect of climate change over the world followed by an analysis of Graaff-Reinet's weather patterns. This was the location where the research took place. Next, the relationship between weather and human behaviour is reviewed and then the effects of climate change on education and how different floods in South Africa have affected the teaching and learning for the learners. The ideal temperature for learning and biometeorology were touched on. Lastly, the theoretical framework is discussed namely the TPB and the SCT. As mentioned in the previous chapter, weather and climate in this chapter will be used interchangeably.

## 2.2 THE SOUTH AFRICAN EDUCATION SYSTEM

Education in South Africa is separated into two national departments which are:

- Department of Basic Education (DBE) which consists of primary and secondary education. This includes Grade R (age 6) to Grade 12 (age 18) and adult literacy programmes (South African Government, n.d.).
- Department of Higher Education (DHET) is responsible for universities, post-school education and training and the human resources development strategy for South Africa (HRDSSA) (South African Government, n.d.).

The primary emphasis of the DBE is on sustaining and bolstering the education system to foster lifelong learning, enhance quality of life and contribute to the development of

a non-violent, prosperous and self-reliant South Africa. The DBE is responsible for primary and secondary education (South African Government, n.d.). Primary school is from Grade R to Grade 7, and secondary school also known as high school is from Grade 8 to Grade 12. Grade R has been made compulsory for learners (South African Government, n.d.). The General Education and Training (GET) phase is split into three phases which are Foundation Phase (Grade R to 3), Junior Primary/Intermediate Phase (Grade 4-6) and Senior Phase (7-9). Grade 10-12 falls under the Further Education and Training (FET) phase (Scholaro, n.d.). The academic year in South Africa starts in January and finishes in December every year (South African Government, n.d.).

This research focuses on the DBE, more specifically Grade 3 in the Foundation Phase. These learners are between 8 and 9 years old. The reason this grade was chosen is because I am a Grade 3 teacher, so I have direct contact with the age group, and I am in constant discussions with teachers who are in this phase. The idea of this research topic stemmed from personal experiences and conversations with colleagues, where we observed that learners' behaviour and academic performance could vary even when there are no changes in the classroom environment. Collectively, we deduced that weather and climate change might be factors influencing these fluctuations

### 2.3 PSYCHOLOGICAL EFFECTS OF CLIMATE CHANGE IN EDUCATION

Vergunst and Berry (2021) wrote that half of the world's children are at a tremendously high risk of mental and physical health problems from the effects of climate change which have been mentioned in more than 230 health care journals. These impacts are not confined to a specific time but occur from before birth and increase as children get older (Vergunst & Berry, 2021). Berman and Guildford (2022) wrote that infants and children are the most vulnerable to climate change. Heat waves are disruptive in all aspects of life impacting sleep patterns, concentrate levels and learning (Vergunst & Berry, 2021). Burk et al. (2018) explained in their research about the psychological effects of climate change on children that climate change can lead to PTSD, depression, anxiety, sleep disorders and substance abuse. The consequences impact emotion regulation, learning, behaviour, language development and academic performance. Children react differently to climate change which makes them extremely vulnerable because they breathe at a faster rate than adults do which increases their

exposure to air pollution, drink more water and, because they are smaller and shorter, they are closer to the ground than adults which means their exposure to heat is greater than for adults (Burke et al., 2018). Children are also dependent on people that look after them and do not react fast enough to the threats that occur and their bodies do not regulate their temperature like adults' bodies do (Burke et al., 2018). It is easy to see when learners are struggling and, after investigating the usual challenges that learners typically encounter, I realised that there might be an underlying issue or a different problem causing the difficulties. After many discussions with colleagues, climate change was identified as having a massive impact on the learner's psychological mindset and how they react to their learning environment.

## 2.4 CLIMATE CHANGE

The term "climate change" is frequently discussed and encountered in contemporary conversations and newspaper articles. It is emphasised that climate change has the potential for global devastation, and researchers like Kemp et al. (2022) argue that the severity of the issue is not fully understood by the public, warning of extreme consequences if no action is taken. The problem of climate change was addressed in the Toronto Conference declaration in 1988 which played a pivotal role in bringing attention to this issue (Kemp et al., 2022).

United Nations (2022) defined climate change as a situation when there has been a long-term change in temperatures and weather patterns. Climate change is a global phenomenon that can be described by the changes in the planet's climate that has been caused by human activity which has been predominantly caused by the burning of fossil fuels which results in a rise of sea levels, ice melting and extreme weather events (Turrentine, 2021). We look at weather being a sub-heading under climate change. Weather is classified as a specific event that happens over a few hours, days or even weeks. More specifically, climate is defined as the average weather conditions that take place over 30 years or more. It has been observed by NASA that the earth's climate is getting warmer (United Nations, 2022). Conditions that become warmer, wetter or drier over a long period of time can be defined as climate change (Turrentine, 2021). Human activity by burning fossil fuels (coal, oil and gas) and the increase in the use of transport are the main sources of climate change. A contributing factor is the cutting down of trees which is referred to deforestation (Turrentine, 2021).

Deforestation intensifies climate change by releasing stored carbon, disrupting ecosystems, altering water cycles, and contributing to the overall degradation of the environment.

The following images from Schwarz (2022) display how climate change has affected different parts of the world and will continue to do so.

**Figure 2.1: A dust storm that hit New South Wales in Australia in January 2022**

**Source:** Schwarz (2022).

It has been reported that the drier conditions that have been caused by climate change have increased sand and dust storms across the world. Not only is this detrimental to the landscape but it causes serious health issues to humans.

**Figure 2.2: China's (Luoxingdun Island) record-breaking heatwave that took place in August 2022 where temperature rose, droughts and wildfires spread which lead to shutdown of factories**

**Source:** Schwarz (2022)

Scientists also reported that climate change was the main reason that for increased rainfall which leads to flooding and is becoming more frequent. People lost their homes and livelihoods. Adding to this, waterborne diseases and malnutrition were the main effects from flooding (Schwarz, 2022).

**Figure 2.3: Children being pushed on a satellite dish due to flooding in Pakistan (Jaffarabad district) in August 2022**

**Source:** Schwarz (2022)


**Figure 2.4: The floods that happened in KwaZulu-Natal (Ladysmith) in January 2022**

**Source:** Davies (2022)

Tandon (2022) reported in Carbon Brief that this natural disaster was triggered by climate change, and it will get worse. In Ladysmith, more than 100 people had to leave their homes, lost their belongings and were left without anything in these horrific floods. To add to this devastation, in January 2024, there were reports that revealed that the same area had experienced devastating and extreme flooding that resulted in more than 20 people that had died (McCain, 2024).

Climate change happens when there is a gradual shift in the temperature which is affected by the greenhouse effect which can be described when heat is radiated and gets absorbed by different gases in the atmosphere (Yonkers, 2021). These greenhouse gases are known as carbon dioxide, methane, nitrogen oxide and fluorinated gases which all get released back into the atmosphere. If these gases were not present, we would not be able to live on earth as it would be below freezing making it impossible for life to take place (Yonkers, 2021). However, an over-absorption of these gases leads to increased heating of the earth's atmosphere which results in a phenomenon known as global warming. This heightened atmospheric temperature contributes to a range of environmental changes, including the melting of polar ice caps, rising sea levels, disruptions in weather patterns and the exacerbation of

extreme events such as heatwaves, hurricanes and droughts. Additionally, the impacts of global warming extend to ecosystems, biodiversity and human societies, posing significant challenges for sustainable development and necessitating global efforts to mitigate and adapt to the consequences of climate change.

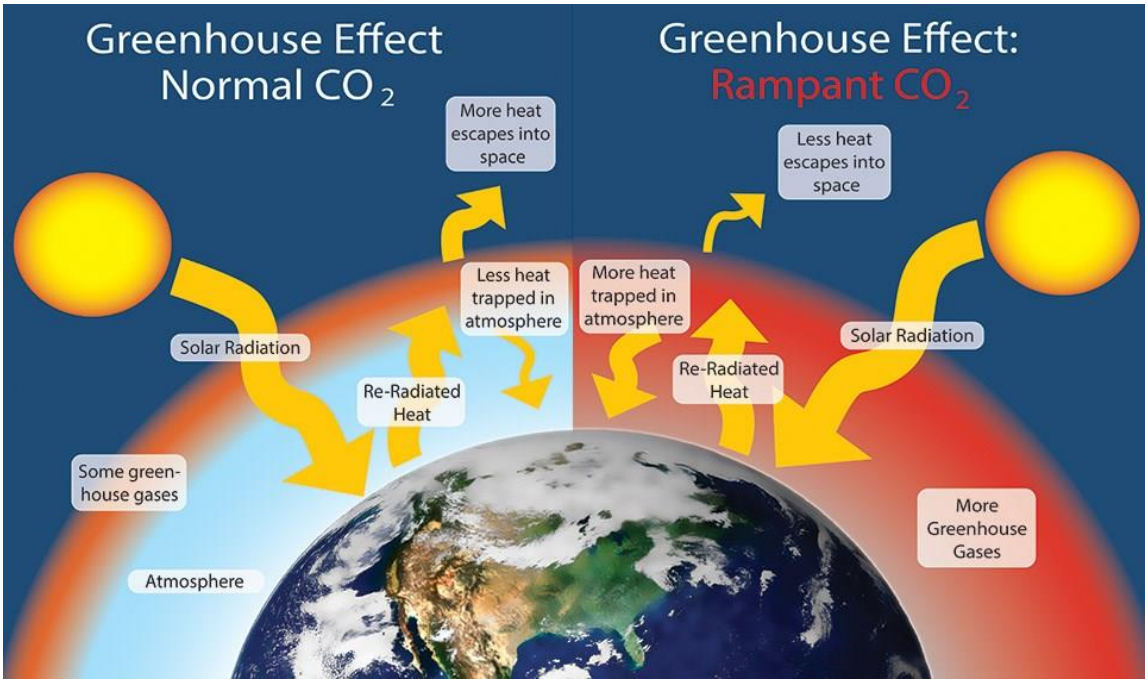



**Figure 2.5: This image shows the greenhouse effect visually.**

Source: Yonkers (2021).

The left-hand side of Figure 2.5 shows us the regular levels of carbon dioxide, methane and nitrous oxide. This shows how the greenhouse effect should be working with the correct amount of gases being released by human activity. It shows how some of the sun's heat is trapped by the atmosphere so that the planet does not freeze (Yonkers, 2021). On the right-hand side of Figure 2.5 we see the adverse effect of the greenhouse effect. Increased emissions of carbon dioxide resulting from people burning fossil fuels trap the surplus heat which results in an increase in the average temperature (Yonkers, 2021).

As we can see, the left-hand side atmosphere is much thicker than the right-hand side which means that there is less heat trapped in the atmosphere which escapes into space and not back into the atmosphere like on the right-hand side. On the right-hand side, because of more greenhouse gases being used on earth and damaging the atmosphere, less heat escapes into space and more heat is created in the atmosphere

which results in the temperature changes which have resulted in climate change over the years (Yonkers, 2021). Romm (2022) explained that life would not look as it does today if it was not for the greenhouse effect. In a nutshell, it is process that occurs when the different gases in the earth's atmosphere trap the sun's heat resulting in the planet heating up as seen in Figure 2.5. This is the one reason why we are able to live on earth. As we start burning and using more fossil fuels, the atmosphere traps more and more heat which results in the earth warming up each year resulting in climate change (Romm, 2022).

Before the eighteenth century, there was a change in the atmospheric carbon which resulted in an increase in the release of these gases. In 2020, the carbon dioxide levels were the highest that they have ever been which is resulting in the earth becoming warmer which increases climate change and ultimately leads to natural disasters (Yonkers, 2021). Conversation (2022) reported on the devastating floods that occurred between 8-21 April 2022 in KwaZulu-Natal, South Africa. This region was declared a state of disaster by President Cyril Ramaphosa as more than 440 people had died: the majority of these deaths were caused by mudslides and overflowing rivers (Conversation, 2022). In addition to the deaths, more than 13 000 homes were damaged, 80% of the water network could not be accessed, over 600 schools were temporarily closed, and roads and bridges could not be accessed (McKenzie et al., 2022). This resulted in learners missing out on schoolwork which had to be caught up in the future putting extra pressure on these learners (McKenzie et al., 2022). Monana (2022) states that 630 schools were affected by the floods of which 124 schools were seriously damaged and 72 schools could not be accessed. The DBE had to ensure that these schools opened as soon as possible and sent 98 mobile classrooms to the affected areas (Monama, 2022). The transport to school was also affected by these floods as buses and minibus taxis could not transport learners to school because the roads were badly affected. Learners thus missed school for reasons beyond their control. Monama (2022) also mentioned that teachers and learners needed to go for counselling to work through the trauma that they had been through at home, adding that 57 pupils teacher and a food handler had passed away. Many of the learners lost family members and all their personal possessions and then could not return to school which had a significant effect on their mental health and their educational journey (McKenzie et al., 2022).

The South African Weather Service (SAWS) reported that extreme weather events are happening on a more frequent basis and is getting worse and worse due to climate change (BBC News, 2022). In an article about the floods that occurred in December 2022 in the Western Cape (Worcester, Paarl, Ceres, Oudtshoorn, George, De Doorns, Mossel Bay), Engel (2022) explained that there were heavy downpours of rain which led to huge flooding where lots of road accidents occurred, roads were closed, homes were destroyed and informal settlements were severely affected. Gift of the Givers (GOTG) stepped in to help by providing charitable support to the places that were hit very badly from the storm, namely, De Doorns, Worcester, Paarl, Ceres and Gouda. The Ward Councillor Oscar Ralehoko mentioned that over 52 000 households were affected by the floods in the Breede Valley Municipality, more specifically De Doorns (Engel, 2022).

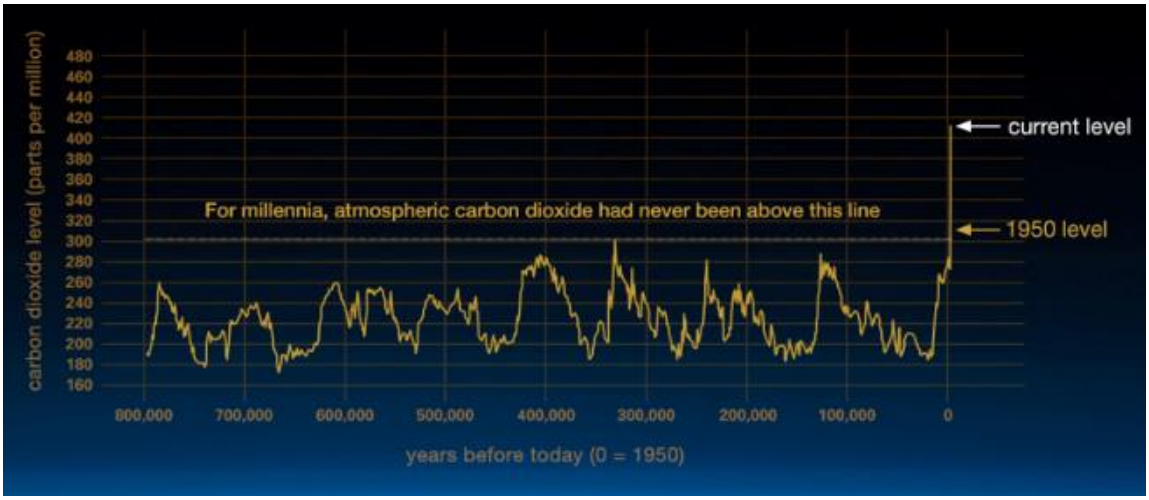



**Figure 2.6: How the level of carbon dioxide has increased over the years**

**Source**: Yonkers (2021)

It is evident that the changes happening in the earth's climate are a result of human activity. These temperatures will continue to increase if we do not do anything to stop it. The occurrence of additional natural disasters, exemplified by events in KwaZulu-Natal and Western Cape in 2021, will lead to a rise in the number of individuals forced to relocate and facing the loss of their crops and livelihoods due to extreme weather conditions (O'Neil et al., 2016).

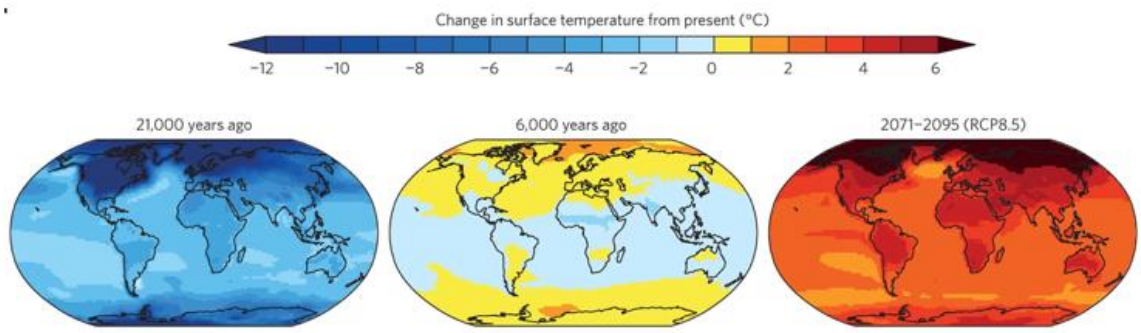



**Figure 2.7: Model-simulated global temperature anomalies for the Last Glacial Maximum (21 000 years ago), the mid-Holocene (6 000 years ago), and projection for 2071–2095, under RCP8.5**

Source: (O'Neill et al., 2016).

Upon reviewing and examining the provided information and visuals, it becomes evident that climate change requires our attention. Humankind is responsible for the Earth's increasing temperature, and significant consequences are imminent unless we unite to implement changes. It is crucial that we collaborate and initiate necessary adjustments to ensure a better life for ourselves and future generations.

### 2.4.1 Effects of Climate Change on Mental Health

When considering climate change and its potential impacts, there is a common tendency to believe that we will be unaffected by these changes. Nevertheless, the repercussions of climate change are currently unfolding and are observable in our immediate surroundings (Balbus et al., 2018). Rising sea levels, altered drought and flood patterns, as well as negative impacts on wildlife, ecosystems and human health, are all outcomes of climate change. We recognise that the increase in greenhouse gases, aerosol emissions and land use changes contribute to climate change, with human activities identified as the primary cause (Balbus et al., 2018). Climate change brings various transformations to the Earth, including warmer land and air, ocean warming, melting ice and glaciers, increased flooding, harm to ecosystems, damage to infrastructure and food insecurity (Balbus et al., 2018; United Nations, n.d.).

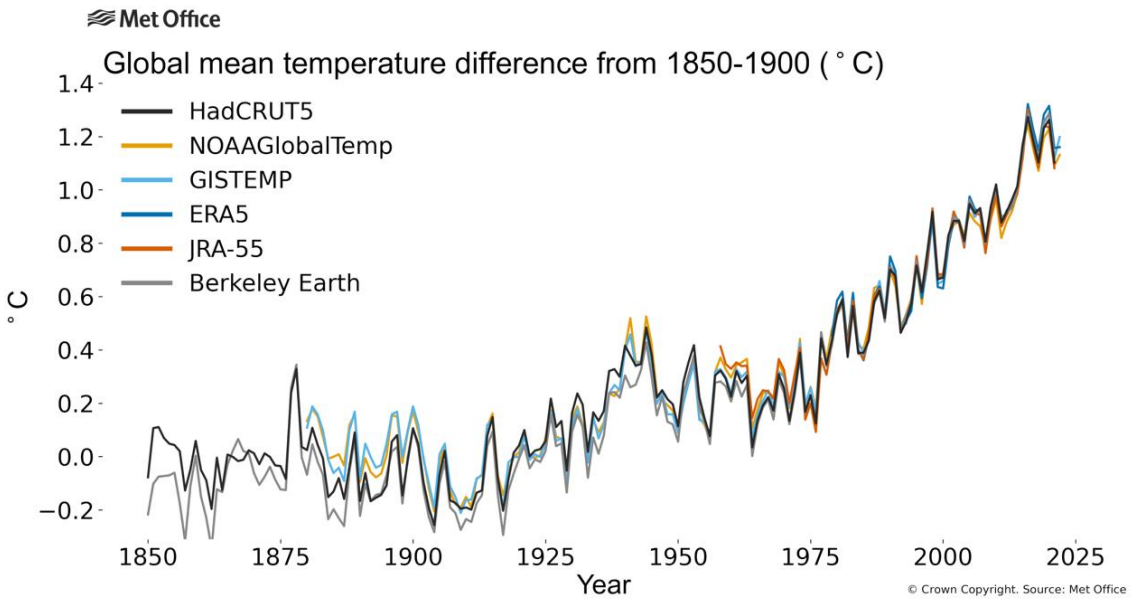



**Figure 2.8: The global temperature change from 1850 to 2021**

Source: Met Office Hadley Centre (2021)

It is evident that the Earth's temperature has risen incrementally over many years. With every degree of increase, climate change inflicts greater damage on the world (Met Office Hadley Centre, 2021).

Climate change also affects human health. Young children, families that have a low income, woman that are pregnant, people with co-morbidities and older people are particularly vulnerable. When the temperature increases, a perfect environment is created for different diseases, fungi and mould to multiply which results in and increase in illnesses, more specifically respiratory diseases and asthma (Goshua et al., 2020). In 2023, in the Kakamas in the Northern Cape in South Africa, eight people lost their lives due to heat stroke that was caused by a heat wave (SABC News, 2023). The weather had been averaging 43° Celsius for many days (SABC News, 2023). The South African Medical Research Council (SAMRC) explains that when a person's body becomes too hot, this results in heat cramps and heat exhaustion, and the human body struggles to function how it normally would by regulating its own temperature (AfricaNews, 2023). Reading about these individuals that have passed away because of a heat stroke, it is evident to me that climate change is increasing, and the side-effects are becoming worse.

Goshua et al. (2020) explained that medical practitioners have to be better prepared and gain a better knowledge on how climate change affects people and their mental and physical health. Practical training needs to be available for new medical students going into the field to be able to address health issues relating to climate change.

Munzhedzi and Cele (2018) explained that their research programme took place over two phases in June 2013. They looked at how climate change affected human health, water, agriculture and biodiversity. The second phase focused on how to adapt to the climate change effects. They also stated that the relationship between human health and climate change has not been fully understood. They reported that the increase in climate change in South Africa has resulted in various health risks for human health namely heat stress, vector-borne diseases (for example malaria, dengue fever and yellow fever), extreme weather events, air pollution, communicable diseases (HIV/AIDS, TB and cholera) and non-communicable diseases (cardio-vascular and respiratory diseases). Adding to this list, climate change has damaging effects on mental health and occupational health which is exacerbated by food shortages, hunger and malnutrition (Munzhedzi & Cele, 2018).

Mental health is affected by climate change when families lose their houses due to extreme weather conditions which results in people losing their livelihoods in the destruction or aftermath. This has a negative effect on a person's mental state as it increases anxiety, apathy, helplessness, depression and chronic psychological disorders. Goshua et al. (2020) also discussed this point in their research by reporting that there is an increase in mental health disorders because of the weather. People are forced to move, and there is food insecurity and extreme heat waves which result in post-traumatic stress disorder, depression, domestic abuse, anxiety and substance abuse. Temperature increases and heat waves have been associated with mental health and there has been an increase in hospitalisation for mental disorders, mood disorders, senility and psychological development disorders. The warmer the temperature, the less productive people are which results in people being in distress and having mental breakdowns (Munzhedzi & Cele, 2018).

Master (2022) wrote on Project Hope that the World Health Organisation projected that an additional 250 000 deaths per year due to an increase in heat stress, dengue, malaria and malnutrition will occur between 2030 and 2050 which are linked to climate

change. Disasters happen more frequently which increase levels of anxiety, depression and post-traumatic stress disorders. Furthermore there has been a noticeable increase in anxiety, schizophrenia and personality disorders because of the exposure to poor air quality. People who already have mental conditions and children are the most defenceless. Currently, 7 million people die every year from air pollution. Heat waves, particularly in the U.S., cause more deaths every year than any other disasters that occur combined (Master, 2022).

Balbus et al. (2018) concluded that the effects that climate change has on health will only worsen as the temperature continue to increase causing heat waves, floods, droughts and other extreme weather. Vector-borne diseases will more than double by 2050 (Masters, 2022).

In 2017, 11 experts spent two days looking at climate change and the worsen of violent conflict and they concluded that if climate change carries on increasing, the violence will increase dramatically especially in poorer countries (Levy, Sidel & Patz, 2017). Figure 2.9 below illustrates climate change and health. The grey boxes show different factors in the environmental and institutional context and the social and behavioural context. The different shades of blue boxes shows the different climate drivers, the exposure pathways and the various health outcomes that occur.

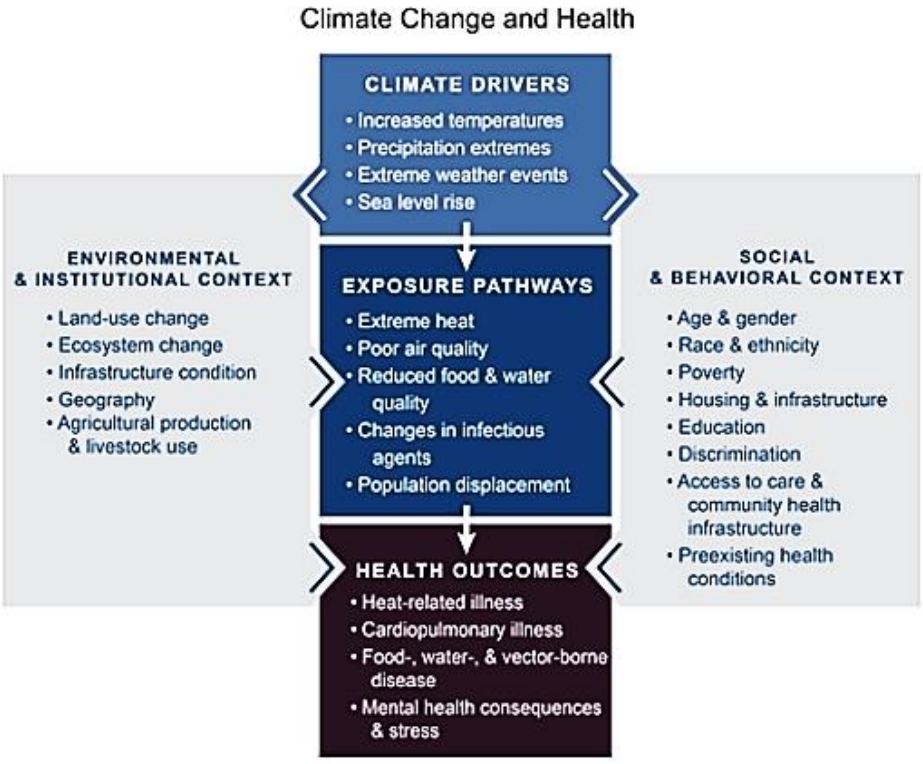



**Figure 2.9: Climate change and health**

Source: Crimmins et al. (2016)

Crimmins et al. (2016) showed the various ways that climate change can affect human health. The grey boxes show different factors that have a positive or negative influence on human health. The right-hand box portrays the individual social and behavioural vulnerabilities. The left-hand box shows the environmental and institutional factors that are influenced.

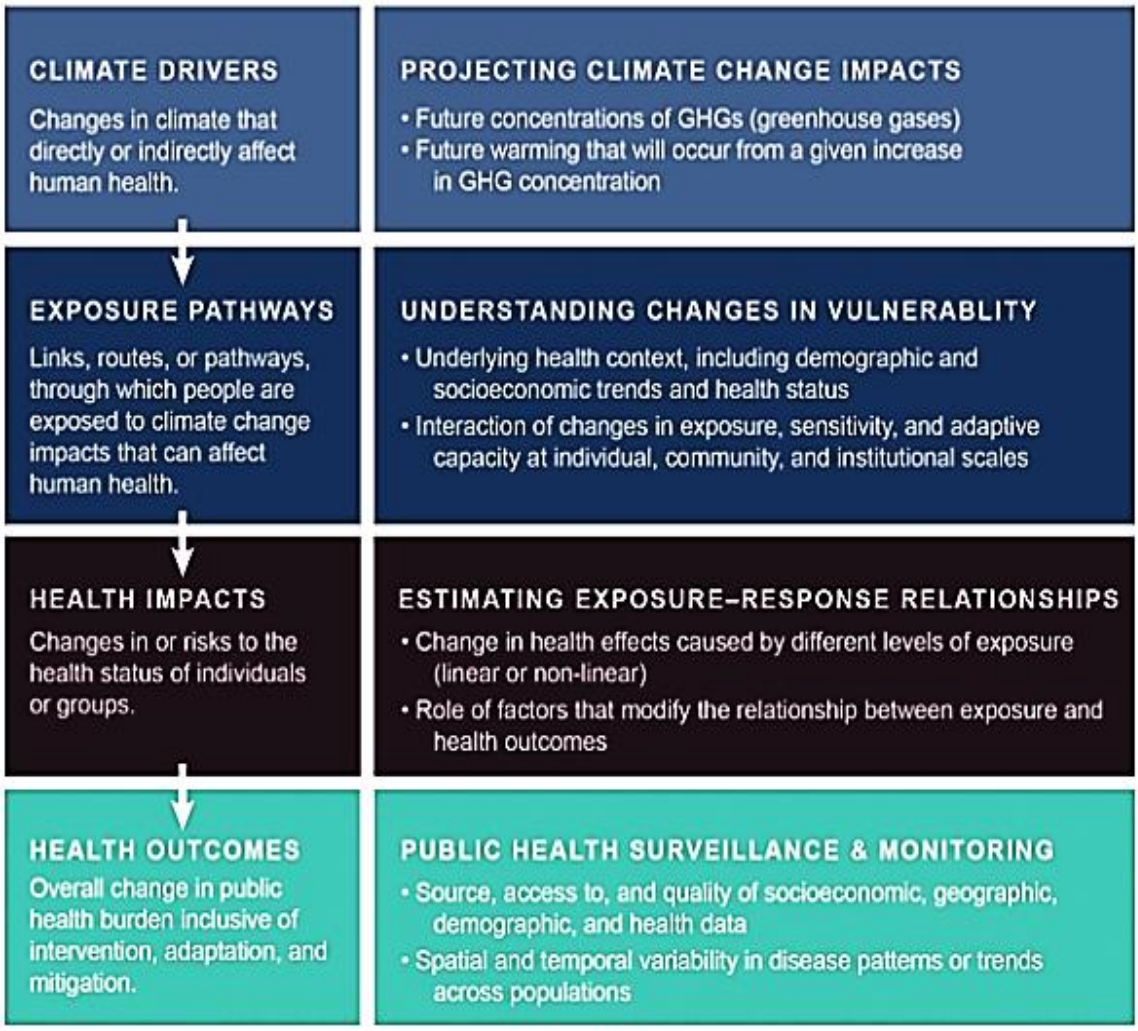



**Figure 2.10: Probability of impact of climate change on human health**

Source: Crimmins et al. (2016).

The left side shows how the exposure pathway through climate change can affect human health and the right shows the foundations of the uncertainty surrounding effects of climate change.

Looking at the above figures, namely, figure 2.9: Climate change and health and figure 2.10: Probability of impact of climate change on human health, it seems that climate change, human health and teaching and learning should all be linked. In my opinion, it is crucial to examine how temperature fluctuations impact children's health, particularly when they find themselves in crowded classrooms with inadequate ventilation. This situation can lead to difficulties in concentration, sensations of lightheadedness or dizziness, and ultimately hinder the ability to breathe properly. This

is one example of how the change in climate affects learners. Another example would be when it rains for a long period of time which results in floods. Learners who spend extended periods outdoors, such as those who walk to school or have a considerable distance to cover from the gate to the classroom, are particularly vulnerable. This is because these learners may end up sitting in class with wet clothes, leading to illnesses that cause them to be absent from school. Consequently, this negatively impacts their academic performance in the long run.

Clayton (2020) stated that when we hear the words “climate change”, we think of ice caps melting and the polar bears dying, but the concept is much bigger than the natural impacts as these impacts have a snowball effect on humans and their way of life. Clayton (2020) backed up the research by explaining how human health is threatened by heat, the spread of waterborne and vector-borne diseases, malnutrition and forcing people out of their homes and communities. The relationship between climate change and mental health is not easy to identify resulting in lack of evidence. Learners go to school for five days a week and school is known as their safe place, but the learners cannot change the way in which these variables affect them, which makes them the most vulnerable to climate change (Clayton, 2020). Heat has been proven to be associated with aggression and conflict and there have been increased rates of suicide and more people being hospitalised for mental illness. After decades of gathering information, it can be said that there is a relationship between climate change and mental health.

I am of the opinion that learners bear the brunt of the impacts of climate change, being the most susceptible to its effects. They exhibit pronounced reactions to extreme weather events, including conditions like depression and sleep disorders. Additionally, their bodies respond adversely to heat and rising temperatures, as they struggle with thermoregulation. This inability to cope with emotional stressors can lead to behavioural problems among children (Clayton, 2020).

From what I have read and reported on, there is no doubt in my mind that climate change affects mental health. The literature review also showed that children are the most vulnerable and are affected the most which relates back to my topic about climate change and learners’ behaviour and academic performance. This research also

showed that climate change has a negative impact on the natural environment and human health.

2.4.2.1 Climate change in Graaff-Reinet

World Weather Online (2022) reported that weather in Graaff-Reinet, which is in the southern hemisphere, is known for its extreme heat or extreme cold. The warmest month is February where the highest temperature averages around 34° Celsius and the lowest temperature is around 15° Celsius. Adding to this information, December, January and February have a daily average of 11 hours of sunshine. The rainfall has been different the last few years but generally it rains for 63 days of the year and collects up to 338mm. The wettest month is March. January, February, November and December have the highest UV index which is a maximum of 12. The coldest month is June where the temperature averages around 18° Celsius and the lowest is 5° Celsius and the months that are the driest are June and September (World Weather Online, 2022).

2.4.2.2 Average temperature

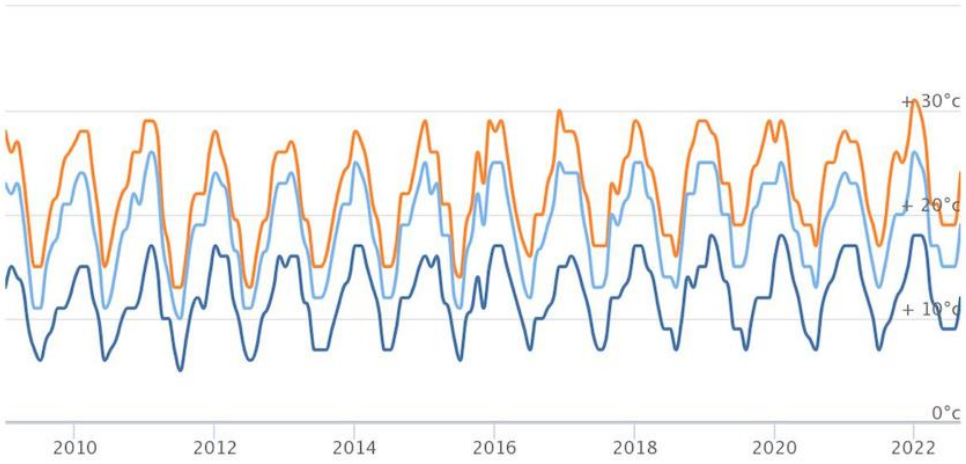



**Figure 2.11: The average temperature in Graaff-Reinet from 2010 to 2022**

Source: World Weather Online (2022)

2.4.2.3 Average rainfall amount

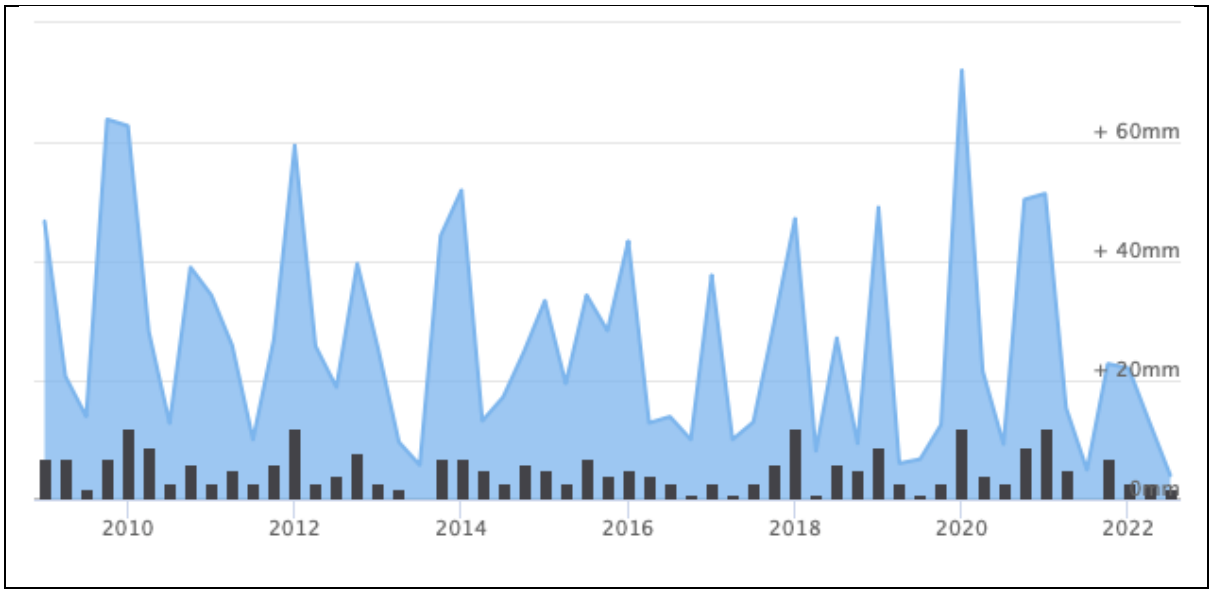



**Figure 2.12: The average rainfall in Graaff-Reinet from 2010 to 2022**

Source: World Weather Online (2022)

## 2.5 CLIMATE CHANGE ADAPTATIONS AND MITIGATION

Climate change adaptations and mitigation cannot be seen as separate; rather, one cannot function without the other (Morecroft et al., 2019). Climate adaptation is the way our behaviour, systems, routines and lives change so that we can protect ourselves, our families, the economy and the environment (Morecroft et al., 2019). Adaptation means changing one's lifestyle because of the change that is happening to manage the impact it has on one's life. Mitigation is the actions that we take to reduce greenhouse gases into the atmosphere which should result in the earth not getting warmer and the temperatures not rising (Morecroft et al., 2019).

Achieving climate mitigation is a complex task. Immediate results are not apparent when initiating the necessary changes; hence, a sustained effort over many years is essential for significant impact. In my view, an effective approach to mitigation involves addressing root issues. This involves transitioning from fossil fuels to clean renewable energy, minimising deforestation, and reducing personal emissions to contribute positively to one's community and overall environment (Landauer et al., 2018). To prevent further release of greenhouse gases, it is imperative to implement measures like enhancing energy efficiency, promoting the use of renewable energy, adopting

alternative transportation methods to decrease car emissions, and complying with carbon tax and emissions regulations (Morecroft et al., 2019).

Mitigation means reducing the risk of loss from unfavourable events (Readiness and Emergency Management for Schools (REMS), 2019). Schools need to be prepared for almost anything that comes their way and by being prepared for these events, mitigation needs to take place (REMS, 2019). Many different events that arise in schools, are stopped before something bad comes to surface for example any violence acts can be prevented by having different bullying and support programmes in place for the learners (REMS, 2019), but there are some events like heavy winds, rain and extreme heat that schools need to plan to eliminate the impact of these events. Schools need to have fire drills in place and management needs to make sure that everyone is aware of what the plan is when a specific event happens at school (REMS, 2019).

Rofiah et al. (2021) explained that there are five mission areas namely prevention, protection, mitigation, response and recovery that all go together in order to be prepared.


**Figure 2.13: The five mission areas that contribute to being prepared in the education system**

**Source**: REMS (2019).

In the realm of teaching and learning, various situations unfold daily, and it is impossible to prevent every occurrence. However, one can be prepared for unforeseen circumstances. For instance, even if there is a planned curriculum for the day, and the class turns out to be disruptive, a skilled teacher has the ability to restore order and resume normal class activities. Moreover, the teacher has additional strategies in place to ensure that the planned content is covered within the designated time period. Combining different concepts may also be employed as a strategy to save time. In this way, mitigation strategies are applied to prevent learners from falling behind in completing the necessary curriculum (Rofiah et al., 2021).

Adaptation is how individuals respond to climate change and the consequences that come with it (Landauer et al., 2018). My point of view is that adaptation is when we change little things in our lives but do not look at the whole concept. There are many different actions that we can do to help reduce the consequence of climate change. Rojas (2019) explained that some of these actions are restoring the natural landscape and planting more forest; being flexible and prepared for natural disasters before they happen; developing and researching different concepts that will help the individual change their daily lives to reduce their carbon footprint; for example, homes having their own vegetable gardens and making sure that there are preventive and precautionary measures in place when the temperature starts increasing and natural disasters start happening. There are a few examples of countries that have already started planned adaptations. For example, Egypt has adopted a law that infrastructure close to the coast has to be approved and has set out regulations to keep the natural world safe (Rojas, 2019); Sudan is using traditional rainwater harvesting and water-saving techniques to help it through the drought; Botswana is helping farmers develop their crops after the drought that they have had (Rojas, 2019). I believe that if all countries stand together and follow a plan, the climate change will, over time, improve (Rojas, 2019).

I feel that sometimes seeing something visually helps to explain the concept better than words. Figure 2.14 shows the similarities and differences between mitigation and adaptation.

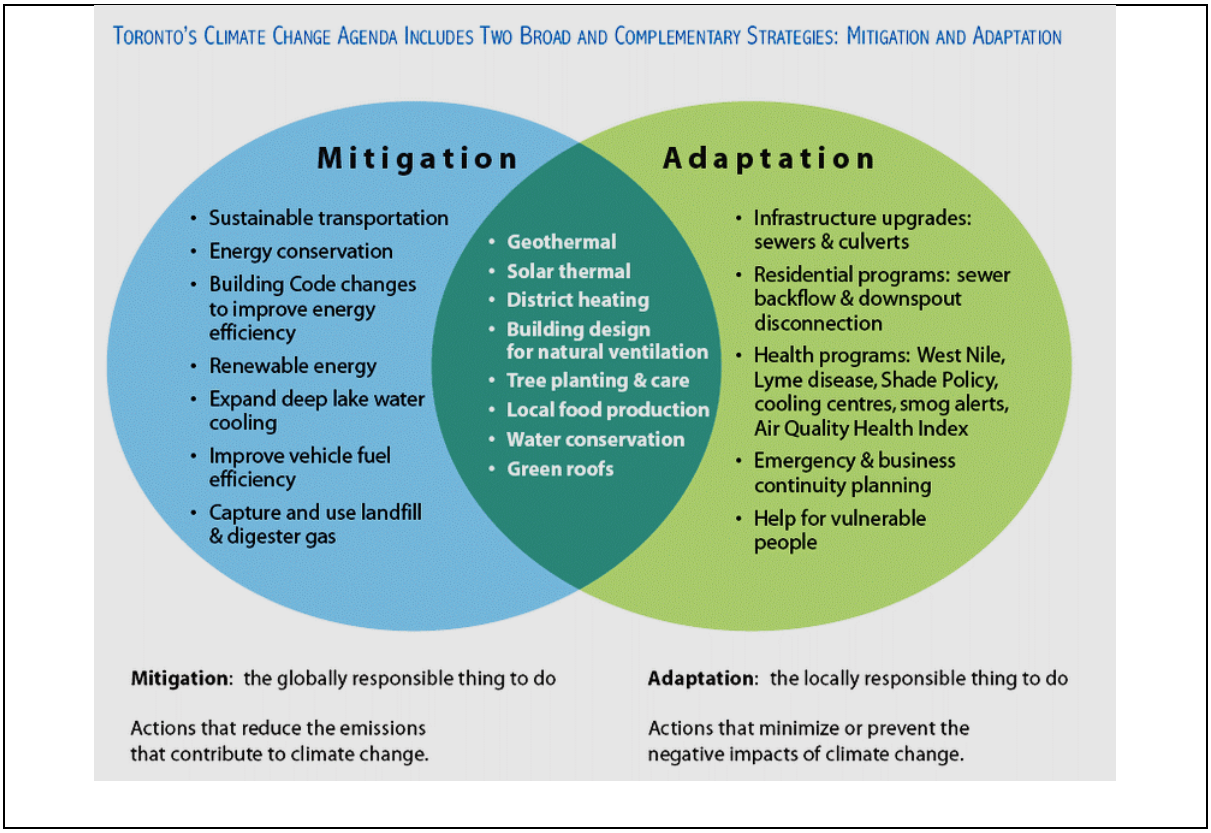



**Figure 2.14: The overlap between mitigation and adaptation**

Source: Kazmierczak and Carter (2010).

## 2.6 WEATHER AND HUMAN BEHAVIOUR STUDIES

Weather is defined as the state of the atmosphere at a specific time (Gutierrez et al., 2017). Weather is what we physically feel and experience outside namely hot, cloudy, sunny, rainy, windy or snowy (NOAA, 2021). Weather influences peoples' moods and has an impact on people's work ethic and how they deal with specific conditions. Therefore we can say the same for learners and their motivation and attitude towards their schoolwork (NOAA, 2021).

Ciucci et al. (2010) did a study with 61 children attending a day-care centre in Italy (Florence). They looked at what impact the winter weather conditions had on young children's behaviour at day-care centres. The average age of the children was 24.1 months. The teachers who were involved observed the behaviour and emotional state of the children during the morning and over the winter months completed a questionnaire five times over a period of three weeks.

The findings of the study showed that children were not emotionally fully developed which meant that their reactions to external factors were not controlled and children struggled to deal with these changes (Ciucci et al., 2010). The researchers explained that there are only a few studies that examine the relationship between weather, social behaviour and emotional affects in children. In a study that was done over a five-week period, specifically in spring, the children reacted differently; for example, when the weather was stable, children interacted more with the materials and work than with the teacher and their peers. When the weather was unstable (which was a combination of rain, snow, cloudiness, strong wind, unstable barometric pressure), children engaged in a more appropriate manner with their peers and teachers and less with the materials in front of them (Essa, Hilton & Murray, 1990). Ciucci et al. (2010) concluded that weather has a stronger impact on children than on adults because children struggle to regulate their model of behaviour. Furthermore, they also stated that the children's aggressive nature was increased in summer when they were outside, and boys showed more of these characteristics.

Lagacé-Séguin and D'Entremont (2005) cite Hilton and Murray's (1990) study where they observed the children over a five-week period and found that the learners were more interactive with their materials when the weather was stable and less interactive with the materials when the weather was unstable. Lagacé-Séguin et al. (2001) examined children's emotions over a 33-day period and reported that when the weather was calm and the sun was shining, the children showed more positive behaviour traits whereas when there was a high level of humidity, their behaviour showed a higher level of irritability.

Psychologist Craig Anderson (cited in McAndrew, 2019) mentioned that data from the U.S. confirmed violent crimes increased when the temperature increased; however non-violent crimes did not increase. He concluded that as temperatures rise, people tend to avoid being in close proximity to one another, which isn't always feasible, leading to heightened tensions in crowds. However, there is conflicting data from Russell and Dua (1983), who studied a Western Hockey League game and found no supporting evidence linking aggressive behavior to climate change.

VanBuskirk and Simpson (2013) did a study on three children who were diagnosed with autism spectrum disorder, where data was collected daily on each student which

focused on behaviour and academic performances and meteorological data (barometric pressure, humidity, outdoor temperature and moon illumination). The results from this study showed that was a very weak relationship but it was mentioned that many of the reactions were negative to humidity, increased temperatures and the different phases of the moon. They also found that when the temperature was extremely cold the children struggled to stay focused and engaged in their work (VanBuskirk & Simpson, 2013). The research findings that the researchers reported on is the opposite of others as they found that when humidity increased, the children's' behaviour problems decreased. Even though the findings from this researcher are not the same as those in other articles, and there are many limitations that have been mentioned, it still shows that weather affects children's behaviour in one way or another.

In my opinion, the researchers found a relationship between weather, barometric pressure, behaviour and students' performance. However, the amount of research that focuses on children's behaviour in the school environment is limited. Therefore, it is difficult to draw direct conclusions because we are not looking at exactly the same concepts. This is the main reason why I have chosen to investigate the effects of changes in weather patterns on the behaviour of learners in the South African context.

## 2.7 THE EFFECTS OF CLIMATE CHANGE ON EDUCATION

Ballotpedia (2011) defined academic performance as being "the measurement of students' performance across various academic subjects. Teachers and education officials typically measure achievement using classroom performance, graduation rates and results from standardised tests". In South Africa, there are many different factors that affect the learning process such as overcrowded classrooms, HIV infections, sexual and physical abuse, floods, landslides, extremely high and cold temperatures, high unemployment rates, shortage of food, droughts, drug and alcohol abuse and poverty (Mabuza, 2019).

Byishimo (2021) conducted a study in Rwanda on how weather affects learning and concluded that climate change led to changes in the learners' academic performance. When it was the dry season, the learners struggled to concentrate for long periods of time and they were constantly sleepy in class. This became worse when they were fed leguminous nutrients. With the weather that was warmer, the learners sweated more

which makes them more tired and influences their learning environment negatively (Byishimo, 2021). In contrast, when it was rainy, learners were often late for school or did not come to school at all because their mode of transport was walking, and these learners came to school with wet clothes which made them uncomfortable and influenced their learning performance. In addition, the actual noise that came with thunderstorms, winds and rain made it difficult to teach in the classrooms and learners became distracted and did not stay focused (Byishimo, 2021).

Randell (2019) reported that climate change influences education directly or indirectly in many ways. When the weather shows patterns of tropical cyclones, hurricanes, floods, disastrous winds, tornados and heat waves, school buildings or the children's homes could be destroyed or severely damaged resulting in them not being able to come to school. Droughts and heat waves influence children's parents' livelihoods and some of them lose their jobs and cannot pay for school fees or the children get taken out of school to earn more money for the household. Indirectly the children can be affected in the early childhood development phase when the brain develops more rapidly which means that acceptable nutrition is critical. Randell (2019) found that in countries where there were extreme heat waves, fewer children finished schooling or stayed at school for long periods of time. Thus, it is important to investigate the effects of climate change in education.

In support of the above, Phillips (2022) reported that excessive amounts of rain had fallen in 2022 which resulted in flooding all over South Africa, especially in Ladysmith, KwaZulu-Natal. More specifically, schools had to close. Roads were closed, infrastructure collapsed and buildings were under water which resulted in learners not being able to go to school. This means that there needs to be a future-proof education plan to protect the learners against the different risks of climate change. See more images in Figure 2.15 below.

**Figure 2.15: A classroom in KwaZulu-Natal damaged by floods**

Source: Phillips (2022)

The News Team (2018) wrote a report on Safe Schools: They identified a hidden crisis that listed three threats of climate change which were the environment, conflict and violence. In 2018, 550 million school children who lived in a low- to middle-income families experienced these three threats which were anticipated to increase to 622 million school children by 2030 (The News Team, 2018).

The more climate change increases, the more the teachers and learners will experience the consequences in the schooling system especially in developing countries like South Africa. These consequences will have lasting effects on the learners' educational and psychological development.

Natural disasters are worse than what we are used to. Programmes need to be put in place by the various departments involved to build flexibility to the consequences that climate change brings to education. These changes need to be taken on by each provincial department because each province suffers different climatic events; for example, some provinces experience floods where others experience hotter and drier conditions (Phillips, 2022).

Fricker (2021) stated that the children in South Africa are greatly affected by climate change which leads to a scarcity of water and water pollution which affects their health and education. The representative of UNICEF in South Africa highlighted that climate change has a disproportionate impact on the country's children, rendering them even more vulnerable. This vulnerability often results in children missing school, ultimately affecting their educational development (Fricker, 2021).

Chersich et al. (2019) commented on how extreme heat exposure in schools gives children sick-building syndrome which is when the temperature in classrooms get extremely high and there is low ventilation and poor levels of $CO_2$. The children will experience very low concentration, low school attendance and increased rates of respiratory problems. The teachers could open the windows but in places where the air pollution is high (for example in Witbank, South Africa), this comes with its own health issues as the children get exposed to air pollution from the coal mines. It would be easy to believe that opening windows is a solution; however, in towns where the air pollution is high, it increases air pollution exposure which brings its own health issues. In South Africa, many schools are situated close to major roads, mine dumps and various industrial operations (Scorgie et al., 2019).

Chersich et al. (2019) conducted research in Cameroon, examining not only schools but also the living conditions of children, particularly in Rural Development Programme houses. The study revealed that these houses were approximately 4-5 degrees warmer than the outdoor environment, making it nearly impossible for children to engage in homework and study at home. The resulting lack of sleep further contributed to adverse effects on their academic achievement.

When examining climate change, it is essential to acknowledge its interconnectedness with poverty. The individuals impacted by climate change often experience the compounding effects of poverty, manifesting as shortages in water and food, job losses and a surge in gender-based violence. These factors collectively contribute to the vulnerability of the most affected demographic, children. As a consequence, these children face barriers to obtaining the education necessary for their success, ultimately influencing the overall education levels of the country (Concern Worldwide, 2022).

Concern Worldwide (2022) confirmed that climate change affects many different facets of a person's life, such as their access to resources like clean water and food, the

stability of their livelihoods, the prevalence of health-related challenges, and the overall resilience of their communities. The impact of climate change on hunger is significant, especially when children as young as two years old are diagnosed with malnutrition. This condition not only hampers brain development but also results in children missing school due to hunger, affecting their academic progress. As a teacher in a primary school, I have observed that factors such as air pollution, floods, high temperatures, cyclones, waterborne diseases, and other illnesses, all intensified by climate change, contribute to increased absenteeism in schools. The more children miss school, the more academic work they miss, leading to a negative impact on their overall academic development.

Scorgie et al. (2019) discussed the escalating challenges related to water security and quality. The increasing frequency of droughts poses a threat to water availability in schools and communities, while floods, exacerbated by climate change, contribute to the spread of diseases that thrive in warmer conditions. In instances where schools lack proper sanitation facilities, closures are necessary, depriving children of their education for the duration required to improve these facilities. If children miss school, even the most skilled teacher faces challenges in helping them to catch up and progress with the curriculum alongside the rest. Ultimately, both the teacher and the children find it challenging to meet all the expectations placed upon them.

Until this point, we have been looking at the children's development and how they are being affected by climate change, but one tends to forget about the impact this has on teachers. Concern Worldwide (2022) explained that teachers are also affected by different diseases that comes with climate change and in some villages, there are limited teachers available which means if one gets sick, they are not easily replaced so classes sit without a teacher for a long time.

As stated in Concern Worldwide (2022), UNESCO states that if all children just had the basic reading skills, 171 million people would be able to escape extreme poverty but the effects of climate change and everything that comes with it, makes this task seem almost insurmountable by teachers, children and the education system.

Mabuza (2019) reported on a study in Johannesburg where there is a relatively mild climate. To address the shortage of classrooms, cargo containers are sometimes used as classrooms and temperatures in such classrooms sometimes reach 45.5° Celsius.

The students who have lessons in these containers experienced symptoms of drowsiness, low concentration and dehydration all of which impacted their learning. In places where the temperature is higher like the Northern Cape and Limpopo, these temperatures in these containers are unbearable and the consequences even worse (Mabuza, 2019). Scorgie et al. (2019) also wrote about the containers being used in South Africa as school classrooms and that the learners struggled to concentrate, leading to poor academic results. The overcrowded classrooms also generate more heat as there are some schools who have more than 50 children in a class which makes children irritable, aggressive and violent towards their peers and their teachers which presents a great threat to the educational system.

In Costa Rica, air conditioning machines have been installed in all their classrooms and a noticeable improvement in the learner's academic achievement was reported (Porras-Salazar et al., 2018). Unfortunately, to my knowledge, this is not financially possible in South African schools.

Park et al. (2020) did a widespread, in-depth study which gathered information from 58 countries and 12 000 schools which looked at weather and the academic calendar to see if there was any relationship between the two. They concluded that on hot school days, the rate of learning decreased which showed that the hotter the learners became, the less motivated they were to stay focused and learn.

Academic achievement is a core focus when someone is looking for a job. Specific careers require people to have a matric certificate or to have a diploma or a degree qualification. A study done by Briones et al. (2022) on the factors affecting academic performance of Grade 11 students at SKSU - Laboratory High School in the Philippines concluded that the students' environment has a huge impact on their academic performance which can have a positive effect or negative effect. Factors considered were parenting styles, characteristics of the student, access to the internet, teacher effectiveness, lack of concentration and motivation. Climate change impacts learners' ability to concentrate for long periods of time. The teachers can also be affected by the extreme weather circumstances related to climate change which has a direct impact on the learners' academic performance. Simons (2019) reported that when it was windy in England there was a noticeable increase in bad behaviour amongst school children resulting in many more children being sent to the principal's office.

## 2.8 IDEAL TEMPERATURE FOR LEARNING

Byishimo (2021) stated a survey he conducted showed that if the weather was not favourable for learners to burn off energy at break times, they were less likely to stay focused on lessons especially younger children who then spend all their time looking outside and not focusing on their academic work. Similarly, Scorgie et al. (2019) reported that, where temperatures reached 30° Celsius, learners scored 20% lower than other learners who did the same test but where the temperature was only 20° Celsius.

A temperature of 23° Celsius is the temperature that is the most favourable for students to succeed in their academic achievement success, as stated by Braswell (2018). As the temperature rises, there is a corresponding decline in learners' concentration, and conversely, when the temperature drops, concentration levels also decrease (Braswell, 2018). The Courier (2021) supported this by stating that students perform best in weather conditions where the sun is shining, but it is not excessively hot or cold. This weather tends to make individuals feel more alert and less stressed or anxious.

The literature makes it clear that there is a link between climate change and learning, be it direct at school or indirectly at home and the challenges that arise with that. As stated, children are the most vulnerable and they are the ones, in my opinion, who are most affected by climate change and are disadvantaged in their academic development.

## 2.9 BIOMETEOROLOGY

Biometeorology is a multidisciplinary field that deals with how life on earth (plants, animals, humans) are impacted by weather (Lowry, 2013). Biometeorology assesses how atmospheric conditions can impact living organisms, how weather influences people and preventive approaches that can be implemented (Kalkstein & Valimont, 1987). The Royal Meteorological Society (2017) reported that one also needs to look at the relationship that exists between weather and health, namely:

- Cold and flu: When there is an atmospheric pressure change, it contributes to sinusitis and colds.

- Asthma and allergies: When seasons change and there is air pollution present, extreme weather conditions can accelerate someone's asthma and allergies.
- Blood pressure: When the atmospheric pressure decreases, a person's blood pressure has shown to decrease. Adding to this, when temperatures are low, it also triggers the narrowing of blood vessels which shows that blood pressure is lower in summer and higher in the winter months.
- Joint pain: When there is a sudden change in the atmospheric pressure, for example, when a storm is building up, this prompts joint pain. Furthermore, colder weather changes the joint fluid thickness which also adds pain.
- Headaches: The exact reason why this happens is unknown but atmospheric pressure prompts headaches and migraines, but it may be linked to longer exposure to bright light, pollen exposures and increase in heat.
- Blood-sugar changes and diabetes: As soon as weather fronts start building up, which is related to low atmospheric pressure, this impacts the blood viscosity and thickness which results in diabetics not being able to control their blood sugar when a cold front hits.
- Heart attacks: When there is a 1° Celsius drop in temperature, heart increase.
- Lung diseases: If the weather is hot and humid and air pollution is high which is generally aggravated by heat, breathing problems occur specifically for people who already have lung conditions.
- Heat stress: When there is extreme heat, it creates heat stress because the body struggles to control its internal temperature.

Adding to this list, Shukla (2013) mentioned that with the rising temperatures, people are suffering from heatstroke which affects their mental health. In South Africa, Northern Cape in the town of Kakamas, eight farm labourers passed away due to a heatwave that happened in January 2023, due to the extreme heat and it being harvesting season when these workers were outside for long periods of time (eNCA, 2023). There was a study done in Israel which showed that there was an increase in schizophrenia patients in hospitals in summer and autumn which are the warmer

months in this country (Shukla, 2013). Salib and Sharp (2002) did research where they discussed in their results that “with relative humidity, atmospheric pressure, rainfall and hours of sunshine there has been an increase in bipolar admissions” (p. 147). Evans (2019) explained that, in England, more adults have mental health problems as the temperatures have started rising; the extreme results are that the suicide rate has also increased.

Weather and climate change have an impact on every living creature on this planet which involves reproduction, population variations and the health of the different species. Biometeorology includes the measurement of agricultural yields and weather, the influence of weather on human health, the impact of pollution on tree species, the tolerance levels of organisms to their environment, and the consequences of climate change on plant life (Lowry, 2013). Having more information about different climate change variations, such as extreme heat waves, strong winds and pollution, is crucial for professionals in the medical field. This knowledge aids them in addressing emerging health issues, particularly among vulnerable populations like the elderly (Zerr, 2017).

Van Nieuwenhuizen et al. (2021) conducted a global research project examining the influence of different seasons on adult physical activities and behaviours. The findings indicated that during the warmer months of summer, there was an increase in temperature, leading to adults being more active and more motivated to engage in physical activity compared to the colder winter months. When extremely hot temperatures were experienced, people also moved away from areas where this occurred.

My study focused on how the elements that make up climate change influence Foundation Phase learners’ behaviour and academic performance. The research that has been done on how climate change changes learners’ behaviour and academic performance is limited mainly to adults’ behaviour and their mental health relating to climate change. I plan to add information to the debate so that teachers can have a better understanding of what affects the learners’ reactions and their academic performance.

## 2.10 THEORETICAL FRAMEWORK:

### 2.10.1 The Theory of Planned Behaviour

The research's theoretical framework adhered to the theory of planned behavior (TPB). Ajzen (2011) highlighted that, in the 26 years since its inception, TPB has evolved into one of the most widely cited theories for understanding human social behavior. TPB builds upon the theory of reasoned action, developed in 1980, by incorporating the concept of perceived behavioural control, enhancing the model's predictive capabilities (Luenendonk, 2019). This theory helps people understand how individuals can change their behaviour in specific situations, for example, how people can reduce addiction and stop smoking (Alhamad & Donyai, 2021). The crux of TPB is that an individual's behavioural intent is the most important factor in social behaviour and TPB has three main components which are attitudes, subjective norms and perceived behavioural control, which together make up an individual's behaviour intention (Janse, 2023).

TPB predicts the probability of a specific behaviour happening to an individual by using an individual's intentions, attitudes subjective norms (what a person perceives of importance of someone else beliefs which influences if he or she should carry on with the behaviour or not), covering the implementation of the behaviour and the individual's insight of their control over the behaviour (Ajzen, 1991). Azjen (1991) suggests that a persons' choice to take part in a particular behaviour can be founded by their intention to engage in the behaviour. This theory suggests that for a person to change their current behaviour, their attitudes, subjective norms and the perceived behavioural control all need to be changed and altered to achieve the desired behaviour (Janse, 2023). Criticism of the theory is that it is an incorrect way of measuring social behaviour (Ajzen, 2011).

Ajzen (1991) explained this framework in the following way:

> Intentions are assumed to capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour. Generally, the stronger the intention to engage in a behaviour, the more likely should be its performance. (p. 181)

The intentions that are mentioned are determined by three main concepts: personal attitudes towards behaviour (behavioural beliefs), subjective norms (normative beliefs) and perceived behavioural control (control beliefs). TPB accepts that all behaviour that arises are mindful, rational and intentional; however this does not address the role that emotions play in determining a person's behaviour (Brookes, 2021).

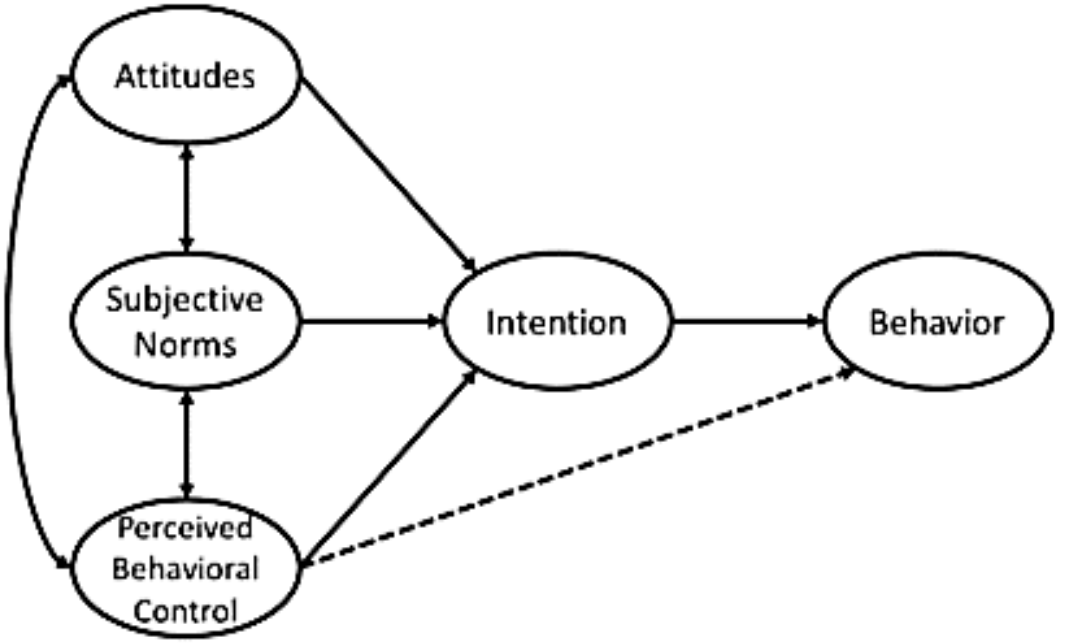



**Figure 2.16: The Theory of Planned Behaviour.**

Source: Ajzen (2005).

Luenendonk (2019) explained these core assumptions in more detail, starting with attitudes which indicates what the person believes about the specific behaviour. When the behaviour is positive, individuals are inclined to develop a positive attitude toward that particular behaviour, thereby enhancing the likelihood of a change in performance. Specifically, the individual's beliefs about the behaviour will revolve around whether it is perceived as positive or negative. A person's attitude toward a specific behavior plays a crucial role in determining the likelihood of executing that behaviour. For instance, if there is a positive belief that engaging in the behaviour will bring about positive changes in one's life, the likelihood of that behaviour occurring is heightened (Luenendonk, 2019). When I look at the learner's behaviour and how they react to what was happening in the classroom, if they are positive about their schoolwork and

about their abilities, I believe that they will automatically put more effort in their schoolwork and their focus will be more on listening and behaving.

Subject norms can be measured by the social pressures, which include the expectations of others and how the individual feels about those expectations (Ajzen, 2005). The subject norm looks at the individual's social circle which are the people that the person interacts with (Luenendonk, 2019). It covers what the other people around them are thinking. Looking at the school set up, if some learners in the class are getting positive feedback from their actions, the chances are that other learners will follow their behaviour. Perceived behavioural control is how the individuals feels about doing the specific behaviour. The individual will ask themselves if they can do the specific task at hand. It looks at whether the individuals believe that they can do the specific behaviour that is being expected from them (Ajzen, 2005). The individual's perception of the particular behaviour is influenced by the judgement of those around them. Learners might think that they are not good enough to do the specific task that is being presented to them and their concentration levels are more likely to decrease when it gets discussed in the classroom. The more interconnected and favourable these factors are, the higher the likelihood of the behavior occurring (Ajzen, 2005).

Examining these essential components reveals that they converge around intentions. Intentions refer to an individual's desire to perform a particular behaviour (Ajzen, 2005). Although a person may contemplate doing a specific task, taking no concrete steps suggests a gap between their aspirations and the actual execution of the behaviour. This gap can be addressed by creating a plan to facilitate the action, turning the intention into a realized behaviour (Ajzen, 2005)/ In the school set up, a learner could be thinking about doing homework to improve their marks, but they never get to actually completing the task. By having a plan and routine, they can complete the task and start improving academically.

There are advantages and disadvantages to using the TPB. TPB is a theory that focuses solely on peoples' behaviours (Alhamad & Donyai, 2021). TPB can also explain and show the difference between the purpose and the real behaviour taking place (Alhamad & Donyai, 2021). The TPB can be employed proactively, such as before undertaking a significant risk. This theory aids in gathering essential data, enabling individuals to identify potential issues and obstacles that may arise when

attempting to change behaviour (Alhamad & Donyai, 2021). I find a positive aspect of this theory lies in its emphasis on individual behaviour and its exploration of various relationships between behaviour, understanding its origins, and identifying ways to bring about change. It assists in comprehending an individual's response to a specific event. However, a drawback of this theory is its failure to consider an individual's needs before initiating action (Alhamad & Donyai, 2021). The critics believe that the individual's needs would affect the behaviour regardless of the attitudes (Alhamad & Donyai, 2021). Adding to this, the theory does not take emotions into consideration which means that the behaviour outcome may not be anticipated and could be different from what is expected (Alhamad & Donyai, 2021).

In examining the relationship between a learner's behaviour, academic performance and climate change through the lens of the TPB, we can anticipate how learners might react to changes in weather patterns. By using the TPB, we can also work towards changing learners' perceptions of their behaviour during challenges beyond their control. This study is centered on children's behaviour and academic performance, with the TPB being the chosen theory to explore the connection between these aspects and climate change patterns. It is anticipated that TPB will aid educators in assessing learners in a specific manner, allowing for the prediction of potential behaviours. While this theory may reveal patterns in desired behaviour during specific events, it is acknowledged that certain aspects may not align with the research topic, leading to the incorporation and explanation of the SCT.

### 2.10.2 Social Change Theory

De La Sablonnière (2017) explained that social change is something that not everyone understands, and some people see it as something that just happens. Change is constantly happening, and nothing ever remains exactly the same. Sociologists explain social change as a change in human communications and relationships that change cultural and social establishments (De La Sablonnière, 2017). These changes do not happen suddenly but take place over a period of time and result in long-term consequences for society (Dunfey, 2019).

There are different branches of the SCT which are the evolutionary, functionalist and conflict theories (Naveed, 2019). This research followed the functionalist theory. Functionalist sociology can be characterised by the idea that society shapes the

individual, and it involves a structure composed of various institutions like family and education, which instill values (Parsons, 2018). Functionalists look at what makes the society in order to understand the individual function in that specific society. Parsons (2018) compares society to the human body mentioning that each part plays an important role in keeping the body healthy and functioning (Thompson, 2022). He believed that society needs specific things to function effectively; for example, society needs to provide shelter and food and for this to happen, a specific strategy needs to be in place (Thompson, 2022). Parsons (2018) believed that four needs should be met for a society to be successful: the workplace (which provide goods and services); schools (where individuals learn the difference between right and wrong; courts (an organisation that needs to deal with conflict); and the family (to teach their family norms and values to the next generation).

Looking at schools, teachers are in direct contact with the learners, and they spend more time of the day with the learners, so they are in the front line to change the learners' behaviour and social context beliefs. This can be done directly by the teacher by being firm and laying down the rules of the class and school. By looking at how the learners react to climate change and how it affects their learning, the teacher can collaborate with the parents (home) to break the cycle of the learner not being able to function when climate change affects them negatively. The school and home need to work together to come up with different strategies to make learners aware that how they are reacting is due to the climate and that they need to work through these feelings to become successful. In this way, home and school can change the social behaviour and the individuals can move forward in society.

In this research, the social change theory was implemented to examine how learners responded to specific instances of climate change and how teachers could adapt their role to facilitate the learners in reaching their full potential. The learners learned how to develop strategies to cope with challenges beyond their control. The data collected was then compared against the theory by analysing the observations provided by the teachers to the researcher. This process also provided the researcher with insights into social norms and the impact of various uncontrollable factors on the learners, as well as their reactions to these challenges. The TPB was used to look at the learner's reactions (behavioural and academic) to climate change as it was collected from the teachers and measured against previous data that was collected in a different season

by the same teacher and the same class. This theory used as an interpretative tool when analysing the data that has been captured.

## 2.11 CHAPTER SUMMARY

Chapter 2 delved into various crucial aspects related to the South African education system, exploring its structure and dynamics. The psychological effects of climate change on education were examined, shedding light on the intricate interplay between environmental shifts and mental well-being. The broader concept of climate change was comprehensively discussed, including its specific effects on mental health. The chapter also looked at strategies for climate change adaptations and mitigation, recognising their importance in educational contexts. A particular focus was placed on studies exploring the correlation between weather patterns and human behaviour, providing valuable insights. Furthermore, the extensive examination of the repercussions of climate change on education emphasises the urgency of addressing these challenges. The chapter delved into the ideal temperature for optimal learning conditions and introduces the field of biometeorology. Finally, the theoretical framework was outlined, incorporating the TPB and the SCT, both instrumental in understanding and addressing the multifaceted impact of climate change on education.

The most prominent conclusion that was made from the literature review is that climate change is a global crisis and that it effects everyone in different ways. The serious effects that climate change has on individuals are mental health issues, depression, loss of occupation and anxiety. The literature showed us that children and elders are the most vulnerable to the change in climate which is where the topic of the learners at school and their behaviour and academic performance links with the changes in climate. There have been many weather events, mainly flooding and droughts, across South Africa that have had a negative impact on the learners' schooling and development. I can conclude that climate change has many different influences and impacts on people's lives. These are all negative influences, and the younger generation needs to be protected from them. The next chapter describes the research methodology where the research paradigm, approach, design and the different methods used to collect the necessary data, the ethical considerations, limitations and delimitations are included.

# CHAPTER 3: RESEARCH METHODOLOGY

## 3.1 INTRODUCTION

The purpose of this study was to investigate how climate change affects Foundation Phase learners' behaviour and academic performance. This study was aimed at helping teachers to understand their learners' actions better and adapt their teaching and learning practices accordingly. This chapter discusses the study's research paradigm, approach, design and different methods that were used to collect information about climate change and the Foundation Phase learners' behaviour. It includes ethical considerations and the limitations and delimitations of the study.

## 3.2 RESEARCH PARADIGM

Khatri (2020) defined a research paradigm as a specific model, method or pattern that is used when researching a topic. In other words, it is a set of ideas, beliefs or understandings that specific theories and exercises used in the research. Willis (2007) stated that a research paradigm as "a comprehensive belief system, worldview or framework that guides research and practice in a field" (p. 8). The research paradigm directs the overall research process when investigating and selecting different methods to use in exploring the research topic (Khatri, 2020). There are four pillars underpinning paradigms of research, namely, ontology which delves into the nature of reality (how climate change impacts the behaviour of Foundation Phase learners); epistemology which explores the acquisition and validation of the knowledge of the impact of climate change on such learners; axiology which encompasses the study of values and ethical principles (in understanding the well-being of primary school learners affected by climate change); and methodology which involves the systematic approach or methods employed in research. Together, these components form the foundational pillars that shape the paradigms and frameworks guiding scholarly inquiry. They collectively contribute to the development of a comprehensive understanding of reality, knowledge, values, and the systematic processes employed in various research endeavours (Khatri, 2020). In research, one can follow a positivist paradigm, interpretivism paradigm, pragmatism paradigm or a postpositivist paradigm (Khatri, 2020).

The interpretivist paradigm was selected to obtain an understanding of individuals' views of a phenomenon (Santosh, 2021). Alharahsheh and Pius (2020) stated that the interpretivist paradigm looks at individuals' beliefs and motivations in order to increase the researcher's understanding of these individuals' social interactions; for example, looking at language, perceptions, consequences and instruments. The individuals that are taking part in the research describe their experience in their own way and are not pushed in a direction to fit a certain mould (Khatri, 2020). The researcher gained a detailed and personal understanding of individuals' lives to understand why they react and act in the manner that they do which allowed the researcher to have a close interaction with the individuals (Khatri, 2020). In order to be able to see the situation from different points of view, interviews and observations were used to gather the necessary data (Santosh, 2021). The researcher actively engaged with the participants, and the analysis of the data was directed by the research questions. Conclusions drawn from the data were shaped by the researcher's interest in the subject.

Therefore, this research used an interpretivist paradigm as the aim was to understand and interpret the subjective meanings and social context inherent in human experiences, specifically learners' behaviour and interaction and academic performance in line with what the weather was over a specific time.

### 3.3 RESEARCH APPROACH

This research followed a qualitative research approach. Creswell (2022) defined qualitative research as "an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants and conducted in a natural setting" (p. 72). Qualitative research takes an in-depth approach to understanding a phenomenon and is focused on something that is experienced and observed in its environment in contrast to using numbers (Busetto et al., 2020). MacMillan and Schumacher (2009) stated that qualitative research can be identified by nine different characteristics, namely; a natural setting; context sensitivity; direct data collection; rich narrative description; process orientation; inductive data analysis; participants' perspectives; emergent design; and complexity of understanding and explanation. When the qualitative approach is used, there is no form of manipulation or stepping in to change the

environment (Creswell, 2022). Creswell (2022) outlines that a qualitative approach is used when the researcher is looking to find and understand a specific connection between variables.

In this research, the behaviour and academic performance of the learners was observed directly by the teachers using their personal experience and observations in their classrooms. The teachers reported back on the learners' behaviour, academic performance and the climate change.

The purpose of conducting this study was to investigate how climate change affects Foundation Phase learners' behaviour and academic performance which helped teachers gain more knowledge and a better understanding about how a learner gets affected by circumstances out of their control and how the teacher can help the learners to adapt to adverse climate variations.

### 3.4 RESEARCH DESIGN

Burns and Grove (2013) described a research design as "a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings" (p. 43). In other words, it is a detailed explanation of the process that is required for acquiring the information needed to solve the research problem (Burns & Grove, 2013).

Yin (2013) defined a case study as an in-depth analysis of a case such as a programme, event, activity, process of one or more parties. Extensive information is collected by the researcher by using different means of data collection over a period of time (Creswell, 2022). Case studies are used when the researcher looks at an individual or group and gains in-depth understanding and knowledge from the individual or group (Crowe et al., 2011). when a complex issue is under investigation, and the particular topic being explored cannot be replicated in a laboratory setting but rather needs to be examined in a practical, real-world scenario (Crowe et al., 2011). There are several different types of case studies: a collective case study (a group of individuals); a descriptive case study (starts with a descriptive theory and compared this to pre-existing theory); an explanatory case study (researcher looks at different factors that may have caused a situation to happen); an instrumental case study (where an individual case provides a deeper understanding of the initially observed

phenomenon); and intrinsic case study (when the researcher has a deep personal interest in the research) (McMillan and Schumacher, 2009). The researcher used a collective case study. This type of case study is used to get a better understanding of a specific occurrence and get various comparisons and analysis on the case (Yin, 2013). Schoepf and Klimow (2022) defined a collective case study as an exploration of individual cases to offer specific details and explanations about a particular situation. It provides elaborative data by means of comparing cases and data which allows for a greater understanding of the phenomenon.

A collective case study requires the researcher to focusing on more than one case, in gathering and analysing data (McMillan & Schumacher, 2009). It allows the researcher to find similarities between the participants and look for common themes and patterns in the data (McMillan & Schumacher, 2009). This research was a collective case study as there were more than two cases (schools) included in the research and the teachers involved were asked to document their findings allowing the researcher to compare the different data received from the participants.

### 3.5 POPULATION AND SAMPLING

Banerjee and Chaudhury (2010) defined population as an entire group that is the focus of a study whereas a sample is the specific group selected from the population from whom the data will be collected. The sample will always be less than the population. When looking at these two concepts in research, population is not always people, but a group of elements, countries, events or objects while the sample is the target population that will be focused on (Banerjee & Chaudhury, 2010).

The participants, namely teachers, came from three different schools in Graaff-Reinet specifically Grade 3. The learners were eight and nine years old. The children were from different races, cultures, socio-economic backgrounds and gender. One school was situated in the central part of Graaff-Reinet and the total number of learners in the school from Grades 1 to 3 was 170. This school wase a Quintile 5 school. The next school was in the community of Asherville and the number of learners from Grades 1 to 7 was 700. This school was a Quintile 3 school. The last school was also situated in Asherville and the number of learners from Grades 1 to 7 was 1 100 learners and this school was a Quintile 3 school. The quintiles indicate that these were poor schools where learners did not pay school fees.

### 3.5.1 Convenience Sampling

McMillan and Schumacher (2009) explained that there are three types of nonprobability sampling, namely, convenience sampling, purposeful sampling and quota sampling. Stratton (2021) defined convenience sampling as a method used where the subjects participating in the research are readily available and in close proximity to the researcher for data collection purposes.

In this research the subjects were chosen because the schools and teachers were in close proximity to the researcher, so it allowed the data collection method to run smoothly. The researcher chose these participants purely because they were easily accessible and allowed the researcher to select a small sample to represent the population (Stratton, 2021). Out of the 15 schools in the town of Graaff-Reinet, three were chosen; the grade that was chosen to focus on was Grade 3 and one teacher per grade was chosen.

## 3.6 DATA COLLECTION METHODS AND INSTRUMENTS

Data collection is a systematic process of gathering information and giving the researcher first-hand knowledge and information about the topic (Carr et al., 2019). There are many data collection methods such as experiments, surveys, interviews, observations, ethnography, archival research and secondary data collection (Carr et al., 2019). For the purpose of this research, observation, document analysis and face-to-face interviews were used.

### 3.6.1 Observation

Observation is used when the researcher wants to understand what is happening in the natural setting of the topic of interest and is done in a way that causes the least disruption to the normal way of life (Kumar, 2022). Basic methods of just stepping back and watching what is happening around one is the best way to describe observation. By doing this, the researcher tries to make sense and gather information about the world around them and draw conclusions based on what has been observed. (Kumar, 2022).

In order to gain the information that is needed, teachers first took part in face-to-face interviews where they answered questions which allowed the teachers to give their

personal point of view on the topic. After the interviews were completed and all the necessary permissions were granted, the teachers received a questionnaire/check list that they filled in daily for the month (Appendix H). This questionnaire/check list had the necessary information about climate change, behaviour and academic performance on that specific day. These forms were collected monthly by the researcher for further processing. The researcher was a non-participatory observer for a whole week in each school. The teacher would get a separate form for the girls and boys where the teacher would mark off at the beginning of the day what the behaviour trait was and the academic performance was and the same checklist for mid-morning.

Three teachers participated this study which resulted in one teacher per school. The proximity of the schools was about five kilometres, so this made the climate change conditions the same. This study was conducted for a month during each season namely summer, autumn, winter and spring. In Grade 3, the teacher teaches all subjects, namely, Mathematics, Home Language (English or Afrikaans), First Additional Language (English or Afrikaans) and Life Skills. The teachers observed the learners' behaviour and academic performance in all these subjects The researcher analysed the data that was received by using an Excel database.

The teacher in each classroom was the observer. The teacher was the individual who was in close contact with the learners and picked up on the learners' traits more easily than a third-party observer. The learners are too young to fill in a questionnaire on their own therefore the teacher used their observations and completed the checklists.

The data was collected by means of check lists/questionnaires filled in daily by teachers for a month each season(Appendix H). The teachers marked off what the learners' behaviour and academic performance was on the specific day, twice a day. A check list/questionnaire was the instrument being used to gain the information needed from the observation (Appendix H).

#### 3.6.1.1 Non-participant observation

When using non-participant observation, the person observing the participants or the situation, does this in a way that the group does not notice that they are being observed which allows the observation to be as natural as possible (Kumar, 2022). The researcher is not actively involved in the data collection process which allows the

researcher to use the reports from the observer and not use their personal feelings about the topic (Kumar, 2022).

The researcher regularly visits the place where the research is taking place but takes on a more distant role (Hofmeister, 2021). The researcher took on the role of a non-participant observer as she was observed at the three different schools five days per month per school. She observed the Grade 3 classroom and all four subjects (Mathematics, Home Language, First Additional Language and Life Skills). The researcher reported on the observations that were made and this was used to gain more information about the class and the learners taking part in the observation.

### 3.6.2 Face-to-Face Interviews

A face-to-face interview is a method of collecting data where the interview is in direct communication with the person taking part in the research which allows the research to gain a better understanding of what the participant is feeling and attitudes about the topic being researched (McMillan & Schumacher, 2009). There are clues that the researcher can pick up on namely, body language and social cues (Creswell, 2022). When doing a face-to-face interview, the researcher can make the participant feel more at ease which allows the participant to answer questions more easily and get more personal and real answers (McMillan & Schumacher, 2009).

The interviews were done with the teachers involved and the researcher explored the teachers' points of view on the effects on adverse climate change and the learners' behaviour and academic performance. The instrument that was used to collect this data were detailed notes that the researcher made while doing the interview and commented on different cues that were picked up on. The researcher recorded the interviews which she listened to several times in order to transcribe the data for analysis. The questions that were asked (Appendix G) were drafted before the interview and the researcher made notes according to the answers to these questions.

### 3.6.3 Document Analysis

Document analysis is when documents are decoded by the researcher to give meaning to the topic (Bowen, 2009). When these documents are analysed, the researcher looks for and documents different themes and groups the information into similar themes and categories (Bowen, 2009). The researcher needs to obtain what

information is beneficial and identify what the relationship and similarities are in the data (Bowen, 2009).

In this research, there were three different teachers who did their observations in their class and recorded their experiences on that day which allowed the researcher to get new insight and different perspectives on the same topic. This also reduced possibilities of being biased (Morgan, 2022).

When researchers look at different types of research articles, for example, documents, research papers, interviews and newspaper articles, the researcher must look at their authenticity, trustworthiness, representativeness and what the meaning of the document is (Morgan, 2022). When the documents have been selected, they would need to be analysed where a thematic analysis would take place. After this, the reflective approach would be used (Morgan, 2022).

All the data collected from the interviews and observations were analysed with a fine toothcomb to make sure that all documents were relevant.

### 3.7 DATA ANALYSIS AND INTERPRETATION

Data analysis is regarded as the most important part of doing research as it summarises the data that has been collected and involves the interpretation of the data that has been collected (Girod, 2008). When doing qualitative research, the researcher needs to be patient and constantly review the findings and reflect on them by making notes and going through transcripts from the interviews and observations (Girod, 2008).

McMillan and Schumacher (2009) reported that there are different steps that will be followed once the research has taken place and the data needs to be analysed. These steps included collecting the data, organising the data, transcribing the data into segments, coding the data, describing the data, categorising the data and developing patterns. In more detail, the steps are:

- The data needs to be organised into different categories. The researcher should use predetermined categories.
- Data needs to be transcribed. There are three different kinds of data, namely, notes that have been taken during interviews, audio-recorded interviews and visual

images. This research used notes that were taken during the interviews. The notes were typed out after each interview.

- The next step is data coding. This step includes identifying segments that can stand on their own. There are different types of codes, namely, setting/context, participants' perspectives, participants' thinking about people and objects, processes, activities, events, relationships, social structures and strategies.

- Forming categories is the next step. This is where categories or themes are identified.

- Discovering patterns is the ultimate goal of qualitative research. The researcher tries to understand the various links amongst the peoples' situations, mental processes, beliefs and actions.

- There are different techniques of pattern seeking which are gauging data trustworthiness, using triangulation, evaluating discrepant and negative evidence and ordering categories for patterns, sorting categories for patterns, constructing visual representations and doing logical cross-analyses.

### 3.7.1 Thematic Analysis

Thematic analysis is a method used when the researcher reads through the data and searches for patterns, similarities and themes which will contribute to making sense of the data (sets of texts, interviews and transcripts) that has been collected (Kiger & Varpio, 2020). This method follows a six-step process: familiarisation, coding, generating themes, reviewing themes, defining and naming themes and writing up (Thomas & Harden, 2008).

These steps were followed in the research (Thomas & Harden, 2008):

Step 1: Familiarisation: To acquaint herself with the data and the subject under investigation, the researcher engaged in reading through information on the topic and reviewing various texts and notes.

Step 2: Coding: This step involved highlighting different sections of the data and coding the sections by describing what those phrases said. All interviews that took place needed to be analysed and if were any themes that arose in the interviews, the

researcher added new codes. These codes allowed the researcher to find common points and meanings throughout the data.

Step 3: Once the codes had been identified, the researcher was able to find different patterns which turned into themes. Many different codes together made the themes. In this step, after codes were chosen, there were some that were discarded as they did not show in the themes as often.

Step 4: Reviewing themes: At this stage, the researcher identified themes that were accurate and represented the data that had been collected. This was where the researcher went through the themes and made sure that they were all relevant. If there were some that did not fit, they were discarded.

Step 5: Defining and naming themes: By now, the final list of themes was identified, named and defined.

Step 6: Writing up: This was the last step. There was an introduction, methodology section (describing how the data was collected), results (this touched on each theme that was identified) and a conclusion (which summarises the main points that were made and how they connected to the topic).

### 3.7.2 Coding: Deductive Approach / Coding

There are two approaches in thematic analysis, namely, inductive analysis which involves deriving general principles from specific observations, and deductive analysis which applies established theories to make predictions or test hypotheses based on existing knowledge (Kiger & Varpio, 2020). Deductive coding is known as a top-down approach where the researcher starts with predetermined codes and then the data fits to these codes (Kiger & Varpio, 2020). The researcher selects initial codes before analysing the data, assigning each one a distinct colour; during the data reading process, information falling under the predetermined codes will be categorised accordingly (Saldaña, 2009). Figure 3.1 illustrates this process.

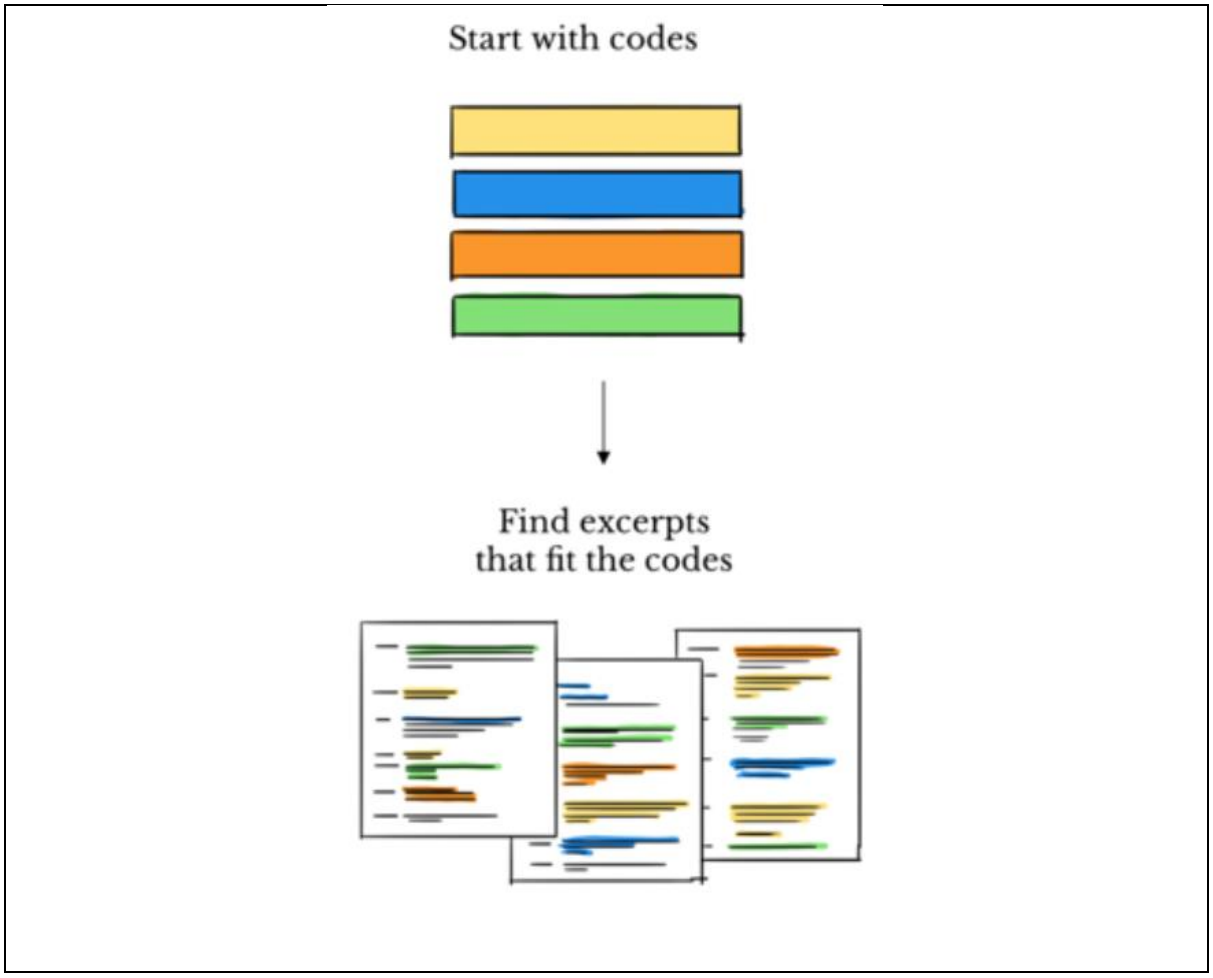



**Figure 3.1: Deductive approach coding**

Source: Saldaña (2009)

### 3.7.3 Codebook Thematic Analysis

Codebook thematic analysis involves the creation of a systematic document or guide, known as a codebook that outlines the predefined codes and themes to be applied during the analysis of qualitative data. The codebook serves as a reference tool for researchers, providing clear definitions and examples of each code or theme. This approach ensures consistency and reliability in the coding process, as multiple researchers can use the codebook to apply the same codes consistently across the dataset. (DeCuir et al., 2011). These codes are normally chosen before the data has been collected and analysed and the data then gets ordered into these predetermined codes (DeCuir-Gunby et al., 2011). In looking at the topic of how climate change affects learners' behaviour and academic performance, a few codes have already been identified like the different behaviours (disruptive, noisy, calm, talkative and hard-working) and the weather patterns like windy, warm, hot, cold and rainy.

The data analysis proceeded as follows:

1. Data was collected every school day for a month in every season resulting in four months of data that was collected throughout the year. The researcher gave the month's checklist to the schools that took part, and the checklist was collected when the month was over. The researcher analysed the data from each school.
2. The researcher took notes during interviews with the teachers. Furthermore, after the interviews, the notes were typed out and the researcher began to find common topics that arose.
3. There were also observation notes taken when the researcher went to the classrooms and the time, date and behaviour was recorded.
4. The teachers were given their questionnaire/check list to be filled in over a month.
5. The data was collected by the researcher, grouped into different categories namely different behaviours, weather, academic achievements and the teachers' notes.
6. The data was organised into patterns.

An Excel spreadsheet was used to record the data from the teachers and this data was used to help the researcher visually look for patterns. After this data had been recorded, the different types of climate change and children's behaviour and academic performance was evaluated and reported on.

### 3.8 DATA INTERPRETATION

Data interpretation was the last step of the data analysis process which is known as raw data where the results were collected got transformed into actionable and useful information (Kulkarni, 2016). Data interpretation is finding meaning in the data that has been collected and reporting on the connections and links (Girod, 2008). When doing this final step, the researcher needs to collect the information and find different patterns and then the researcher will use this data to come up with conclusions and finally report on different recommendations and solutions to the topic (Kulkarni, 2016).

Data interpretation is important as it helps the researcher make informed decision making. It shows the data in a way to identify trends and it gives the researcher a clear

insight of what the data represents and lets the researcher pick up on any difficulties or problems (Kulkarni, 2016).

The researcher needs to be aware of their own bias that could occur while interpreting the data by focusing only on the information that is relevant to what they believe. The researcher also needs to include data that is relevant and exclude irrelevant data and lastly, the data analysis process needs to be done thoroughly and include all the necessary data so that the interpretation process is successful and accurate (Kulkarni, 2016). When interpreting qualitative data, the data that is being analysed is called categorical data as this form of research uses interviews and texts to gather the information rather than numerical data (Kulkarni, 2016).

A researcher should exercise caution in presenting interpretations, avoiding reliance on sweeping generalisations or existing stereotypes. It is crucial to carefully monitor the data and establish a meaningful connection between the data and the research topic. This research was analysed on a monthly basis, which helped with analysing the data as it was in smaller chunks and then when all the data was collected, the final conclusions were made by the researcher who used all the data and themes and found links and conclusions.

### 3.9 ETHICAL CONSIDERATIONS

Ethical considerations in research can be defined as a set of values that guide the research as these will protect participants taking part in the research, improve validity and uphold academic truthfulness (Dudovskiy, 2022). There is a range of ethical issues that need to be considered when doing research, namely,

- voluntary participation (participants have the right to take part and opt out at any time); the teachers who took part in the research knew from the beginning that they could take themselves out of the research at anytime, this was made clear in the consent form and interview;
- informed consent (the participants receive all the necessary information about the research and the benefits of the study); all the necessary parties involved in the study received a consent form before the study started;

- anonymity (the researcher does not know who the participants are and does not collect any personal information); the researcher knew who the teachers were but did not know the learners names or any background information about the learners that were being observed;

- confidentiality (if the researcher knows who the participants are but removes their information that would identify them in the research paper); the teachers and schools names were not mentioned in the research paper, instead got different names;

- potential for harm (psychological harm; social harm; physical harm and legal harm needs to be considered and communicated if any of these pose a threat); the teachers knew that they did not have to answer any of the questions or if they felt uncomfortable they could communicate with the researcher; and

- results communication (the researcher needs to make sure that the results are as accurate as possible) (Dudovskiy; 2022). The teachers and schools all got a copy of the data once it has been analysed and reported on.

To start off the process, the researcher applied to the CEDU ethics committee for an ethical clearance certificate. (Appendix A). The principals of the three schools that took part gave permission for their school to be used by means of signing a consent form (Appendix D). The teacher that the school chose, signed a consent form (Appendix E) that she agreed to actively take part in the research for the full amount of time. The teachers were informed that there were no right or wrong answers in their observations and they just needed to use their observation and knowledge to gather the information that was required. There was full confidentiality with regard to the learners taking part and no learner was individually reported on. The researcher ensured that ethics remained the topmost priority throughout the study.

### 3.10 CREDIBILITY AND TRUSTWORTHINESS

Norman and King (2020) mentioned that, in qualitative research, the researcher does not use different instruments to measure the validity and reliability of the research. One needs to make sure that research study findings are credible, transferable,

confirmable and dependable. By achieving this, trustworthiness is assured (Norman & King, 2020).

Norman and King (2020) explained that there are different aspects of trustworthiness, as follows:

- Credibility is how the researcher ensures that the findings of the study can stand up to scrutiny. With this in mind, triangulation is used to show if the findings are credible. Triangulation is a strategy used to test the validity of the findings by merging information from different sources. The researcher should explain all the research processes and methods of data gathering by providing an audit trail.

- The next concept is transferability. This is how the researcher shows that the findings can be applied to similar situations or groups. This can be shown by using descriptions to show the connection between the different findings. This is successful when the results prove to be valuable to people that are not linked to the research and can relate these findings to their own experiences.

- Authenticity involves the genuine portrayal of the diverse feelings expressed by the participants in the research, ensuring that readers comprehend the emotions and observations conveyed by the participants in the study.

- Confirmability is how the researcher reports on the findings making sure that the report shows the participants' results and not the researchers' viewpoints and beliefs. The researcher should create an audit trail detailing each stage of the data analysis process. This aids in linking the findings to participants' responses, systematically outlining the steps taken to draw conclusions and demonstrating the direct derivation of the data.

- Lastly, dependability refers to whether a person could use the study's finding to strengthen their own research and if they could replicate your study. In order for this to happen, the researcher can ask a third-party person to review and scrutinise the data analysis and the research procedure to make sure that the results are reliable.

One needs to remember that all of the above-mentioned strategies need to be used together for the research to be successful and credible (Lemon & Hayes, 2020). These

were all used in this research study and the researcher made sure that all the data collected and being reported on was trustworthy and accurate.

## 3.10 LIMITATIONS AND DELIMITATIONS OF THE STUDY

Limitations and delimitations are not seen as the same concepts, but they are related to each other (Simon & Goes, 2020). Limitations and delimitations are related as they both focus on limits in the research study but the difference between these two concepts is the amount of control the researcher has over them (Simon & Goes, 2020). One needs to remember that all research studies have limitations as it is something that happens in the natural world and should not be seen as a negative aspect of the research (Miles, 2019). Limitations can be described as the weaknesses of the study as the researcher does not have control over these factors; for example, time constraints, funding, lack of technology and equipment, little to no available evidence of previous research about the topic, unexpected events, participants and participants' answers and findings which may be too vague or general (Miles, 2019). The study's limitations, or its shortcomings, refer to the challenges encountered by the researcher. However, these limitations can serve as valuable insights for future researchers tackling the same topic, providing opportunities for improvement in results and allowing them to anticipate and address potential research challenges beyond their control (Miles, 2019).

Questionnaires/checklists were used to gather the information. This could be problematic if the participants did not take the time to fill these in properly and daily. In addition, the participants do not have the opportunity to freely explain themselves and their responses (Simon & Goes, 2020). Using different peoples' unpredictable observations and experiences is a limitation on its own. People are very unpredictable and what each interprets can be different. The actual climate change and weather can be unpredictable which may influence the results. The schools that have been chosen in the study are in one town which might not reflect all climate variations. The research only focused on Grade 3 learners and not all grades.

Delimitations also limit the study but are determined intentionally by the researcher by using their research questions and aims (Miles, 2019). The researcher sets specific boundaries on their research in order to narrow the focus and make sure that the

research is focused on one specific area and develops meaningful conclusions on the desired topic (Simon & Goes, 2020).

This topic was chosen because I am a Foundation Phase teacher and from my observation and experience this topic challenges me. The research topic focused on Grade 3 learners which made conducting the research easier as it focused on one age group. The number of teachers that were used in the research (one per school) narrowed down the data collection process.

### 3.11 CHAPTER SUMMARY

The goal of this chapter was to outline the different research methods used in the study to answer the research questions and reach the research aims and objectives. A discussion of qualitative research, interpretivism philosophy, collective case study, population and sampling, nonprobability sampling, convenience sampling, data collection methods (observation, non-participant observation, face-to-face interviews), data analysis and interpretation more specifically thematic analysis, ethical considerations, credibility and trustworthiness and limitations and delimitations of the study were all explained. In order to gain all the necessary information, three schools were approached and three Grade 3 teachers were approached to take part in the study to collect the necessary information over a month in every season in Graaff-Reinet. The next chapter reveals the different themes and categories that were identified from the data that was collected and transcribed. The findings are reported on and conclusions are made.

# CHAPTER 4: DATA PRESENTATION, ANALYSIS, AND DISCUSSIONS

## 4.1 INTRODUCTION

This chapter presents the data that has been collected in this research topic: The effect climate change on Foundation Phase learners' behaviour and academic performance in the classroom. Adding to this, the teachers challenges in the classroom are reported on. The data has been collected, analysed and the findings are reported in this chapter.

### 4.1.1 Main Question

How does climate change affect the Foundation Phase learners' behaviour and academic performance?

### 4.1.2 Sub-Questions

- What patterns in behaviour and academic performance are shown by learners because of climate change?
- What are the main challenges faced by teachers in the classroom as a result of climate change?
- Which teaching strategies are used by teachers during adverse weather conditions?

The researcher gathered information from teachers in Grade 3 on their observations of the learners in their classes and participated in face-to-face interviews and answered questions about their experiences in their classrooms.

In my experience in Graaff-Reinet, when the weather changes, the learners' behaviour and their academic performance clearly changes. It appeared that when it is too cold, the learners ran around more at break times, they spoke more in class and were more disruptive. However, when it was too hot, the learners were more lethargic and did not walk around as often and there was a lack in concentration. In my opinion, if teachers had a better idea of when learners' behaviour and performance change, it would make it easier to understand how to work with the learners at that specific time.

The weather not only affects the learners' performance in the classroom but at times, learners do not come to school because of the weather on that day, which results in learners missing out on what is being taught and falling behind academically. Overcrowded classrooms are a common problem in South African schools which

makes it even more difficult for learners to stay focused and succeed academically. Overcrowded classrooms and bad ventilation is also something that will affect the learners' academic performance (Mabuza, 2019).

My colleagues and I discussed this topic daily but there is not much research evidence to back our statement and experience up. This could result in teachers making their own assumptions which could be based on mistaken knowledge and understanding (Javid, 2019).

This chapter presents the findings from the data that has been collected from these teachers over the four seasons which was based on the four themes that are listed in the diagram below.

Table 4.1 indicates the themes, categories and characteristics used to analyse data. The themes mentioned were generated from the above sub-questions.

.

**Table 4.1: Predetermined themes and categories that emerged from the participants data**

| Themes | Categories | Characteristics |
|---|---|---|
| ***Theme 1:*** Positive and negative impact that climate change has on the learner's behaviour and academic performance. | *Teachers' responses and observations* Teachers observe positive and negative academic performance for boys and girls namely focused, enthusiastic, participation, unfocused, disinterested, struggles to participate and lethargic respectively. Adding to this they observe positive and negative behaviour for boys and girls namely calm, well behaved, respectful and talkative, restless, aggressive, fiddling and lethargic respectively | What the teachers observes the learner's behaviour and academic performance over the four seasons every month for the year. The number of times the various observation traits occur with regards to the learner's behaviour and academic performance for boys and girls separately. |
| ***Theme 2:*** Different strategies implemented by teachers during adverse weather conditions. | ***Teachers' responses and observations*** Teachers' responses and observations with regards to finding strategies to help learners namely speaking calmly and explaining situations carefully, do not lose your temper, brain breaks, quiet time, give more time for tasks (slow things down), breathing exercises, communication, creative tasks, show learners to control their behaviour, stretching exercises and use your discipline system. | Methods used by teachers to accommodate the learners' reactions (behaviour and academic performance) to adverse weather conditions. |
| ***Theme 3:*** Challenges faced by teachers | ***Teachers' responses and observations*** Response from teachers with regards to the learners struggling academically, time constraints, limited knowledge to complete Grades tasks, bullying and fighting, discipline, increase learner absenteeism, water shortages and speaking out of turn. | The extent that learners struggle in the Grade, teachers and learners not getting enough time to complete work, increase in fighting and bullying occurring, the learners' discipline in class while working, Eskom's mis management of electricity resulting in load shedding which means one can only start working later than usual, schools having to close due to a water shortage and learners not attending school. |

**Source:** Author

## 4.2 DATA ANALYSIS

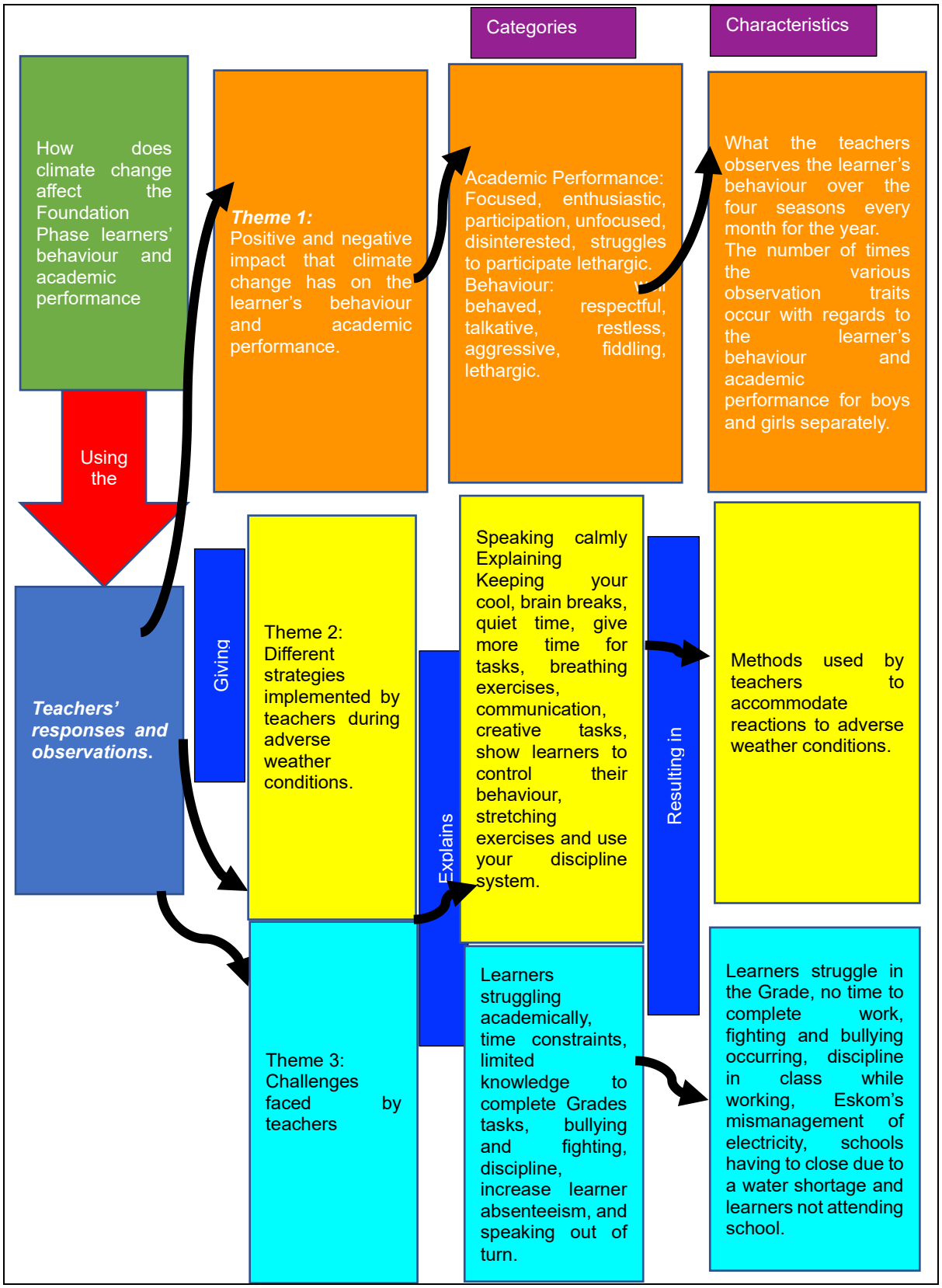



**Figure 4.1: Diagrammatic overview of the chapter**

The teachers and schools' names were changed therefore the names are not real as the teachers and schools had to remain anonymous. I used pseudonyms for the schools and teachers.

### 4.2.1 Case 1: Mrs Ready from Boat Primary School

4.2.1.1 Theme 1: Positive and negative impact that climate change has on the learner's behaviour and academic performance*.*

Lala and Hagishima (2023) mentioned that primary school learners are the most vulnerable to extreme weather conditions caused by climate change such as floods, heat waves, droughts and constant abnormal rainfall. They mentioned that learners' health is also negatively impacted by excessive heat which affects their learning process. The learners' bodies cannot adapt to the heat as well as adults meaning that when in the classroom, the learners will be more irritated and exhausted.

Figure 4.1 and 4.2 form part of the Children's Climate Risk Index (United Nations Children's Fund [UNICEF], 2021). This shows a detailed view of the children's exposure to climate change and how vulnerable they are to the impact of climate change. They work on two pillars to show this multifaceted structure. It captures the exposure of the children to various climate and environmental shocks and stress.

UNICEF (2021) wrote in their report that there are two pillars as described below:

- Pillar 1: This measures the exposure to climate change and environmental shocks and stresses.
- Pillar 2: This shows the child vulnerability.

| COMPONENT | INDICATOR | DATA SET | SOURCE* |
|---|---|---|---|
| Heatwaves | Children exposed to heatwaves (absolute) | Annual average number of heatwaves between 2000 and 2020 | Berkeley Earth Surface Temperature |
| | Children exposed to heatwaves (relative) | | |
| Air pollution | Children exposed to outdoor fine particulate matter (absolute) | Exposure to ambient fine particulate matter (PM2.5) | Atmospheric Composition Analysis Group |
| | Children exposed to outdoor fine particulate matter (relative) | | |
| Soil and water pollution | Children living in areas with pesticide pollution risk (absolute) | Pesticide risk (high to very high) | Tang et al. |
| | Children living in areas with pesticide pollution risk (relative) | | Tang et al. |
| | Children with blood lead levels (BLL) over 5 µg/dL (absolute) | Number of children (under 20) with blood lead levels (BLL) over 5 µg/dL | IMHE |
| | Children with blood lead levels (BLL) over 5 µg/dL (relative) | Percentage of total population by age group, both sexes (per 100 total population), 2019 estimate | UN WPP 2019 revision |
| **Common** | Total population count, both sexes combined | Gridded population of the world v4.11 (counts), UN Adjusted, 2020 estimate | CIESIN |
| | Percentage of child population under 18, both sexes combined | Percentage of total population by broad age group, both sexes, 2020 estimate | UN WPP 2019 revision |

| COMPONENT | INDICATOR | DATA SET | SOURCE* |
|---|---|---|---|
| Water scarcity exposure | Children exposed to water scarcity (absolute) | Drought events | UNEP |
| | | Water stress | WRI |
| | | Seasonal variability | WRI |
| | Children exposed to water scarcity (relative) | Interannual variability | WRI |
| | | Groundwater table decline | WRI |
| Riverine flood exposure | Children exposed to riverine floods – 50 years (absolute) | Riverine flood hazards, 50 years return period | GAR 2015 |
| | Children exposed to riverine floods – 50 years (relative) | | |
| Coastal flood risk | Children living in areas with coastal flood risk (absolute) | Coastal flood risk (high to very high) | WRI |
| | Children living in areas with coastal flood risk (relative) | | |
| Tropical cyclone wind exposure | Children exposed to tropical cyclone winds – 100 years (absolute) | Tropical cyclone windspeed, 100 years return period (above 119 km/h and above 178 km/h) | GAR 2015 |
| | Children exposed to tropical cyclone winds – 100 years (relative) | | |
| Exposure to vector borne disease | Children at risk of Malaria (absolute) | Spatial limits of **Plasmodium vivax** malaria transmission (stable and unstable) | The Malaria Atlas Project |
| | Children at risk of Malaria (relative) | Spatial limits of **Plasmodium falciparum** malaria transmission (stable and unstable) | |
| | Children exposed to Zika (absolute) | Environmental suitability for Zika | Messina et al. |
| | Children exposed to Zika (relative) | | |
| | Children at risk of Aedes (absolute) | Probability of occurrence of Aedes | Kraemer et al. |
| | Children at risk of Aedes (relative) | | |
| | Children exposed to Dengue (absolute) | Environmental suitability for dengue | Messina et al. |
| | Children exposed to Dengue (relative) | | |

**Figure 4.2: Pillar 1: Components and indicators of exposure to climate and environmental shocks and stresses**

Source: UNICEF (2021)

When looking at these two pillars, they show short term and long-term components and have been constructed in a way that one needs to study them as a whole to gain a better understanding for the welfare of all children (UNICEF, 2021).

Pillar 1 presents an overview of climate and environmental hazards, shocks and stresses that have arisen from climate change. A wide array of climate and environmental hazards, shocks and stresses are presently being monitored and logged. It needs to understood that the components that are listed are what is happening in the present are not a future prognosis. The figure shows us the different effects that climate change has on the environment and how these changes have a direct effect on the children.

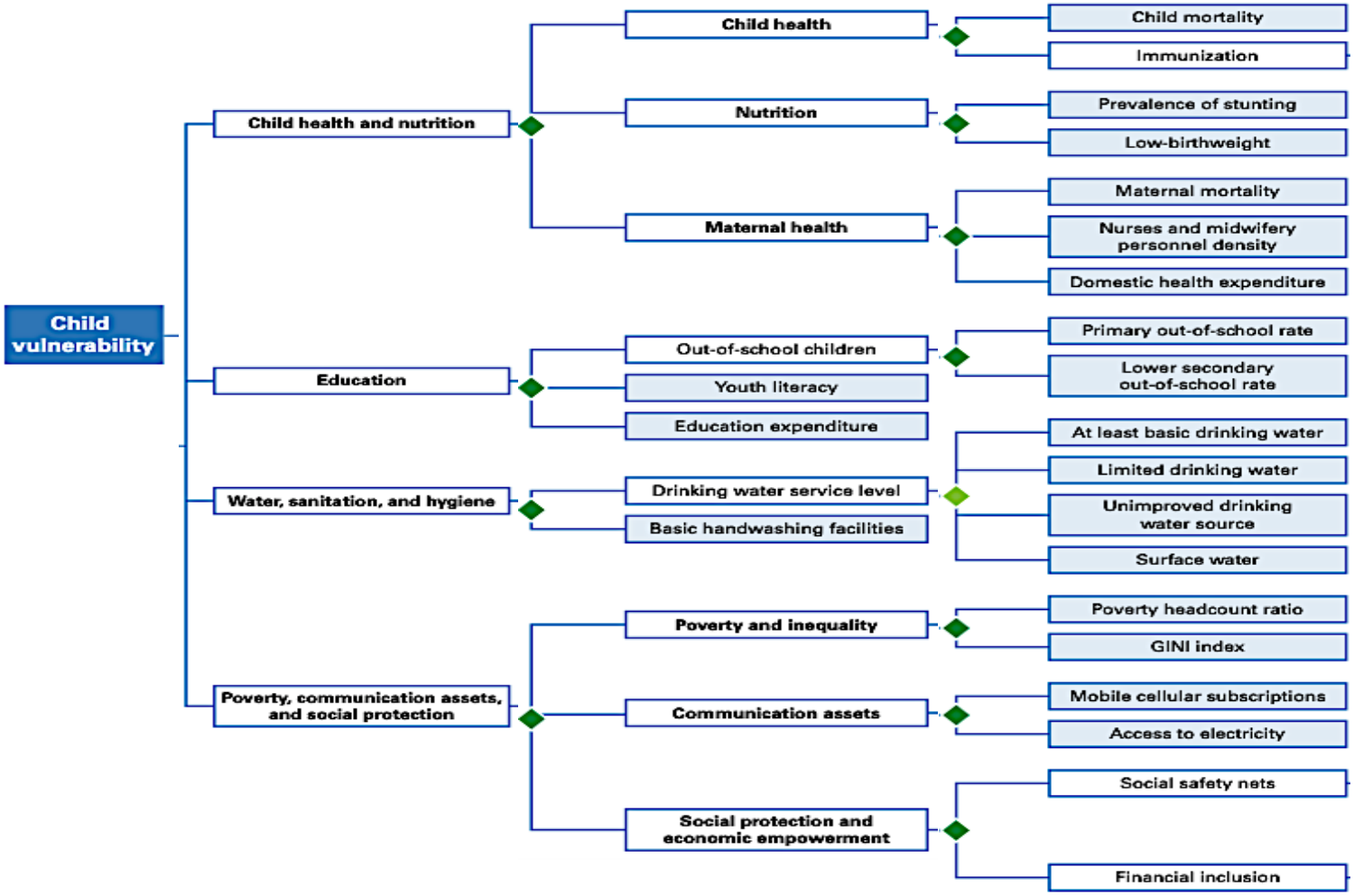



**Figure 4.3: Child vulnerability to climate change**

**Source:** UNICEF (2021)

Figure 4.3 known as Pillar 2 shows us the child's vulnerability and surviving capacity (which has been reflected in the Convention on the Rights of the Child). It has a child-specific scope as shown in Figure 4.2. Also included are different variables that are associated with the community, national or institutional abilities to deal with the impact of these shocks and stresses. This shows us that climate change affects the whole child and every aspect of their lives, the results of which can be detrimental to the child.

During extreme climatic conditions, Mrs Ready experienced learners missing school and being more lethargic. She indicated when asked about the learners' attendance at school and what the learners' behaviour and academic traits were in the summer months, more specifically in February:

> *"In the summer months, especially when the temperature went over 33 degrees Celsius, the learners, especially the boys, were more lethargic and restless after break time. These days was also when the learners would fight with each other more at break times as well. The girls would be lethargic in class and not always be totally focused but at break times they would be under a tree finding shade and they would be more relaxed."*

In summer, the weather in Graaff-Reinet is extremely hot with temperatures reaching over 37° Celsius and with climate change, it seems to be increasing each year. On hot days, the humidity increases as well. Davies (2023) explained that when the temperature is over 33° Celsius, it poses a substantial health risk to children as it causes them to get sick, dehydration, heat exhaustion, they become more irritable and they lose focus much quicker than normal days. When looking at Graaff-Reinet summer temperature, out of the 20 school days, there were 10 days where the temperature was over 33° Celsius. This showed that the learners felt different emotions relating to the heat for half of the month. Mrs Ready's observed the following when asked about how the learners reacted in the morning when they arrived at school and how these traits changed after break time:

> *"When the days were hot and humid, the girls were extremely chatty, some even fell asleep in class, unfocused when it came to work, and the work rate was very slow. The mornings would start off well with the girls but after break time the above characteristics would occur. The boys would also start the day off well but after break, it feels like the*

*boys are extremely restless, talkative, disinterested, aggressive and their concentration levels were extremely low."*

Looking at what Mrs Ready has experienced; I can see how the heat influenced her class's behaviour and their motivation to stay focused on their work. I am certain that this slowed down the learning process and I believe the learners would not absorb all the information which means that the teacher must reteach the work at a later stage which means that learners fall more behind according to the curriculum and what is expected. Figure 4.2 shows that one of the components is heatwaves that children are exposed to in climate change and that this create stress for learners. I have read what Mrs Ready experienced in her class when there is extreme heat and humidity, and Figure 4.3 supported this statement as heatwaves are a component that the learners are exposed to in climate change. However, Figure 4.3 showed us the vulnerability of the learner, which does not mention this under education; rather it shows that the learners are vulnerable by being out of school, have low literacy levels and few educational resources. To conclude, Figure 4.2 shows heatwaves and heat as a component to what the learners are experiencing in climate change, but Figure 4.3 does not show the heat as a component under education.

In summer at Mrs Ready's school, a few events took place namely swimming galas (interschools, karoo gala and the list continues depending on how far swimmers go), athletic days (school, interschools and the next stages if learners would go further), cultural events and she was sick for a few days as well. She commented about these days that took time away from teaching:

*"When there was swimming galas that all learners took part in, and then a few went further to the next stage which means they lost school days, there was a cultural event as well which takes away teaching time and there was an athletics day in school time as well. All these events put pressure on the curriculum as you must catch up these days and then there are times when you put pressure on the learners because you as the teacher are under pressure because of these missed school days which is not fair on the learners. When I am not at school because of sickness of personal reasons, a student teacher would take my class for the day and the learners also struggle to adapt to this change which means that the amount of work that gets done is not as much as if I was there and I can only plan for the teacher to do revision resulting in again, more time lost and having to play catch up and put everyone under pressure."*

Commenting on Mrs Ready's statement, I can see that even if the weather was not affecting the learners, other factors influenced their academic performance and the learner's behaviour. Looking at the month where it was extremely hot, and based on the observations from this teacher, I can conclude by saying that the boys were very aggressive, especially on the humid days and they struggled to stay focused in the classroom. The girls were more talkative, but they were more lethargic after break and worked slower than usual.

In autumn, Graaff-Reinet's weather started cooling down and the mornings started getting cooler and there were more overcast days. The sunny days were not as humid and hot as in summer and the wind started blowing on some days (Meteoblue, 2023).

In the month of May, there were days when it was overcast, cool in the mornings and heating up as the day went on. There were also days where the temperature would increase to over 30° C and then there are other days where it would only be 17° C. Looking at the observations, the Grade 3 learners struggled when the temperature would suddenly go from a few cooler days to a very hot day.

> *"The weather this month seems to suit the learning process and behaviour better than the previous one. The girls thrived in this weather and most of the month they were calm, well behaved and focused, but there were days when we had a hot day in between and then the girls would be restless and struggled to stay focused. The days that it was overcast from the beginning of the day, this seemed to have a negative impact on the boys, and they were very restless and unfocused."*

When looking at Autumn weather, the temperature varied from 9° to 22 to 26°. According to Wargocki et al. (2019), the best temperature for learners to get the best academic performance is between 20 and 22° C. This statement supported why the teacher felt that in autumn, Graaff-Reinet learners' behaviour and academic performance were more productive. The increase in temperature that suddenly happened in autumn, in the month of May 2023, is a direct link to climate change as this is not the normal pattern that has happened in in previous years, and this effects the learners negatively as on these days they did not perform and behave the same way as they generally had throughout the month.

Mrs Ready supported the above statement that has been made by indicating that:

> *"I feel on the cooler days, all the learners seem to be calmer and more focused in the class and with their peers on the playground. The boys are less aggressive as before and are not as restless after break."*

Johnston et al. (2021) conducted a study on children age from 8 to 15 years old and established that cold weather hindered learners' learning process and had a negative impact on learners at school. In Graaff-Reinet, the winters are extremely cold where temperatures ranging between -2° in the mornings to 15° throughout the day. There were days when a cold wind started blowing and then there were days when the temperature went up to 27 / 28° which not the normal winter pattern (Meteoblue, 2023). Cold weather impacted the learners and the teachers in a negative way as teachers had to come up with creative ways to get learners moving and to keep them busy at break times if the learners could not go outside (Hyndman & Vanos, 2023).

Mrs Ready explained the experiences she had during this winter cold month of July 2023;

> *"I actually thought that the learners would be more focused and disciplined in winter as they will not be getting too hot and irritated. I was not completely wrong but also not right. There were days where it went well but the very cold mornings resulted in the boys and girls writing slowly and talkative. The boys were disruptive and restless after break times but were focused. The girls seemed to be more talkative on the colder days than they have been this year. Generally, the learners seem to be more restless and talkative, but they seemed to be focused and participates in discussions more. The days where the weather did not go over 12 degrees, the learners struggled to get going and keep their focus, I suspect it was because they were focusing on the cold and them shivering which hinder their learning process and their behaviour."*

There are many different aspects in winter that affect the learners as sometimes it is freezing cold, and the learners cannot get warm and all they are focusing on is getting warm. Furthermore, teachers tend to keep everything closed which also creates a breeding ground for viruses and bacteria. Winter for teachers is known as the "sickness season" as teachers and learners seem to pick up sicknesses.

Balingit (2023) stated that although people think that winter is what makes people sick, it is not the weather but rather that specific germs and viruses (common cold, influenza, bronchitis and pneumonia) spread much more easily in lower temperatures.

People tend to close buildings and not allow fresh air to flow through a room making it easier for these germs to spread. To be more specific, our nasal temperature drops which results in our immune systems being dampened and people getting sick.

Mrs Ready explained how learners being sick, regardless of how they get sick affected her teaching:

> *"There have been many days where there are a lot of learners absent from school this month of July. There are learners who are sick, and it feels like a never-ending cycle as learners kept on making each other sick. Some of these learners would be absent for three days and that is a lot of work that the learners miss."*

When learners stayed away from school because they were sick, they missed work and it was difficult for the teacher to revise it, automatically affecting the learner's academic knowledge on that specific topic. The learner's academic knowledge is affected by missing school because they are not present when the teacher gives that lesson to the class. Upon the learner's return to school, the teacher endeavours to facilitate catching up; however, due to time constraints, the lessons are typically condensed. This abbreviated version often results in learners not receiving the full depth of knowledge imparted. In some cases, teachers may assign work for learners to complete at home, potentially leaving them to navigate the tasks independently with minimal support – a contrast to the in-class experience where the teacher is readily available for guidance. Learners present in the classroom benefit from immediate assistance, while those who missed school may lack support, especially if attempting to catch up at home or when the teacher is occupied with current lesson material. This absence from the complete teaching experience can pose challenges for learners trying to comprehend and relate to the concepts taught. Figure 4.3 showed that when looking at the learners' vulnerability to climate change, different components and subcomponents affect a learner. Education constitutes a primary element, and within its subcomponents lies the issue of being out of school, categorised as learner absenteeism, as mentioned and observed by the teacher earlier. Figure 4.3 supported the teachers' statement about the learners in her classroom not coming to school and confirms that this is a problem that arises and can be attributed to climate change. In winter, people do keep windows and doors closed, which can be one of the reasons why sickness spreads so quickly in a classroom and school. From this finding, I believe

that people should change our routines and try and leave windows or a door open from time to time to try and prevent the germs from spreading at a faster rate.

In winter in the month of July, there were cold winds especially when there was snow outside of Graaff-Reinet. Mrs Ready mentioned:

> *"I noticed that the wind blew for about 8 days this month where, some days the wind was not as bad as others. The boys seemed to be more aggressive and constantly started fighting with each other and were not focused and did not participate in class discussions, rather shouted out and were disruptive. The girls were very lethargic on these days and were not focused when doing their work. I believe that the wind has a negative impact on these learners' behaviour and their academic work."*

Although many teachers have reported from their personal experiences that the wind does affect the learners, there is not a lot of research that supports this statement. It has been mentioned that strong winds may affect adult behaviour due to the change in air pressure, atmospheric pressure and an increase in ions, all of which are created by hot and dry winds. Ultimately, the existing research indicates that changes in weather and atmospheric pressure have an impact on children. However, the specific link between strong winds and disruptive behaviour in learners has not been thoroughly investigated (Hetzler, 2017). The teacher further indicated that:

> *"Winter is the time when the learners are the most absent. The reasons given from parents are not always sicknesses. For some of my learners, they only have one school uniform and at times, the uniform does not dry in time for school the next day. This is incredibly sad for me as the learners are getting disadvantaged by situations that is out of his or her control. This means that the learner falls behind in their work, even though they would have wanted to come to school."*

As the seasons started changing, the weather started changing as well. It started getting lighter earlier in the mornings and the crisp cold mornings gradually became warmer and the cold days started turning into warm, sunny days. The weather was also unpredictable at this stage of the year as it started moving towards summer; for example, there are days when it is cool, cold, windy, overcast and then extremely hot, sometimes all on one week (Bluemeteo, 2023). In spring, which falls in September, October and November, the temperature tends to fluctuate where sunny days can be

replaced by stormy weather and there are times that this happens on the same day (National Centre for Environmental Health, 2023).

Mrs Ready felt this way about the Spring season;

> *"Spring is sometimes much a difficult season regarding to weather and adapting to what the weather will be like for that week. Sometimes you must wear warm jackets and other days you wear a dress without any warm tops on. The rain also comes and goes and the wind. I feel that this season feels like we have all seasons in one month. Learners' behaviour and concentration is also all over the place and it seemed as if every day was a lucky packet meaning you never knew what you were going to get."*

By looking at what Mrs Ready said, and some definitions of what spring weather is like, it makes sense that the learners behaviour fluctuates the way it does in class. If the weather is unstable, the learners also struggle with their internal clock dealing with these weather changes. Figure 4.2 showed the different components that learners are facing due to climate change and Figure 4.3 showed different facets of how vulnerable the learner is in connection to climate change. These two figures illustrate the multiple factors that combine to cause stress and problems for learners relating to climate change. There are different components that make the learner more vulnerable in this situation. The learner's whole self and their surroundings are affected by climate change, and this is something that they have no control over. When the weather fluctuates in a season, different parts of the learners' lives are affected and they struggle to regulate themselves to deal with these sudden weather changes as well. Although the actual spring season is not mentioned in these figures, when looking at them together, one can clearly see the complexity of the situation and how all these conditions can affect learners.

Seasons are categorised by regular annual weather patterns, temperature ranges and the length of days. Climate change which is caused by greenhouse gases released by human activity results in the average temperature increasing which influences weather patterns and environmental responses which means that it alters the natural pattern that one would expect in a season (Škvareninová et al., 2022).

Mrs Ready observed the following for the different weather patterns in October;

> *"This month, the behaviour and academic performance from the learners has been a rollercoaster. The days that the weather is cool (between 22 – 25 degrees) the learners are such a dream. The girls are well behaved, take part in discussions, focused when they are working, just any teachers dream. When the hot weather hits and the wind, the whole dynamic changes where the girls still remain focused, but they are restless and talkative on those days. The boys struggled in this month; they cannot seem to find their routine at all. They are very aggressive and talkative. They are also very disruptive, and their focus is very limited. No matter what the weather is like on that day, but the cooler days are a little bit better for the boys."*

It appeared to me that the Grade 3 girls in this school exhibited a more effective adaptation to their circumstances and changes compared to the boys. The girls also seemed to be unconsciously progressing through stages of self-development and emotional control, whereas the boys exhibited behaviors such as fighting, restlessness and talkativeness in class. This suggested to me that the boys may not be dealing with their internal emotions as effectively as the girls.

Psychological effects involve a person's beliefs, attitudes, self-esteem, coping skills and social skills (Burke et al., 2018). Climate change is recognised to have an impact on the mental health of learners, potentially subjecting them to various traumas. Factors such as adverse weather conditions, school disruptions due to inclement weather and heatwaves that hinder their ability to concentrate can negatively affect their academic performance (Martin et al., 2021). When COVID-19 took over the world in 2019, some learners lost almost a whole year of formal teaching, which already put these learners behind academically. The pressure placed on both teachers and learners to make up for missed curriculum is apparent, significantly affecting the mental health and motivation of both parties. This heightened pressure may lead to feelings of failure, impacting the enthusiasm for continued learning (Schermbrucker, 2021). Adding to this, learners are absent from school more frequently which results in these learners missing work which means their academic performance decreases. This results in learners feeling less connected to their peers and they feel lost in their schoolwork which affects their mental health in a negative way. This is a vicious cycle, as the worse they start doing in their schoolwork, the more demotivated they will feel and then they start going to school even less which makes them fall more behind. In the long term, these learners have a greater chance of dropping out of school which

has a negative impact on their future (Burke et al., 2018). Climate change can affect sea levels, changes in growing seasons, prolonged droughts, loss of livelihood which results in families losing their jobs, food insecurity, scarcity of clean water, an increase in group conflict and economic hardship (Burke et al., 2018). Children are extremely vulnerable to these changes, and it has a direct impact on their schooling performance and their mental health state (Burke et al., 2018). There have been reports of learners committing suicide due to their mental health disorders created by climate change and there have been reports of learners trying to hurt themselves because they feel like a failure at school (Hussaini, 2023).

The negative impacts of climate change (heatwaves, poor air quality, floods, and extreme winds) have a long-term impact on children's health which results in learners missing school and increases their anxiety, depression and different mental health disorders (Burke et al., 2018). Learners may develop sleep disorders due to stress induced by missing work, and emotion regulation challenges can lead to peer mistreatment and isolation at school (Burke et al., 2018). The primary psychological effects of learners missing school due to extreme weather, conflicts or bullying include mental health issues. This situation can make learners feel like they are failing academically, leading to demotivation, anxiety, difficulty focusing and even depression as they struggle to meet their academic goals (Mann, 2023). Climate change, as seen in this study, has a negative impact on learners' lives. In certain instances, circumstances are beyond their control, such as extreme weather events causing learners to miss school and lag behind, conflicts between learners leading to irritation, and difficulty concentrating in extremely hot conditions. These situations have an adverse effect on the learners' mental state, hindering their ability to succeed in their schoolwork. Many of these challenges are beyond the control of the learners and are directly influenced by climate change (Mann, 2023).

The TPB and SCT, specifically the functionalist theory, form the theoretical framework for this study. Climate change is something that is not new to people, and everyone has knowledge about what this means for the country. Mrs Ready used her observation and knowledge of what the effects of climate change are on the weather patterns for the specific season, month and day. If there was an extremely bad storm, she would be aware that the next day many learners might be absent from school. With regard to the TPB, learners are prone to exhibit negative behaviour during

extreme weather events, consequently impacting their mental health and potentially leading to academic setbacks. However, the teacher can use this theory to predict what the learner's behaviour will be, which means that she can prepare the school day accordingly and have an understanding of why learners are reacting the way they are or why they are not at school. This will also guide the teacher on how to handle the learners when they do return to school. I see this theory as applicable for the teacher and the way that the teacher handles the school day and the learner's behaviour. focuses on the psychological impact of climate change, influencing learners' home environments and mental well-being. This creates a gap in the system for academic success, as learners require positive home circumstances, including sufficient food, warm blankets and parents who are not grappling with climate change-related challenges, to effectively support their academic endeavours. Climate change contributes to the formation of this gap, negatively impacting learners by leading to school absenteeism, missing crucial coursework, behavioural changes arising from frustrations at home, ultimately resulting in academic challenges and compromised mental health for the learner. When these events occur, the teacher needs to educate the learners on how they can deal with these emotions in a positive manner to reduce any harmful psychological effect on the learner.

As one can see, climate change has no positive effects on the learners. It impacts their mental health, their emotions, their personal lives and their school journey. These learners struggle with different aspects that they sometimes do not understand. The teacher needs to be aware of these signs and react appropriately to minimise the negative psychological effect that climate change has on these learners and rather try and make the environment a positive one when the learners experience these changes.

#### 4.2.1.2 Theme 2: Different strategies implemented by teachers during adverse weather conditions

If the weather is horrid (bad winds, heavy rain, extreme heat, bitterly cold or humid) there are times when learners cannot go outside at break times to get rid of their energy so teachers need to do activities in the classroom if they must stay inside to give the learner a "brain break".

There is also time when these adverse weather conditions affect the learners' moods, behaviours and academic performance and teachers must try and find ways to accommodate the learners to make it easier for them to adapt to these circumstances and to make it easier to teach in the classroom. Dörnyei and Muir (2019) emphasised that in our diverse world, where individuals are distinct from one another, teachers should harness these differences to enhance the learning environment and cater to the diverse needs of all learners in their educational journey. According to Aaron (2019), there are a few ways that teachers can help with these different diversity challenges namely:

- Use various materials to illustrate different concepts.
- Ensure learners feel supported and heard.
- Familiarise themselves with the learners' usual behaviour in the classroom and identify what they require for success.
- Maintain communication with parents to involve them in the learner's academic journey and provide guidance in specific situations

Mrs Ready explained:

> *"There are so many different learners in the classroom that all come from different households and communities. Looking at teaching, you do not just teach a concept, but you have to look at the learners in your classroom and make sure that they are all feeling included for example, I have a Muslim learner in my class and have to make sure that this learner feels included."*

When looking at a classroom and having to deal with the challenges that arise especially when learners are being disruptive and not always listening, there are a few things that a teacher can implement in their classroom to try and reduce the disruptions (no matter what the reason for these disruptions are). Consequently, Ali and Gracey (2013) explained that when dealing with any type of disruptive behaviour, prevention is the best way to start. In other words, the teacher needs to be prepared and set out what is expected from them from day one. In this way, the learners will know what is expected from them straight away and understand the consequences of their actions. The teacher needs to stay calm and not get emotional as this action fuels the learner

to carry on with misbehaviour. The teacher needs to be firm and not allow the learner to get away with bad behaviour. If there is a specific punishment set out in the classroom rules, the teacher needs to implement it (Chakraborty, 2023). They need to listen to the learner before reacting straight away as the learner might be able to explain him or herself. They should remove the learner from the situation, as they do not want other learners to pick on this learner in the future (Chakraborty, 2023).

Mrs. Ready backed this statement up by saying:

> *"You also do not want to single these learners out too much because then you could expose them by name calling and bullying."*

The teacher also needs to have a behaviour contract where the learner and the teacher collaborate on determining the rules of the class and consequences for breaking the rules so that when something does happen, they know the reason for the punishment. Teachers need to make sure that the parents and the teacher are united in their approach to maintaining the rules. This creates a cohesive environment, ensuring that the learner receives consistent treatment both at home and in school.

When I am in my classroom, it is difficult to not react straight away when something happened or a learner is misbehaving. There are times when I must take a few breaths and remember these basic steps before I react to the situation.

When learners are in the classroom for a long period of time and sitting at their desks, they also seem to get noisy and restless and when the weather is unpleasant outside and they cannot go outside for their break, it gets even more tricky as they cannot release their energy and get a break from the class. Baines and Blatchford (2023) explained what break times mean to learners, allowing them to have unstructured outdoor activities and to teachers, which gives them time to stretch their legs, have a snack, take a breather from the classroom and get some fresh air. It has been said that break times might be more for the teacher's peace of mind than the learners. Baines and Blatchford (2023) explained that break times allow children to build relationships, develop imagination, get fresh air and exercise, learn how to interact with each other and learn empathy which are skills that are also associated with academic achievement. For a teacher, break times give teachers a chance to speak

to other teachers and get their ideas about specific situations or just to have a brain break from teaching. Mrs Ready mentioned:

> *"You know what that is so true. Wow, our pool of support is so great and there is always someone who is there to listen to you and help where they can, and you must also be that person to your fellow teachers as well"*

Although break time and allowing the learners to go outside are important, there are times when the learners cannot go outside due to the weather (it can be raining, extremely hot, awfully windy or freezing). To allow learners to have a break from formal teaching and to benefit from playing outside there are various activities that the teachers can perform. I have noticed that when learners do not go out on these days, they are restless, talkative and struggle to focus for the rest of the day. Baines et al. (2020) stated that one of the main challenges in a Foundation Phase school day is when the learners cannot go outside for break time. They explained that there are several indoor games that can be played like 'Four Corners' which is a dynamic and engaging activity that encourages quick decision-making and movement. The teacher can also use children's board games and allow children to draw or do puzzles. A teacher should try and have a "rainy/bad weather box" which allows learners to still get a break from working and to release their emotions and get rid of the "bad day blues".

Mrs. Ready felt the following way about these rainy days:

> *"The days that it rains, or the weather is horrible is one of the worst days at school because I always feel that the learners do not get rid of their energy and do not get out of the classroom environment. On these days, after break, it is always a struggle to get their attentions back to working."*

Kleinjan and North-western College, Iowa (2020) reported movement in the classroom is very important for the child's body and the child learns best when moving. This statement makes it clear to me that teachers need to find different ways to incorporate movement into their lessons as this will help with the academic performance abilities of the learners.

#### 4.2.1.3 Theme 3: Challenges experienced by the teachers in the classroom

Challenging behaviour in the classroom can be observed as culturally unsuitable, socially unwelcome and intolerable behaviour that disrespects the rules of school that have been set out in the Code of Conduct by the School Governing Body (Department of Basic Education, 2014). For my experience in my own classroom, there are many different types of challenging behaviour from the learners and bigger classes make it even more challenging. Mrs Ready mentioned bullying as a challenge in her classroom:

> *"Aaah, there are so many different things that happens on a daily basis which creates challenges. Boys seem to be bullying each other a lot more at this level than the girls."*

According to Marais and Meier (2010), disruptive behaviour is one of the most regularly discussed issues in South African schools. Teachers are experiencing an increase in disciplinary problems which results in teachers experiencing more stress in their teaching career. Within the classroom, learners differ and efforts need to be made to engage and stimulate all of them. However, disruptions may occur, hindering the completion of the intended tasks. Mrs. Ready experienced disruptive behaviour in the following way:

> *"Sometimes you take your 5 minutes just to get everyone to focus and listen to you which means your teaching time and the time you need to do an activity just gets shorter and shorter because you need to first get everyone to listen to you and just stay focused. Uhm, so this is a challenge and I feel is so self-inflicted by the learners and sometimes, you try everything and that day things just seem not to work."*

Rodríguez and Welsh (2022) explained that discipline is a very important aspect of classroom management and supports strong academic achievement although this is an aspect that teachers find very challenging. There are established rules that learners need to adhere to which results in work being completed and the teacher and learners being able to reach their full potential (Rodríguez & Welsh, 2022). In the classroom, learners tend to shout out, speak out of their turn, walk around class, and leave their work unfinished because they keep on speaking to each other and not listening to the teacher. This is one of the most challenging scenarios in a class, as it creates a constant struggle, preventing the focus on the academic aspects of teaching. Mrs Ready experienced discipline issues in her class as well and she felt the following:

> *"Oooh and another big challenge is the discipline. It feels like each year there is a drop in this area and there are times where you end up speaking and telling them to keep quiet and just to start listening and not speaking to their friends the whole time than actually getting to work."*

Adding to discipline problems that occur in the classroom, there has been an increase in bullying and children displaying extreme hostility to one another. As a teacher, I have observed that this seemed to be getting worse and from a younger age. Mrs Ready also experienced his:

> *"Sjoe, you know what, nowadays children can be very nasty to each other and the name calling just seems to get worse."*

Källmén and Hallgren (2021) did a study about bullying and mental health problems, and concluded that boys seemed to be more exposed to the harmful effect of bullying than girls. This conclusion strengthens what Mrs Ready and I have observed about bullying and what the learners have experienced.

When looking at reading, learners in Grade 3 should be able to read fluently and be able to read independently. Govender and Hugo (2020) did a study from 2008 to 2016 where they found that most Grade 3 learners were could not read at the appropriate level which results in learners getting left behind in all aspects academically. This makes it very difficult for teachers as they cannot do what is expected from them according to CAPS (Govender & Hugo, 2020). Their research supports Mrs Ready's statement about the learners being far behind in their work:

> *"I would have to say my biggest challenge is helping every child who is really struggling and giving them the support, they need. Like every learners are on different phase and levels in the class, and you do not want to keep any of them back, but you also want to help those who are really struggling to get to the level that they need to be one. Time does not allow you to always do this and then trying to find time to help these learners and give them the needed support is very difficult."*

Hussaini (2023) reported that climate change has a negative impact on the learners' physical and mental health but the one of the worst impacts is on the learners' learning ability. This statement supports my statement about what happens in the classroom. Learners exhibit diverse learning styles, creating significant disparities in my classroom regarding their abilities. Some struggle with Grade 3-level work, particularly

in reading, while others are at the expected level. Balancing the learning needs of all students becomes crucial, with challenges arising from absentees, often caused by weather conditions like excessive rain or extreme heat. These absentees, common among learners facing difficulties, contribute to their falling behind academically, as the teacher cannot dedicate sufficient time to address their specific needs. Their behaviour then started to become disruptive and restless especially on the days where it is extremely humid and hot as seen in Figure 4.3. These learners are affected by climate change because on the days when it is suddenly hot, they cannot concentrate to the best of their abilities which resulted in them not listening and falling more behind academically.

Mrs Ready also struggled with this concept in her classroom:

> *"Sometimes there are learners who are not on the level that they need to be so you as a Foundation Phase teacher must go back to the basics."*

Extreme heat hinders the learner's ability to stay focused which means that there is a decline in their academic performance and their work ethic (Hussaini, 2023). Hussaini (2023) reports that a possible reason that these learners are so far behind is that they have been affected by climate change in previous years which has had a negative impact on the learning process. Teachers have many different tasks that they must finish in a day, week, term and year. My experience is that teaching is not just teaching a class in the required time that has been given but also involves things like administrative work, writing reports, marking books, creating intervention programmes, helping those who are struggling, differentiating teaching, keeping records of everything, communicating with parents, sorting out fights between learners, lesson planning and making of resources, and making sure that everyone has a pencil to write with. These tasks fall into the teacher's normal daily routine, but when there is an extreme rise in temperature and the learners cannot stay focused on their work, that impacts the routine of what the teacher needs to get done on that day (Hussaini, 2023).

Administrative tasks can occasionally consume a substantial amount of time, hindering the full and proper delivery of a particular educational concept. Constant interruptions during teaching can lead to a sense of dissatisfaction at the end of the day, as not all learners receive the necessary attention. Furthermore, even before commencing a

lesson, there is often a requirement to manage and settle the learners, contributing to additional time constraints. Hussaini (2023) reported that rising temperatures and severe weather occurrences are currently disrupting school days as the learners are sometimes late for school creating a distraction and learners act out which takes time away from teaching time. This supports the statement of calming learners down or dealing with the different behaviours before the day has begun due to the change in weather patterns because of climate change. Bozkuş (2020) reinforces this perspective by asserting that educators encounter various challenges even before entering the classroom, encompassing personal rights, workload, the education system, vocational education, respect and school climate. Additionally, disruptions caused by changes in weather patterns contribute to behavioural issues among learners, compounding the challenges faced by teachers. Consequently, this further impedes the teaching process, leading to a potential decline in students' academic progress, often without them being aware of the impact on their learning trajectory.

> *"You have deadlines that you need to check off you lists uhm, and requirements from the department which makes it more out of reach to help everyone and get to everyone. Sometimes there is just not enough time in the day to get to every single one and thing that you need to get to."*

> *"Sometimes you take your 5 minutes just to get everyone to focus and listen to you which means your teaching time and the time you need to do an activity just gets shorter and shorter because you need to first get everyone to listen to you and just stay focused. Uhm, so this is a challenge and I feel is so self-inflicted by the learners and sometimes, you try everything and that day things just seem not to work."*

It is important to remember that even though the learners are the most vulnerable to climate change, the teachers also experience various health problems namely, mental health disorders, sun stroke, asthma, illnesses and allergies, or may have lost their homes due to extreme weather problems (Cianconiet al., 2020). However, although teachers are experiencing their own struggles, they must focus on the learners and what needs to be completed.

> *"When we have any event at school, to get learners back into routine is a challenge and it takes time which mean it takes time away from what needs to be covered and it results on putting more pressure on the teacher and learner to make your deadlines and cover what the curriculum needs you to."*

Furthermore, schools also have different events which take away teaching time which is very frustrating as this is something that schools should not be doing. Schools have swimming galas, cultural events, interschools weeks and sports matches which means the learners sometimes must leave school earlier and different fundraiser events which at times, take a few hours out of the school day. This all affects time and getting the necessary work done and disrupts the learners as well. The days when all learners are at school are normally the days when there are specific events happening at school on that day. These days are normally the days where the weather is conducive to learning as well. I have realised from the above research that learners are absent from school frequently. The reasons for this vary but I can conclude that on days when the weather changes, especially when it is rainy, learners do not come to school. The adverse impacts of climate change on these students alone pose challenges to their success. However, disruptions in the school routine due to various events, coupled with extreme weather occurrences, further hinder the progress of these learners.

> *"As a teacher, you try everything to get to every learner and help those who are struggling but with a bigger class, this is difficult and learners fall more and more behind. You as a teacher also wants to make sure that you put your everything in for the learners to understand all the subjects so uhm, you are focusing on all four subjects, and you are focusing on each learner to understand what you are teaching."*

Over the past few years in Graaff-Reinet, teachers have to go to various compulsory workshops presented by the DBE. Some of these workshops run during school time and over a day or two. This implies that teachers are absent from their classrooms, leading to circumstances where, in some schools, learners are unable to attend due to the absence of teachers to supervise them. In other schools, alternative arrangements involve assigning different teachers or fellow learners to oversee the students. Consequently, on these days, the introduction of new academic content is limited. Moreover, when substitute teachers are present, learners tend to display increased disruptive behaviour, deviating from their usual routine and exhibiting reduced attentiveness. This disruption may impede the completion of the required schoolwork. Mrs Ready explained how these workshops have affected her teaching:

> *"I have had to leave my class for different workshops this year alone which if I had to count made me lose more than 7 days in my classroom alone which makes a huge difference in my planning and getting through my work that I need to with the learners.*

*Some of these were handwriting workshops, moderation meetings, six-bricks training and sports meetings."*

The days that this teacher was not present in her class, were days where it was extremely hot. The learners' behaviour showed that they were noisy and not focused at all on those specific days when the teacher was not there, and the weather was extremely hot. The learners were not used to having a different teacher in their class and the extreme heat affected their learning. Given the circumstances the learners experienced during those few days, it is evident that the pace of teaching and the learning process was sluggish. Consequently, there may be a need to revisit and reteach the content to enhance the academic performance of the learners on that particular concept.

Looking at what is currently happening regarding electricity in South Africa, loadshedding is getting worse and worse. Daisy Solutions (2023) reported that "Loadshedding, the planned power outage imposed by the government to manage electricity supply, has become part of our daily lives. While the effects of loadshedding are felt across different sectors of society, schools are one of the most affected institutions". Furthermore, it was reported that loadshedding has a massive negative impact on schools as administrators cannot print the necessary documents; teachers cannot print the work needed for that day; in winter, classrooms are extremely dark in the mornings so teaching is delayed; working with computers and technology cannot happen and learners who do not have electricity at home cannot complete their work (Daisy Solutions, 2023).

Even working in the Foundation Phase, load shedding takes its toll. Teachers need to photocopy worksheets for the learners and the functioning of the school gets affected in a negative manner. Examining the correlation between climate change and load shedding, as reported by Nkanjeni (2023) in the HeraldLIVE, the Minister of Electricity, Kgosientsho Ramokgopa, indicated that there would be a surge in load-shedding stages during winter. This is attributed to the significant drop in temperatures, leading to heightened electricity usage by the public, and Eskom's inability to bridge the gap between their supply capacity and the increasing demand for electricity. The weather is undergoing rapid changes, with temperatures fluctuating across seasons. It is challenging to discern a clear pattern in today's times. During winter, where

temperatures drop below 0° Celsius, communities tend to consume more electricity. Consequently, Eskom struggles to generate sufficient electricity to meet the heightened demand, leading to the implementation of load shedding and, at times, higher stages of load shedding. In winter in Graaff-Reinet, it only starts getting light between 7:45 and 8 o'clock in the morning. When the load shedding times fall into this early morning slot, the classrooms are dark which means that learners struggle to see the board in front of them and some of these learners arrive late for school because it is dark for them to get ready for school.

Mrs Ready explained how load shedding affected her class:

> *"Our school does not have a generator, so when the lights go off, we sit without electricity. I use a projector in my classroom to explain and show different concepts which I cannot do. My classroom does not get a lot of light in the mornings, so in winter when the time of load shedding is from 7 o'clock to 9 o'clock in the morning, the learners struggle to see the board which delays my teaching time."*

Plaatjies (2022) reported that loadshedding has a negative impact on the Dr Beyers Naude Local Municipality reservoirs which means that there are water interruptions and water shortages in the area. The town is exclusively reliant on boreholes. Learners come to school thirsty because there is no water at their homes and some schools do not have water in their taps at school. Mrs Read commented:

> *"We are fortunate that the water crisis does not affect us as a school as much as I have heard from other schools, but there are some learners who came to school to fill their bottles to take home and some learners did not have water at home so there were a few who did not come to school because they did not have clean clothes."*

Caboz (2019) reported that in 2019 Graaff-Reinet's dam, the Nqweba dam, dried up due to the drought that started in 2015 and was known as one of the worst droughts in the Eastern Cape. Archer et al. (2022) explained that the reason for this devastating drought was mainly because of climate change which led to a lack of rain in this area and resulted in farmers losing life stock, vegetation dying off, people losing their jobs and no water being available on farms or in the dam. To get water to the town, 28 boreholes were drilled to try and bring relief, but the supply and demand was too high. When the use of water increases, the water pressure is inadequate and some areas do not have water for hours or even days (Janse Van Vuuren, 2022). During load

shedding, the pumps are unable to transfer water from the boreholes to the reservoirs. As a consequence, the reservoirs are not adequately filled, leading to a slow or complete absence of water flow from the taps. The current water crisis faced by the town can be attributed to climate change, with the drought exacerbating the situation. If not for these factors, the town would not be experiencing the current water scarcity (Janse Van Vuuren, 2022). I see it as a chain reaction: because of the drought, the town ran out of water, which resulted in drilling for boreholes which did not pump enough water to the community. Schools require water for students to drink and for hygienic purposes. During summer, as temperatures rise, reaching over 37° Celsius (with an increasing trend in recent years), it becomes crucial for students to stay hydrated. The absence of water in schools poses a serious risk to learners, hindering their ability to concentrate on their studies. This can negatively impact their academic performance, leading to increased irritation and frustration in the classroom

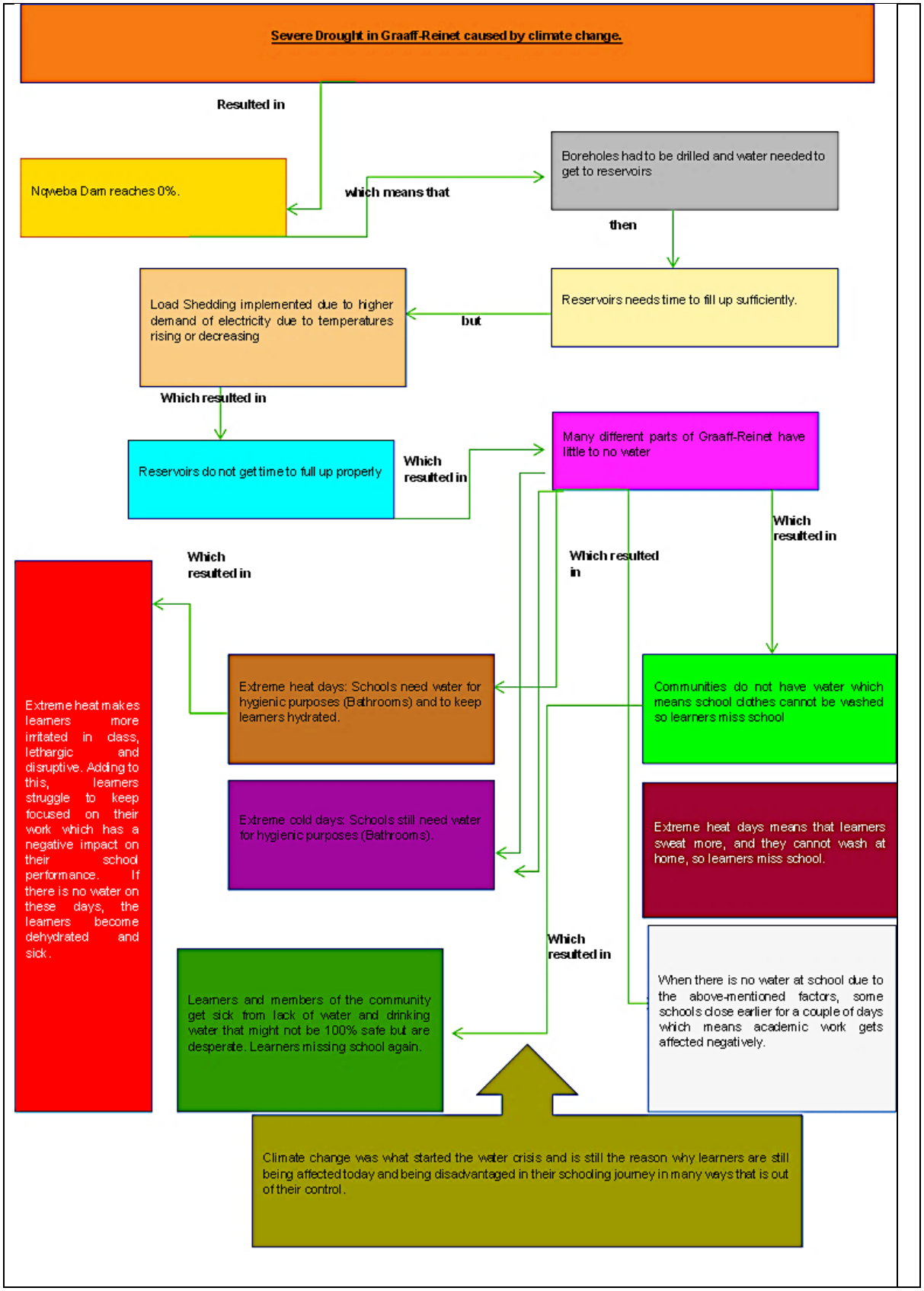



**Figure 4.4: A visual representation of the chain reaction of the drought**

Source: Author

Figure 4.4 shows the chain reaction that climate change brought on the drought. It shows how climate change is the route of the problems arising where learners are missing school which in the end affects their academic achievement and their behaviour at school. As shown, numerous factors emerge from a global issue, all interconnected with vulnerable learners and their prospects for future success

By looking at the above reports about the water situation in Graaff-Reinet and the lack of water that is available for the community, it is safe to say that the result of climate change happening over the years, is the main reason why the water shortage problems have arisen and will continue as climate change worsens. At my school, we had to close school early because the school had no water and if the school had water, the community did not, which resulted in learners missing school because they could not do washing or keep clothes clean.

Learners spend a substantial amount of their time at school which should be a wholesome learning atmosphere that gives them the support and skills to learn and succeed (Pule et al., 2021). Mboweni (2014) reported that one of the greatest reasons for poor academic performance is high learner absenteeism. Kearney et al. (2022) stated that when temperatures changed, learners did not go to school, and they fell more behind in their schoolwork. Mrs Ready explained:

> *"After a weekend, there are always some learners that are not in school and miss a lot of work on the days that they miss. There was also a time in Term 2 where there were so many learners who were sick and could not come to school and they miss a lot of work as well. Learners also missed school after school events like galas, interschools and cultural events which took away school time and the learners missing work. When learners miss school, they miss a lot of work as they have that subject every single day and a lot gets done in the lessons. When it is very cold, there are learners who also do not come to school on these days and in our winters this happens often."*

Several factors contribute to learners' non-attendance at school. The reality is that the rate of absenteeism in schools is escalating rapidly, posing challenges for teachers to cover the curriculum. Consequently, learners fall further behind, becoming increasingly disoriented within the educational system. This decline in academic performance often leads to reduced interest and focus in school. Kearney et al. (2022) found that learners stay out of school more often when temperatures are below 15° Celsius and when the

temperature suddenly increases drastically or reaches over 33° Celsius. Learners stayed away more from school in the colder months than in the summer months in their research (Kearney et al., 2022). They also stated that classes that had air conditioning were the classes where the learners were not absent as much as the ones that did not have it. Their study indicated that variations in temperature are influencing the rate of learner absenteeism, and climate change is exacerbating these temperature fluctuations. This shift towards more frequent occurrences of extreme cold and heat is causing learners to miss more school, leading to a decline in their academic progress.

#### 4.2.1.4 Case 1: Summary of findings

##### *4.2.1.4.1 Theme 1: Positive and negative impact that climate change has on the learner's behaviour and academic performance.*

This study found that certain climate change conditions impacted the learners in a negative manner regarding their behaviour and their academic achievement. Mrs Ready explained that many learners were absent from school on days when the temperature was over 33° Celsius and in the winter months where learners were sick and missed school often. Learners did not always miss school because of sicknesses, but some learners' circumstances and economic status played a role in absenteeism. She added that the school arranged many different events which resulted in a loss of academic time.

She also experienced that when it was over 33° Celsius, the girls were constantly chatting and at the end of the day were lethargic, where the boys were restless, aggressive and were not focused at all in class. In May, the autumn weather would fluctuate from extreme heat to extreme cold and Mrs Ready observed that the learners struggled to adapt to these rapid weather changes. The days when it was overcast, the boys' behaviour was extremely restless and they did not focus on their work. In the winter months, especially the extremely cold weather, the learners would write slowly which affected the amount of work that had to be covered and they were extremely talkative. Although research does not confirm that the wind affects learners' behaviour, Mrs Ready observed that when it was very windy, the boys were a lot more aggressive, and they were incredibly disruptive in the classroom. In spring, the learners' behaviour

seemed to fluctuate from calm and focused to talkative, restless and not focused. Looking at what was observed over the four seasons, Mrs Ready's observations show that the learners' behaviour and academic performance is affected negatively on the hot, humid, windy, overcast days and on the cooler days, they are more focused and calmer. Adding to this, the boys seemed to react more sensitively to these conditions regarding their behaviour and their academic performance. The girls struggled when it was hot and humid and overcast.

*4.2.1.4.2 Theme 2: Different strategies implemented by teachers during adverse weather conditions.*

Break times allow learners and teachers to get a break from the formal atmosphere of the classroom. When the weather does not allow for outside play and the learners cannot release their energy, the teacher should have different strategies in place to still allow learners a "brain break" even though they have to remain inside. Different games and activities can be used by the teacher in these times like puzzles, activity games, board games and colouring in to make sure learners are having fun and giving their brain a break from schoolwork. Movement is a very important concept to integrate in the classroom to develop learners' bodies and minds and this helps to keep the learners' discipline under control. Teachers should have different materials available, support all learners, know their learners and communicate with parents to help address the diversity of learners in their classroom, to reduce disruptive behaviour and to create a relationship between home and school.

Disruptive behaviour and inattention are problems teachers have to deal with in their classrooms. The study found that teachers need to make sure that they lay down the rules from the beginning, always stay calm, prepare the learners what the consequences are if they break the rules and teachers need to listen to the learners before making assumptions about the situation. The positive influence of outdoor activities, playing with friends, running around, and enjoying fresh air on the academic and behavioural development of learners is often overlooked. Even on days when such activities may not be possible, it is crucial to provide breaks to ensure that learners can still reap the benefits.

*4.2.1.4.3 Theme 3: Challenges faced by teachers*

Mrs Ready noticed that the amount of bullying and fighting has increased greatly over the last few years especially among boys. Another challenge she faced was learners' discipline which meant their academic achievement was negatively impacted. Her biggest challenge was the learners' discipline and helping all learners with their individual needs. Climate change poses a significant challenge to the learning abilities of students, impacting them in diverse ways. This presents a considerable challenge for teachers, who must adapt to each student's unique situation and meet them at their individual learning level. When the temperatures rise to extreme heat, it hinders the learners' ability to stay focused and work ethic which affects their academic performance negatively. She explained that she was overloaded with administrative work and deadlines from different departments and having to face the different challenges in her classroom. Meeting all the expectations placed upon her within the allotted time proved to be a significant challenge. The school organised various events that further reduced available academic time. Additionally, on days when all learners are present, adverse weather conditions often hindered the meaningful progression of learning.

Mrs Ready noticed when loadshedding was implemented, especially in winter, schoolwork could only be started later than usual as the classrooms were too dark for the learners to see work on the board. Graaff-Reinet is grappling with a water shortage crisis caused by a drought linked to climate change. Consequently, there were occasions when water was unavailable, leading to early school closures or learners' absence for various reasons, such as the inability to maintain personal hygiene. Lastly, learner absenteeism was a massive challenge for Mrs Ready. When temperatures were very hot, this study has shown that learners did not come to school and fell behind in their work which had a negative impact on their academic achievement.

4.2.1.5 Case 1: Concluding remarks

After analysing all the data received by Mrs Ready, it is safe to say that this information shows that climate change does have a direct impact on learners' behaviour and academic performance in several ways. The teachers need to play a part in trying to decrease the impact that climate change is having on these learners, and they need to come up with different strategies when there is diverse weather. The learners'

behaviour and their academic performance is influenced by many different aspects of climate change and the results of the extreme weather conditions are mostly negative for the learners and their success in school.

### 4.2.2 Case 2: Pencil Primary School – Mrs. Book

4.2.2.1 Theme 1: Positive and negative impact that climate change has on the learner's behaviour and academic performance.

The following table shows the primary impacts of climate change on children in South Africa.

| | Areas with increased likelihood of a higher concentration of affected children | Type of impact |
|---|---|---|
| **Health** | Limpopo, Mpumalanga and Gauteng | **Incidence of malaria** could increase resulting from a moderate rise in temperature and an increase in the number of 'hot' days per annum, combined with increased intensity of rainfall and insufficient sanitation infrastructure, which can lead to an accumulation of stagnant water. Those farthest away from health facilities and with poorer access to water and sanitation will be most affected. |
| | Free State, North West | **Malaria outbreaks.** Although malaria cases are currently very few, a steep increase in temperature and of the number of 'hot' days per annum could increase the spread of the disease. Health infrastructure in these regions is currently unprepared to deal with malaria outbreaks given the historically low prevalence in the area. |
| | KwaZulu-Natal, Limpopo and Mpumalanga, particularly common in informal urban settlements | **Vulnerability to infectious diseases such as diarrhoea and cholera** could increase resulting from higher intensity rain episodes where water and sanitation facilities are inadequate, in both rural and urban localities, although potentially worse in informal urban settlements where there are greater concentrations of poor. |
| | Free State and North West and some larger inland urban areas such as Johannesburg, Pretoria and Polokwane | **Incidence of respiratory diseases and heat stroke may increase.** Higher temperatures and a greater number of 'hot' days over the annual cycle are particularly linked to reduced air quality. Higher levels of pollution can lead to asthma and tuberculosis, which are particularly problematic given the reduction in resilience incurred by a higher prevalence of HIV/AIDS in these areas.<br>Incidents of heatstroke are likely to be exacerbated by deteriorating levels of water due to evapo-transpiration. |
| | Limpopo, Mpumalanga, Gauteng, Eastern Cape, KwaZulu-Natal – particularly for those living in informal housing | **Risk of drowning or injury resulting from damage to infrastructure.** Increases in rain intensity, particularly with insufficient water management systems and high population density, can lead to flooding. |

| | | |
|---|---|---|
| **Nutrition** | Eastern Cape, Free State, North West | **Risk of food shortages, linked to child hunger and malnutrition.** In rural areas where subsistence agriculture is prevalent, there is greater likelihood of drought linked to higher temperatures and unpredictable rainfall. This is likely to have particularly acute effects where child hunger is already significant. |
| **Education** | Limpopo, Mpumalanga and Gauteng, Eastern Cape, KwaZulu-Natal | **Potential floods and heavy rainfall could damage school infrastructure and roads or bridges that reach schools.** Flooding is already a cause of school absenteeism and this could be aggravated by heavier rainfall patterns.<br>Possible increase in disease and malnutrition could affect school attendance and student performance across the country. |
| **Emotional and social well-being** | In different localities where disasters occur and are likely to become more prominent, increased variability likely nationwide, notably across much of the north-east (flood), and south-west (drought). | **Children can be emotionally distressed by the occurrence of disasters** such as floods or droughts, especially in the absence of counselling, official support mechanisms or a stable, supportive home environment. |
| **Other areas** | Free State, North West, Limpopo, Western Cape, Northern Cape | **Greater time burden for children (particularly girls)** owing to having to travel greater distances to fetch water in those areas where water availability is reduced – particularly where households already experience inadequate access to water sources.<br>In localities with dense forests, forest fires can result in injury or fatality. |

**Table 4.2: Main primary impact of climate change on children in South Africa**

Source: Jones et al. (2011)

Table 4.2 shows the primary impacts of climate change on children in South Africa. The five main areas that have been identified in which climate change-related events can affect a child are health, nutrition, education, social and economic wellbeing. One can see how children in the different provinces are affected.

Children are excessively vulnerable to the influences that climate change brings, which is shaped by the physical, social and emotional changes that occur in their lives. As children spend most of their time at school it makes sense that this is where the effects of climate change are most obvious. The impact that climate change has is more evident in poorer communities situated in rural areas as they lack sanitation and water, housing, food, education and health care. Mrs Book started by explaining where her school is situated and where the learners are from:

> *"I teach at a Quintile 3 school, which is a non-fee-paying school and the community that we are situated in, we find that these learners come from a very difficult home circumstance. I must add and say not every single one of them struggle as badly as others, but the unemployment rate is high, and the circumstances are not always great for all the learners"*

This statement shows that these learners will in some way be influenced by climate change in a negative way. Table 4.2 also shows that learners from low-income families are affected the most by events that occur due to climate change. When looking at nutrition, an impact of climate change is that there is a risk of food shortages specifically in rural areas. Mrs Books mentioned that these learners come from a low-income rural community, which means that they are already in a vulnerable position and the climate will affect them most. The learners are affected negatively if there is not a stable, supportive home environment. Many learners come from homes where the circumstances are not ideal as mentioned by Mrs Book. Table 4.2 supports Mrs Books' description of her learners as she mentioned that they came from a poor community with difficult home circumstances.

Summer is known in Graaff-Reinet to be extremely hot and dry with temperatures over 35° Celsius daily. In 2023, the weather patterns exhibited greater unpredictability compared to previous years, featuring numerous days characterised not by dry heat but by hot and humid conditions (Climate Data, 2023). Graaff-Reinet, traditionally accustomed to a dry and extremely hot climate, has witnessed a shift towards a hotter and more humid environment in recent years (Climate Data, 2023).

Mrs Book experienced the following in the summer month of February;

> *"The boys seem to be aggressive towards each other on the days that the temperature was over 32 degrees Celsius. They constantly fought with each other at break times and were very annoyed in the classroom. The days when it started off extremely hot in the morning, the boys focus levels were down from the beginning and the day was a struggle with their behaviour and work ethic. The girls were extremely lethargic and struggled to stay focused and after break, they seemed to be more talkative on these hot days."*

Sawyer (2023) reported that children are extremely vulnerable to becoming over-heated in extreme heat as they struggle to regulate their body temperature like adults do. Sawyer (2023) mentioned in his report that Dr Clay Yaklin (who is an emergency medicine physician) mentioned when interviewed that children can suffer headaches, dizziness, nausea, mobility problems and constant tiredness. When reading what children go through when it is extremely hot, I can conclude that when learners were feeling these symptoms, the last thing they were focusing on was their work and what

needed to be done in class as they were feeling horrible. This affected their academic performance. Even though they were at school, they were not absorbing the information being taught and were falling behind.

Save the Children (2023) mentioned that in extreme heat situations, learners play outside which results in the learners not realising how hot they are getting, and this increases their chances of heat-related illness. They also explained that when temperature reaches a specific heat, learners struggle to stay focused for long periods of time and they will start becoming more annoyed with one another. Mrs Book also experienced the following with regard to how the girl's behaviour and academic performance was in summer:

> *"We had a lot of humid days this month and this seemed to influence the girls in a negative way where they were constantly speaking, and they were writing very slowly on these days."*

Graaff-Reinet is not known to have humid days, so this experience is something that one needs to get used to. The increase in temperature and the moisture in the air can be the cause of the girls' behaviour and academic performance being impacted negatively. The reason that the weather conditions are changing to humid weather is die to climate change which has a negative impact on these girls' concentration. Unfortunately, a study that was done by Ryan et al. (2022) conducted a study on how humidity effects primary school learners and found that all learners' academic performance was impacted negatively in this weather which contradicts Mrs Books observation in her class where she observed that only the girls were affected.

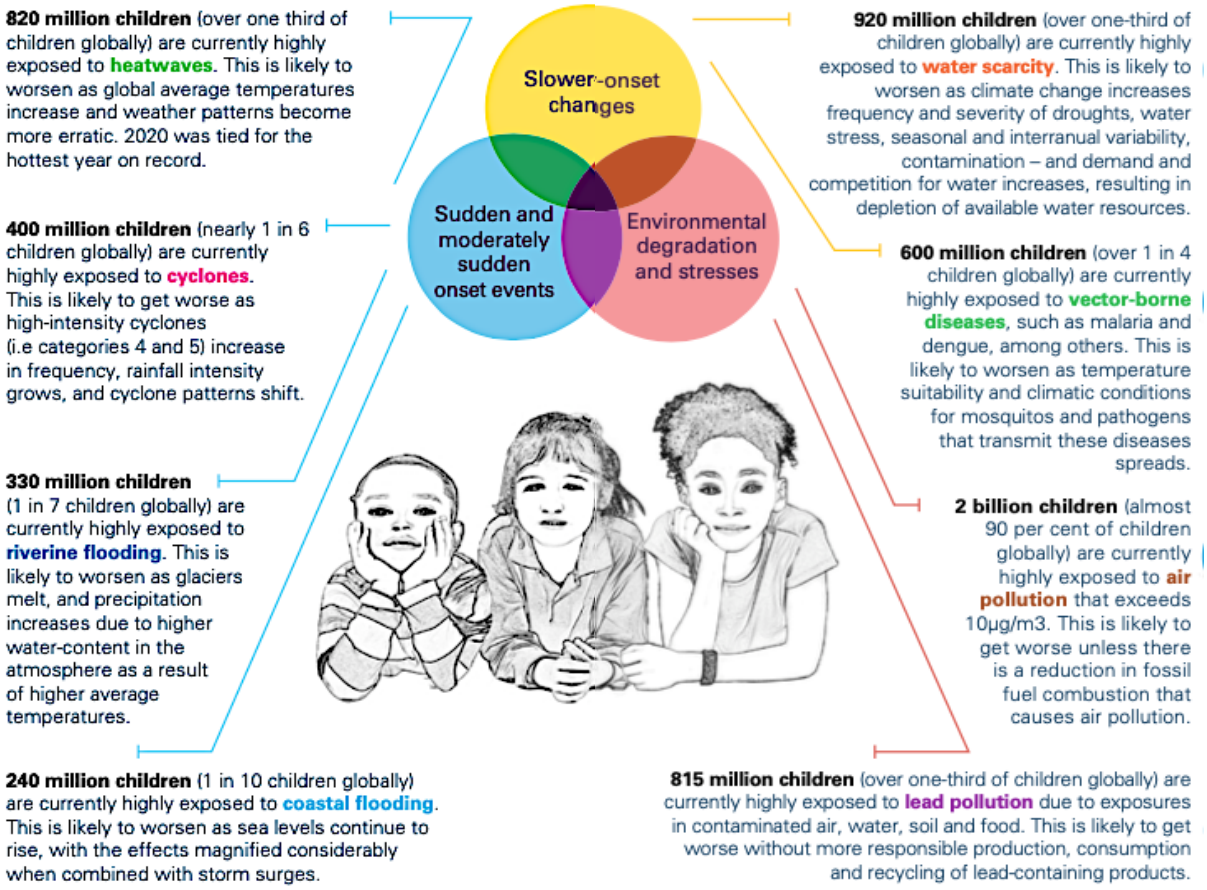



**Figure 4.5: Overlapping climate and environmental hazards, shocks and stresses.**

Source: UNICEF, 2021

Figure 4.5 displays the number of children in world that are exposed to the different effects of climate change and the environmental hazards, shocks and stresses. These climate and environmental hazards are separated into slower onset changes, sudden and moderately sudden onset events and the environmental degradation and stresses. As one can see in Figure 4.5, these events overlap each other and do not happen in isolation but each one affects the other. When the extreme weather occurs, linked with the environmental stresses makes the situation much worse. These hazards exacerbate each other and contribute to the inequality and degradation of various societal segments. The overlapping nature of these hazards renders certain parts of the world highly unjust and perilous, particularly for children, thereby negatively influencing their future prospects. Figure 4.5 explains what the effect of each climate and environmental hazard is on children and what they are exposed to.

The classroom temperature also increases, and the learners start getting irritated because of the heat increasing in temperature which affects learners' behaviour and learner achievement. Upon examining the impact of classroom heat on learners, it is evident that Mrs. Book's observations align with the statements above. The negative influence of heat on learners, as described, affects their focus and academic performance. With this information, the teacher acknowledges the need to reteach the material on such days to ensure a comprehensive understanding of the concepts by all students. Figure 4.5 shows that heatwaves are also increasing more and more, and the effects of these events are moderate and sudden in the learners' lives. The learners' school journey will carry on getting affected negatively the more this increase. Mrs Brooks explained how the water shortage crisis affects the learners in her classroom:

> *"When there is no water at school on these summer days it is such challenge for the girls and the boys. There are so many learners that are absent when this happens so these learners miss work and the learner's behaviour and focus in class is such a challenge."*

The Development Bank of Southern Africa (2023) reported that when the communities do not have water and there is no access to safe water, the learners' academic performance will suffer as the learners find it difficult to concentrate in the classroom and are dehydrated. When there is no water for a long period of time, learners are exposed to getting waterborne diseases and there is also no proper sanitation at school which results in schools having to close earlier and learners missing out on academic time. The fact that there is a water shortage in Graaff-Reinet is the result of climate change as there was a drought a few years back and the town is only starting to recover from this now. The water shortage increased learners and teachers' chances of getting sick at school as the toilets did not work and there was no water to drink. The learners would still be running around at break times and then they would be dehydrated after break, but there was no water for them to drink so they would not be able to give their full attention to the work being taught as they would start feeling ill in class. This would affect their behaviour as well, as they would become more restless and would become disruptive. This explains that on the days when there was no water at the school and in the community that the learners were acting out and the number of learners absent was high at this specific time which means that the

academic performance was affected negatively. Figure 4.5 illustrates the impact of water scarcity on learners, revealing that the worsening trends in droughts and causes of water scarcity contribute to a scenario where the mentioned effects become increasingly severe due to the diminishing availability of water.

The weather in Graaff-Reinet started to show a gentle decline in the summer temperatures and there is a drop in the evening temperatures as well (Weather Atlas, 2023). In the months of autumn (March, April and May), the amount of sunshine started to decrease as it started moving towards winter. There were also more rainy days predicted and the weather started showing more winter characteristics (Weather Atlas, 2023). Mrs Book explained her experience in autumn's weather in May, as follows:

> *"The weather started to cool down but there are still warm days that arose. On the days that it is cool in the mornings, the girls are well behaved and focused but when the temperature increases to over 25 there are days where they were restless and unfocused. Sunny and hot days over 31 the girls are talkative from the beginning."*

Cimons (2023) reported that extreme weather fluctuations have shown that learners get confused, and they struggle to cope with these changes internally. The learners struggle to adapt to these changes, and they cause learners to get sick more frequently as their bodies cannot regulate their bodies the same way adults can. Will (2022) explained that while our bodies have the ability to adapt to temperature change, children take a bit longer to adapt than adults, but this cannot happen immediately. It takes a few weeks to adapt to the weather change. Mrs Book's observation about how the learners reacted to the fluctuation of weather patterns in autumn was:

> *"We had warm days and then a day where the temperature dropped from a warm 25 and the next day it was 14 and cold. The learners struggled in the mornings but got more focused after break. When this drop happens on the same day, the boys are extremely restless and do not focus for long periods of time."*

When looking at how the learners react to the drop in temperature, it is clear that the statement made by Will (2022) provided the explanation for what is happening to the learners. The learners' bodies cannot adapt to the changes in the temperature so quickly which results in these learners' behaviour changing in a negative manner and it shifts the learners' focus which results in a negative effect on their academic success.

The variability in weather leading to illness only affects the learners; Mrs. Book also experienced the impact, being absent from school for a few days during this period of frequent weather changes due to the flu. An assistant teacher taught her class for these few days, and she reported the following about the learners in the class and her experience;

> *"I was under the weather for a few days this month. An assistant teacher was in my class for the time that I was away, and she reported that the learners were impossible on these days and that the weather was cool in the morning but would increase dramatically after break. She also commented that the next day it was chilly, and the learners were still unfocused and disruptive, so she did not finish the work that was put aside for her to do."*

The teacher was not at school for a couple of days due to being sick and it is safe to say that the fluctuation in weather had an impact on this. The days she was absent from school coincided with unpredictable weather, and the learners' reactions aligned with the reports of Will (2022) and Cimons (2023), highlighting the negative impact of weather fluctuations linked to climate change on learners at school. The teacher had to reteach the work that was expected which means that time was taken away from teaching other work that needed to be covered.

Despite limited research specifically addressing overcast weather's impact on learners' behaviour and academic performance, The Courier (2021) noted that the assumption of cooler weather having a positive impact on the learning process is not accurate; instead, learning abilities can be negatively influenced in cooler conditions. Mrs Books explained what her learner's reaction was to overcast weather as follows:

> *"Overcast and windy days were not good regarding the learners focus and behaviour. Girls seem to struggle more this month with the overcast and windy weather. Boys were more well behaved in the morning when it is cool. When it starts getting warmer after break, they are ore restless and unfocused."*

Mrs Book experienced negative behaviour and a drop in academic performance when it was cooler and overcast for both the boys and the girls, especially the girls. She explained how load shedding affected her learners in the class as follows:

> *"Load shedding started playing a role at the end of this month with regards to when the electricity went off in the morning times. When this happened, your time that you*

*can start work on the board is delayed as it is too dark for the learners to copy off the board which means that the learners started the day off being restless and disinterested as it is out of their routine."*

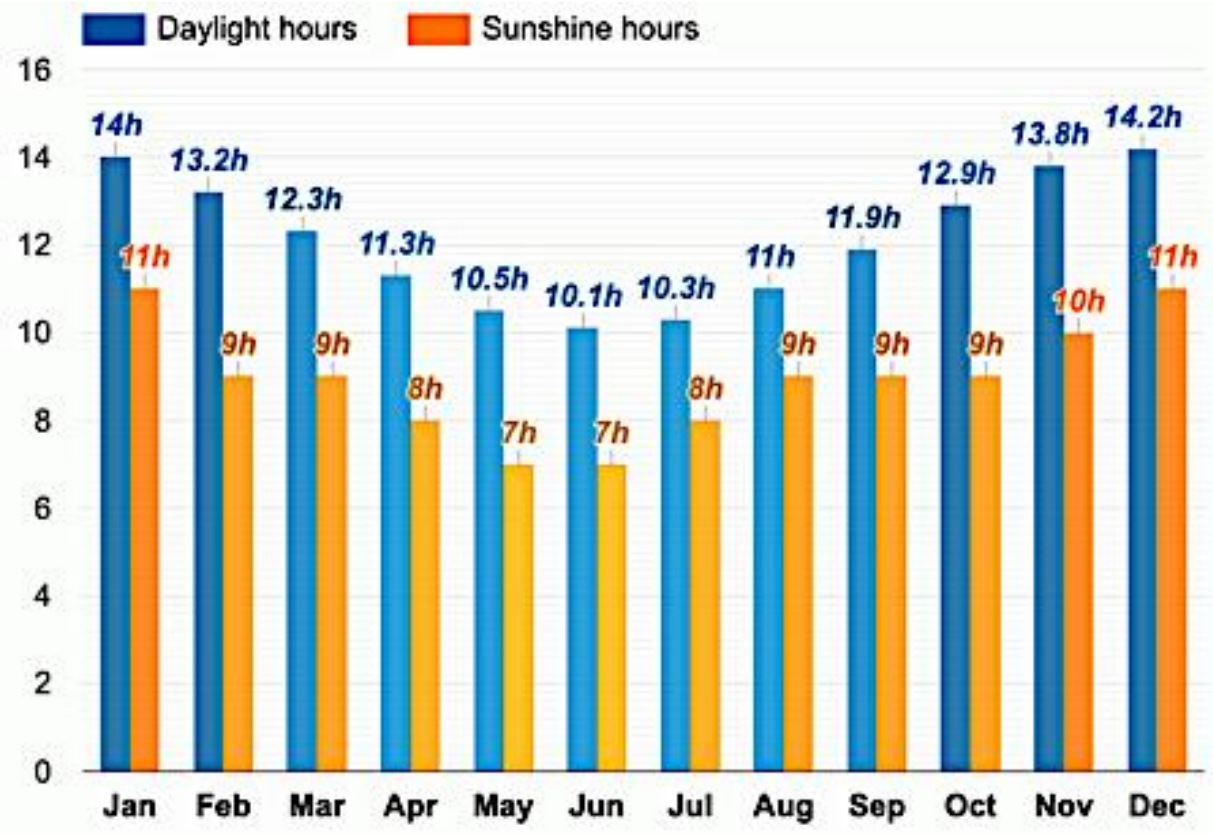



**Figure 4.6: Daylight hours in Graaff-Reinet, South Africa**

Source: Weather Atlas (2023)

Figure 4.6 shows how the amount of daylight and sunshine hours start to drop in April. Mrs Book's observation about it getting darker later in the morning is portrayed in this figure.

BusinessTech (2023) explained that Eskom cannot generate the electricity that is being demanded by the country. When the temperature increases, the country uses more electricity than normal as they are using air conditioning systems and other cooling appliances, but when we get cold weather, the country uses more electricity to keep themselves warm by putting on heating appliances. The fluctuations in the extreme average temperature over an extended period is attributed to climate change. Consequently, this chain reaction adversely impacts the learners' time at school for

learning. Both learners and teachers lack control over this situation, compounded by the school's inability to operate a generator to maintain lighting during load shedding.

Kamara (2019) explained how when a learner is studying in a cold room, this reduces learners' ability to learn and remember the information that is being taught. When the learners are cold, their brain starts focusing more on the effect the weather is having on the body which means that the learners struggle to focus on their schoolwork. Mrs Book explained how her learners reacted to the cold winter weather in July;

> *"When the weather got to very low temperatures in the mornings (between -2 and 4 degrees) the girls struggled to get going and if it stayed cold throughout the day, the girls would be talkative and unfocused. My observation is that they are getting too cold to focus on anything else except the cold. When the temperature increased to 23 degrees, all the learners were more focused and calmer. The boys ran around more at break times which released a lot of their energy so after break they were more focused than they were in the morning but still talkative."*

When it is cold, I always thought that learners would be more focused and they would be calm, but my point was proved wrong by Mrs Book and Kamara's (2019) research that showed that cold weather does not have a positive impact on the learners' learning process and their behaviour is also negative which was new information to me. The best temperature for learners to learn is between 21 and 23° Celsius which is when the brain is known to be the most focused and does not have to change its focus to body temperature or other external factors (Kamara, 2019). This statement supported Mrs Book's observed that the learners were the most focused and calm when the temperature was 23° Celsius.

Mrs Book explained how the weather in winter affected the boys in her classroom as follows:

> *"When it rained, the boys were very restless and did not keep their concentration at all during the day. It felt like they were more focused on the rain outside than what was happening in the classroom. When it is cold in the mornings (-2) and heats up to a warm temperature 26 the boys were aggressive and talkative and unfocused and kept on shouting out."*

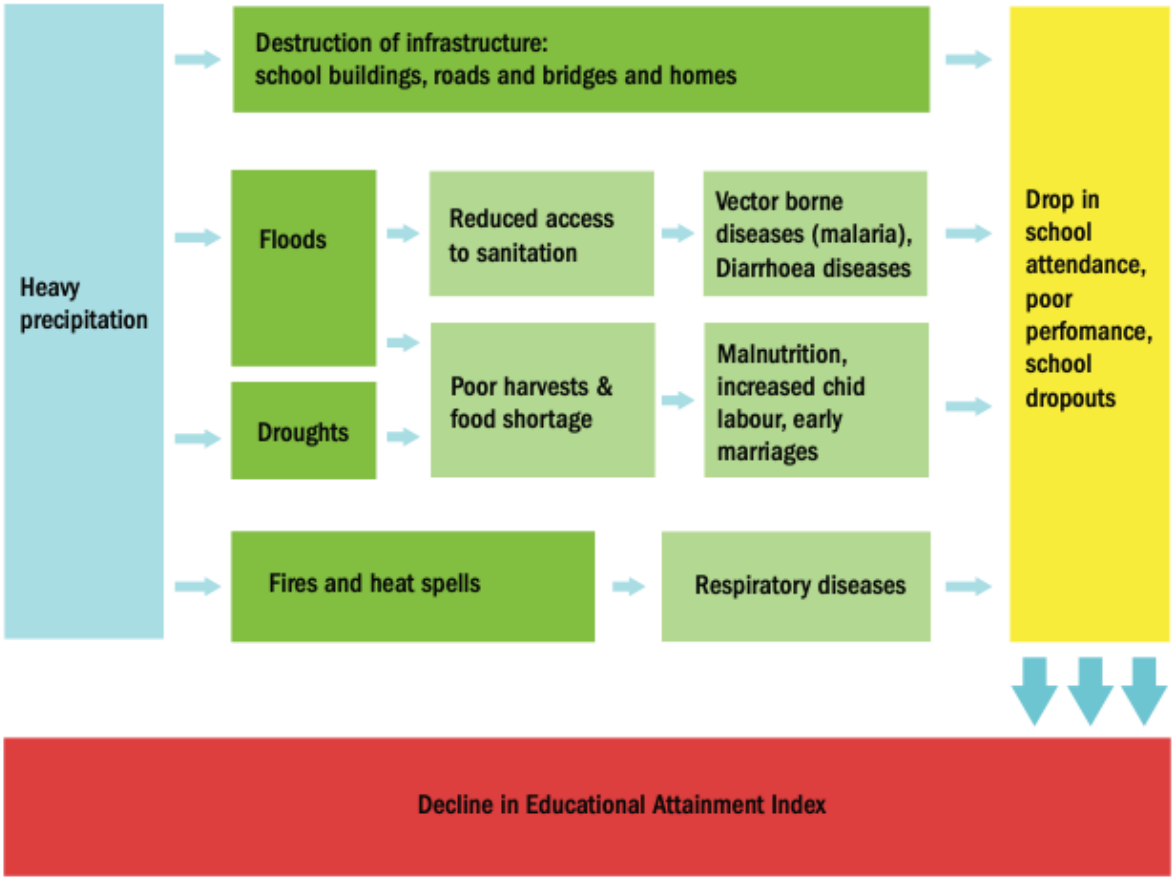



**Figure 4.7: Pathways of climate change impact on education**

Source: UNICEF (2011)

Figure 4.7 explains how climate change has a direct impact on the education system. When there are extreme weather events that occur, one can see that there is a chain effect flowing straight through to a drop in school attendance, negative performance at school and learners dropping out of school. All these extreme events have sub-problems that arise within the community, but the final step is the negative influence it has on the learner's academic performance and success (UNICEF, 2011).

Pule et al. (2021) reported that absenteeism in schools increased during the times that it was cold and increased as the temperature increased. Various factors contribute to learner absenteeism, including violence, abuse, neglect, poverty, illness, and non-climate-related issues. However, during winter, learners often miss school due to sickness (winter illnesses), an inability to walk in rainy or cold weather, or having uniforms that are not dry from the previous day. These circumstances are directly influenced by the changing climate, leading to an increase in cooler days. Figure 4.7

shows how the different impacts on a learners' life result in dropping out of school or a negative impact on the learner's academic performance. It shows that if there is a lot of rainfall that leads to floods, there is reduced access to sanitation, food shortages which lead to diseases and malnutrition, as a result of which learners stay out of school more often and fall further behind. One can relate this to learners missing school because of rain and illnesses. Figure 4.5 represented all the different reasons that learners miss school due to climate change impacts which relates to the statement above about absenteeism increasing when temperature changes due to climate change. Figure 4.4 also supported this statement as it mentions that learners miss school due to heavy weather and not being able to reach schools, infrastructure getting damaged and flooding having a huge impact on learner's diseases which all impact school attendance of the learners. Both figures represent different negative impacts that climate change has on learners' school attendance. The learners are missing out on school and the more they miss, the more they fall behind and it is difficult for the teacher to catch up all the work that is missed. When asked about how many learners were absent from her class Mrs Book answered;

> *"Winter is the time when I really do not have a full class. The number of learners that miss school in this month is extremely high. I feel like I am constantly playing catch up with half the class. The reasons that are given through to us are: it is too dark to walk in the mornings, it is too cold to walk in the mornings, sicknesses, no clean clothes as the sun has not come out to do washing and sometimes the learners just stay away because they get too cold at school."*

Figure 4.7 illustrates that learners are absent from school for various reasons, primarily connected to climate change. The ultimate outcome of these occurrences is not only increased absenteeism but also a higher dropout rate. This, in turn, contributes to elevated unemployment rates, worsened poverty conditions, perpetuating a cycle driven by the profound impact of climate change on the lives and educational journeys of these learners.

Mrs Book mentioned the following on the days when the wind blew at the end of winter:

> *"I noticed that when the wind blew, especially a warmer wind, the boys were impossible in every manner. They were more aggressive towards each other, they would shout out more in class, not focus on their work and they were just disruptive on these days.*

*Looking at what I have observed, wind has an extremely negative impact on learners but especially boys."*

Jarrett (2022) found in a survey done with hundreds of teachers in 2020 that a massive 74% believed that strong winds were the worst weather characteristic for learners' behaviour and keeping them focused in class. They found that learners wanted more attention and adult company when weather made them feel uncomfortable which made them act out (Jarrett, 2022). Although there are many teachers that are adamant that wind has a direct impact on learners' behaviour and academic performance, there is no scientific data supporting this statement, but I would not brush teachers' experiences aside as they are experiencing these reactions on a daily basis.

When the season changed from winter to spring, the days started getting longer, it started getting lighter earlier and temperatures started rising from the cold winter months (National Centre for Environmental Health, 2023). The weather in the Eastern Cape in the season of spring in October 2023 showed something different and out of character. The temperatures dropped so low that there were parts of the country where it snowed at the end of October (Evans, 2023). Evans (2023) reported how the previous week temperatures rose to the 30° degrees Celsius but in the last week of October, various snow warnings were issued and bitterly cold temperatures were experienced throughout the country. He stated that this extreme weather change was influenced by climate change which will lead to similar events in the future. Mrs Book explained what happened in her class in this month of October, as follows:

*"This is one of the months that I felt the learners struggled the most, especially the boys. It felt as if the learners did not know when to bring warm clothes to school and when to come in summer uniform. There were days where learners were freezing because they came in short sleeve shirts and then other days they came in thick jackets, and it was warm. The boys were very aggressive and struggled to keep focused from the beginning of the day to the end. Some days, the girls were restless and talkative but generally they were focused after the first week of the month."*

After reading what Mrs Book mentioned about her class and the extreme weather conditions that occurred in October, I can see that the boys were more affected by these extreme weather changes and could not get themselves to stay focused and calm in class. It could pe posited that if they had been able to go outside, they would

have expended their energy but because their bodies struggled to adapt to the weather changes, it affected their behaviour and their ability to learn successfully. There would be days where they would be more focused than others, but generally, they seemed to struggle throughout this month at school.

#### 4.2.2.2 Theme 2: Different strategies implemented by teachers during adverse weather conditions

Bidassey-Manilal et al. (2020) reported that climate change is raising the temperature of the earth which means that the temperature will keep on increasing with contingent negative effects. Furthermore, Wargocki et al. (2019), in exploring 18 different case studies, concluded that high classroom temperatures affected the learners' ability to learn and function in the classroom. Jiang et al. (2018) used six groups in six different temperature conditions and found that cooler temperature classrooms recorded optimal academic performance where warmer temperatures showed a decrease in learner performance. Teachers need to make sure that they understand the impact that the heat has on learners in the classroom as this is where the learners spend a significant amount of time. The teachers need to find ways to scaffold the learning when the learners lose their concentration due to the extreme weather.

When there are extreme weather conditions like storms, rain, thunderstorms or extreme heat, learners cannot always go outside for break time and release their energy and take a break out of the classroom. Baines and Blatchford (2019) characterised break time as a period during the school day when students typically venture outdoors, engage in physical activities, socialise with peers and have a snack. It serves as a moment to shift learners away from the classroom mindset. It gives the learners time out, but it also gives the teachers time out, even though they are doing break time duty, they can socialise with their colleagues and take a break out of their classroom. Break times offer various advantages to learners, particularly in terms of academic benefits. Taking a break from the classroom allows students to engage in physical activities during play, which has been found to positively impact academic performance. Research indicates that students' behaviour is less disruptive in the classroom when they have the opportunity to go outside for break time.

There are days where learners cannot go out for break time due to the weather and if the learners do not get a break, they will show negative academic focus and negative

behaviour in the classroom. Even though they are confined to the classroom, learners need to feel they are still taking a break from classroom activities so teachers should have some games that the learners can play together or individually (Brookman-Byrne, 2023). When learners have a break, it enables them to refocus, regroup, and become more productive upon returning to class. This break provides the brain with the opportunity to assimilate what has been learned and start anew when reentering the classroom (Brookman-Byrne, 2023). Some break time games include doing stretches and static movement, classroom games like “heads down thumbs up”, puzzles, creative art or colouring in pictures or playing music, allow the learners to socially interact with each other.

Mrs Book explained what she did regarding break times:

> *“There were time when I used to keep the learners in for break times when they were being disruptive and not listening, but I soon realised that this was actually making things more difficult for me after break and the learners seemed to be even more disruptive and not worrying about work even more. Even if the weather is bad and the learners stay in class, I try and let them do activities that makes them feel like they are not in the class.”*

In the classroom, awareness of weather-related challenges is crucial when considering the experiences of learners. This consideration should be an integral part of the teaching approach. Educators need to be responsive and adaptable to the surroundings, taking into account weather conditions. Whether it is an excessively hot, cold or windy day, adjustments to plans should be made accordingly. If students are struggling to maintain focus, the implementation of brain breaks becomes imperative. Youngman (2023) explained brain breaks as being brief classroom breaks that allows learners to give their minds a rest for a short period of time to allow learners to look at their work with a different mindset. Examples of brain breaks are “60 seconds dance party”, reciting nursery rhymes or the alphabet, listening to white noise and playing interactive games. The most obvious answer would be to get air-conditioning in classrooms, but this is a very expensive solution even though it is the most effective, so teachers need to try and find other strategies to help in these situations (Youngman, 2023).

Turek-Hankins (2021) explained that extreme heat has a direct influence on the learners' learning process because when it is hot, learners are sleepy, can get physically sick, have lower concentration levels and are demotivated to listen as they are uncomfortable and irritated. When the temperature increases, the learners' blood temperature rises and this is very dangerous, can lead to heat stroke and is an extreme health hazard for learners (Turek-Hankins et al., 2021). When it is extremely warm, one can safely say that learners are more lethargic and struggle to keep their concentration for long periods of time. Teachers need to change how much information is being received by the learners and reduce the pace and workload on these days. I feel that there is no point in trying to get through all the work that is required, but, because of the external weather conditions, learners are not focusing properly which means that the learners do not grasp the total lesson. Teachers are going to have to go back and reteach the concept which takes more time. They should focus on making sure that what has been taught, even if it is a small amount, is fully understood. Mrs Book mentioned commented about warm weather and teaching as follows;

> *"Hot days feel like teaching is such a struggle. The learners do not seem to listen as well as normal which makes me feel like I am repeating myself over and over again. I also notice when going through the work, the learners do not show a great understanding of what has been taught that day, so I feel like I am doing double work because I have to go back and go through that concept again more in depth."*

Mrs Book stated that teaching on a hot day can be very demotivating for a teacher, but I felt that if she adapted her teaching style on those specific days, the learners and the teacher could be influenced in a positive manner.

Alberto et al. (2021) explained that when it is very cold, the learners' brains focus more on the body's temperature than what is going on around them which means that learners' focus is not fully on what is being taught. They focus more on the discomfort of being cold, rather than on the work at hand. The statement below explains what Mrs Books experienced in her classroom in cold weather:

> *"In winter, I feel like the learners are on a go slow some days. They are not lethargic, but they work slower and they seem to be more talkative on these days as well. I tend to repeat myself more and more and need to make sure that the learners are focusing on what is being expected of them."*

Brain breaks prove beneficial in cold or stormy weather, similar to extreme heat conditions. In cold weather, when learners are confined to a classroom, staying sedentary can make them feel even colder. Incorporating movement during brain breaks can enhance blood flow, preventing learners from feeling as cold as they would if they remained still throughout the session. Letting students jump on the spot, march, stretch and do moves like star jumps are all activities that can be done in the classroom when learners seem to lose focus and start speaking to each other.

> *"There were days when it rained the whole day and it varied from light to heavy rain. My learners would constantly be looking out the window and focusing on the rain outside and not on their work. The learners were also extremely talkative and noisy on these days."*

As per Bekkouche's study in 2023, extended periods of rainfall, occasionally resulting in floods, had a detrimental effect on learners' academic outcomes. During such weather conditions, students struggled to maintain focus, leading to significantly lower test scores and an increased likelihood of grade repetition. While the rain discussed by Mrs. Book was not categorised as extreme flooding, it is evident that rainfall, even in less severe instances, adversely affects students' academic performance. This is manifested through increased daydreaming in class and a lack of concentration on their assignments. Teachers need to try and bring the learners' focus back to the classroom and give small amounts of work with brain breaks in between to keep learners actively involved in their learning process.

When observing the class on a particular day, the approach should be geared towards achieving the optimal outcome. If learners struggle with extended periods of focus and there is a substantial workload, breaking it into smaller tasks with frequent brain breaks can be beneficial. Assessing the ability to concentrate on a topic later and merging it with another can be a strategic decision. The ultimate goal is to ensure the success of the learners. It is acknowledged that circumstances may be beyond their control, despite their best efforts. Therefore, finding a collective benefit in the given situation requires adapting to their circumstances.

#### 4.2.2.3 Theme 3: Challenges faced by teachers

Ndela (2021) explained that a challenge can be defined when something is difficult to achieve, deal with or to comprehend. It is when the task at hand needs to be done but it is difficult due to many different factors like lack of knowledge or skills or both. In a classroom setting, there are instances when an educator has a clear plan for how the class should proceed. However, various challenges faced by teachers can impede their ability to complete the required work.

Prins et al. (2019) explained that discipline is crucial to the learning process. They stated that discipline implies an absence of behavioural problems which means that there is an expected behaviour that needs to be practised. Educators bear the responsibility of managing classroom behaviour and maintaining discipline among learners, even when faced with challenging behaviour. It is essential to teach and guide students when their behaviour deviates from the expected standards. They conclude by mentioning that the teacher needs to create a positive disciplinary environment in order to get through the needed work. According to Park et al. (2020), an increase in the number of hot days was associated with a decline in the rate of learning, leading to heightened disruptive behaviour and decreased focus among learners in the classroom. The learners would be less focused on what is needed from them, and would speak out of turn, break the class rules and not be able to control their outbreaks and emotions well. The rising temperature of the Earth, attributed to climate change, is leading to an observed increase in disruptive behaviour among learners. As consecutive hot days become more prevalent, there is a discernible adverse impact on both the behaviour and academic performance of students, causing them to lag further behind.

Mrs Book explained what happens in her class with regard to discipline in her classroom, as follows:

> *"I would narrow it down and say that my biggest challenge is the children's discipline. They are extremely busy and do not always listen to me when I am explaining the work or helping others as well. The learners will shout out constantly and then the whole class will start being disruptive. They constantly chatting and sometimes the boys. The learners seem to forget that the more I must stop teaching and deal with their discipline issues, the less work we get through or the less time I get to give one-on-one time and*

*sometimes we do not get through all our work. Sometimes it feels like they just do not worry about school and learning as much as they used to a couple of years ago!"*

From my experience, keeping a positive discipline environment is not always easy. The learners do not always stick to the school or classroom rules and seem to challenge the teacher more, which makes it very difficult to get through the work that needs to be done and to deal with these disciplinary problems that arise. It is now clearer that learners find it challenging to maintain focus and composure on exceptionally warm days. Coping with the heat becomes a struggle, leading to negative effects on their behavior, subsequently affecting academic performance. Their inability to concentrate in class is directly influenced by the weather conditions.

Mawila et al. (2023) reported that bullying has become more prevalent in South Africa where it has been shown that 20-29% of learners are involved in bullying (being a bully or being the victims of bullying). Mlambo (2021) reported that a 15-year-old pupil from Limpopo committed suicide by overdosing on pills after being severely and violently bullied by her classmates. Mrs Books also picked up on the increase in bullying and mentioned the following:

*"Over the last few years, I have noticed that there seriously name calling and just plain being ugly to each other as well. The boys are the ones who seem to be fighting with each other and are ugly to each other more than the girl. Sometimes you must play so many different roles in a day that it is exhausting."*

Laas and Boezaart (2014) stated that in a study done with 3 371 learners, 1 158 (34.4%) of these learners were victims of bullying. Furthermore; 55.3% of these learners were emotionally abused; 38.4% were physically abused; 16.9% were cyber abused; and 2.8% were verbally abused. It also showed that 29,3% of the bullying occurrences happened after class while 32.2% happened during class. These figures show how alarming the situation of bullying is and continues to escalate as Mrs Book observed in her class. Escobar et al. (2021) stated that there is a relationship between extremely high temperatures and aggression. When the temperature is over 25° Celsius, it has been shown that there is an increase in learner aggression, learners become more irritable and extreme heat generally has a negative impact on learners' moods and behaviour. It can be inferred that the yearly increase in temperature is contributing to heightened irritability among learners. This leads to increased conflicts

and negative interactions, as the rising heat affects their overall mood and behavior. This escalation in temperature is attributed to the broader phenomenon of climate change.

Marais and Meier (2010) noted that disruptive behaviour, particularly instances of misbehaviour and various disciplinary problems, is a prevalent and frequently discussed issue in South African schools. In their research, they found that Foundation Phase teachers struggled with the learners shouting out, laughing or making unnecessary noise while the teacher was teaching. They also play with their pencils, throw their stationery around or walk around when they are not meant to.

Mrs Book backed up this statement by explaining her experiences about disruptive behaviour and learners not finishing their work in her class:

> *"Another big challenge is the children take so long to finish their work. This makes it so difficult because I do not get through all the work that is required the pressure of making sure you finish the necessary work that is required from you is big. The learners who understand the work get held back as we must wait for those who are struggling, and one cannot always get to all these learners every single day. With this, comes the learners that are struggling and are really behind. One does not have the time to go back to the previous grades work as you have a certain amount of work that needs to be done. Sometimes it does feel like a never-ending cycle, and you are never in front."*

Kingwill (2016) explained that disruptive behaviour not only affects the learners' emotional and academic development but also the teachers. Mrs. Book detailed how the disruptive behaviour of learners impacted her instructional time, resulting in the class falling further behind. She had to repeatedly pause and redirect the class to regain focus. Emerging from the aftermath of the COVID-19 pandemic, where learners missed school and experienced setbacks, the noticeable educational gap that teachers currently face can be attributed to the impact of COVID-19. Adding to this, when extreme weather occurs, learners struggle to stay focused in class and they react negatively which contributes to the negative behaviour in class. Escobar et al. (2021) explained that learners struggle to stay focused on their work in extremely hot temperatures and get very irritated with people around them. With learners losing concentration and becoming irritated, one can see how this affects their behaviour in class which means that their focus is not on work at that moment because of the

weather impact and they fall more behind and struggle to behave in class. You can say that COVID-19 has impacted the learners' academic performance, but the impact of the extreme weather patterns, impacts these learners greatly on a daily basis and they do not have any control over this. Porter (2021) pointed out that the learners most adversely affected by the pandemic, particularly those from low economic and social communities, are also the most vulnerable to the impacts of climate change. Mrs Book comes from a school in the poorer community of Graaff-Reinet, so this statement that has been made by Porter supports what Mrs Book is going through in her classroom. In my classroom, there is a significant disparity in the learning levels of the students. Some can read and write proficiently, while others struggle with basic sight words. All these learners have experienced developmental delays due to COVID-19, and the additional effects of climate change exacerbate their challenges, causing them to fall further behind. Addressing the diverse needs of the students becomes more challenging. These learners find themselves trapped in a cycle of double negative impacts, where their circumstances, most adversely affected by climate change, continue to hinder their progress.

Jones and Spalton (2011) explained that poorer communities are the most vulnerable to climate change impacts as they experience higher levels of poverty, money problems and lower access to basic services and informal settlements. When extreme weather events occur, these learners are directly influenced as they might not be able to gain access to their school due to bridges being washed away or roads being destroyed. Children may stay at home to help support the household and have the added burden of diseases from food shortages and water insecurity.

The above statement supports Mrs Book's statement when asked about the reason why the learners are absent from school so frequently;

> *"The children in our community come from a rural settlement and there are many different reasons why they do not always come to school. If we have had an extremely hot day, there are learners who are absent the next day due to the fact that they only have one uniform. They sweat a lot on these warm days and they either do not get to wash their clothes in time or there is a shortage of water to do washing which means that they stay at home because they do not have clothes."*

Figure 4.8 visually illustrates the various pathways through which climate change impacts education. Notably, the final outcomes involve learners either dropping out of school or experiencing poor academic performance. These consequences arise from the disruptions caused by extreme weather events and the direct influence of such events on the learners' successful educational journey. This highlights the impact of various extreme weather events, such as floods, droughts, and heatwaves, on learners' access to sanitation, food shortages, home destruction, diseases, and nutrition. All these factors contribute to learners frequently missing school and, ultimately, leading to dropout rates. This figure provides further insight into the reasons why Mrs. Book's students are absent on hot days and offers a glimpse into the potentially challenging future these learners may face if the situation does not improve.

When learners miss school, even for a day in the Foundation Phase, they lose out a full day of teaching as these learners have the same teacher for the whole day. The material covered on one day is reinforced the next, and when a learner misses this instruction, they lag further behind. This is because they miss the complete understanding of the concept and the shared experience that other learners had earlier in the week (Kriel & Livingston, 2019). They explained that the learners who miss these lessons, fall further behind the more days they miss, and this has a negative impact on their school performance. Frequently, the factors leading to learners' absenteeism are beyond their control, with climate change exerting a significant influence on the reasons for their absenteeism (UNICEF, 2021). Figure 4.6 shows us the way that climate change can impact education, especially in the Eastern Cape. The risk of floods and heavy rainfall can influence the learners' ability to get to their school. Moreover, the rise in diseases and illnesses is a consequence of increased stagnant water, attracting various insects that can induce sickness. This, in turn, contributes to the absenteeism of learners from school.

The statement below was made by Mrs Book. I share her perspective on the cycle of learners missing school and continuously falling further behind academically. Mrs Book point of view on this topic is as follows:

> *"This is a vicious cycle that is occurring for the learners as they cannot come to school because they do not have clothes because of the weather patterns, which means they*

*miss a whole day of school which is out of their control, when they come back to school they are behind academically and as the weather changes, the cycle continues."*

The reason why the load shedding schedules increase to higher stages is because the demand for electricity increases and Eskom cannot keep up with the demand (Kahla, 2021). As the heat starts to increase, electricity demand increases with people using air conditioners and fans, resulting in Eskom not being able to generate enough electricity and implementing load shedding. You can look at it the same way in winter; the colder it gets, the more people start using heaters and electric blankets which results in more electricity being used and load shedding stages being implemented (Kahla, 2021). It is safe to say that the people are experiencing more consecutive hot days and an increased frequency of colder days, both of which are attributed to climate change. This, in turn, directly leads to the implementation of load shedding, as explained earlier.

McCain (2022) reported that load shedding has a direct impact on schools in many ways. There are schools that use technology in their teaching and learning, but there are schools where the natural light does not reach all classrooms and not every school has the capacity to run a generator to fix this issue. Learning is delayed by the mere fact that learners cannot see the board for a specific amount of time.

Mrs Book explained her situation in her class when there was load shedding:

*"Load shedding has been such a struggle the past few months, especially in the winter months when it is still dark when school starts. You have to change your routine in your classroom as you cannot write on the board for at least the first half an hour to 45 minutes of school as the learners cannot see the board properly because you cannot put the lights and it is too dark at this time in winter.*

Mrs Book explained another problem that load shedding has given her in her classroom, especially when it is extremely hot:

*"Another problem that arises is that when it is extremely hot, I use a fan in my classroom to cool the classroom down. When there are so many different bodies, it can get very hot in the class. When there is load shedding, I cannot use my fan which makes a big difference in the classroom temperature, and I notice that the learners are a lot more lethargic and do not work as well.*

Zali (2023) explained that the extreme heat conditions have a massive influence on learners and adults. Learners struggle to stay focused in school and are also exposed to increase asthma, headaches, rashes, cramps, heat stroke, unintentional injuries and urinary tract infections and dehydration. Learners' concentration levels are very low under these conditions and the adults are also exposed to these problems. By merging Mrs. Book's firsthand experiences with Zali's (2023) research on extreme heat conditions and their effects on learners, it can be deduced that as the temperature in the classroom increases, learners will encounter difficulties in maintaining focus on their work. This struggle subsequently has a negative impact on their academic performance. Additionally, the heightened heat can adversely affect learners' behavior, leading to increased irritation and diminished energy levels. Figure 4.5 also shows us that the temperatures are rising, and heatwaves are becoming more frequent which has a negative impact on these learners.

As mentioned in Case 1, Graaff-Reinet is going through a water shortage crisis due a drought that was caused by climate change. Although there has been rain and the drought was broken, the aftereffects of the drought are still evident and the learners are directly influenced by this. Mrs Book explained this statement in her experience with the water shortage crisis at her school:

> *"There was a week where the community did not have any water which includes the school not having any water as well. These learners could not drink water at school, and this occurred in the summer, so learners were dehydrated. The work that was taught this week had to be retaught as these learners would not concentrate. There were also a lot of learners absent as they could not clean themselves in the evenings for school or they did not have enough clean school clothes to attend school."*

The town is running on boreholes to get water to the communities taps. Even though there is currently water in the dam, there is a lot of sedimentation at the bottom of the dam which effects the water quality, so the town has to stay on the borehole water system (Basson et al., 2022). The borehole system does not meet the demand that the town has for water which means that there are times when parts of town are without water for a few hours. Sometimes, when there is load shedding, the boreholes do not work at all (Janse Van Vuuren, 2021). In instances of water scarcity, schools may close prematurely, impacting academic hours, and teachers find themselves rushing through their curriculum to make up for lost time. Learners often miss school, either due to lack

of hygiene preventing attendance or being sent home after arrival. For those present in the classroom, extended focus becomes challenging as dehydration and the struggle with heat become pronounced, particularly during periods of water scarcity on hot days. Teachers are also affected as they cannot use the ablution blocks throughout the day and if they have not brought water from home if they have water, they also run the risk of dehydration and sicknesses. This cycle is continuous and at the end of the day, the learners are the ones who are missing out on their education. Figure 4.7 supports this scenario as it shows that learners do not come to school or they drop out of school due to drought. One can see that the water shortage arose from a drought so this means that learners are affected, and the result can be that they drop out of school or miss a lot of academic work.

There are various reasons why classrooms and schools are overcrowded, namely, a shortage of teachers in schools, lack of infrastructure, schools losing teachers due to a drop in school learner numbers or teachers moving to other schools and schools not having the necessary funds available to pay extra teachers (Soekoe, 2021). If a schools learner numbers drop below a certain level, that school might lose a departmental post. Sometimes the learners who drop out are not necessarily in the Foundation Phase, yet the teachers are still impacted by the DBE's decision to redeploy them to a different school with increased student numbers. This redeployment leads to larger class sizes in the grade that the teacher leaves behind (Tshinnane et al., 2017).

Soekoe (2021) reported that when classrooms are overcrowded, it affects the physical environment of the classroom and the behaviour of the learners as teachers must focus more on keeping the discipline under control rather than teaching. This has a negative psychological effect on the teacher wo may struggle to teach the necessary work resulting in the lessons being rushed. When this happens, learners will feel neglected which results in learners not being actively involved in the learning process of the lesson and losing interest in gaining an understanding of the work. The learner yet again loses in these scenarios and their academic success is impacted negatively. Examining the impact of overcrowded classrooms on learners is crucial, but it is equally important to acknowledge the effects on teachers. They may experience increased workloads, demotivation, burnout and overwhelming stress, all of which can significantly influence their performance in the classroom.

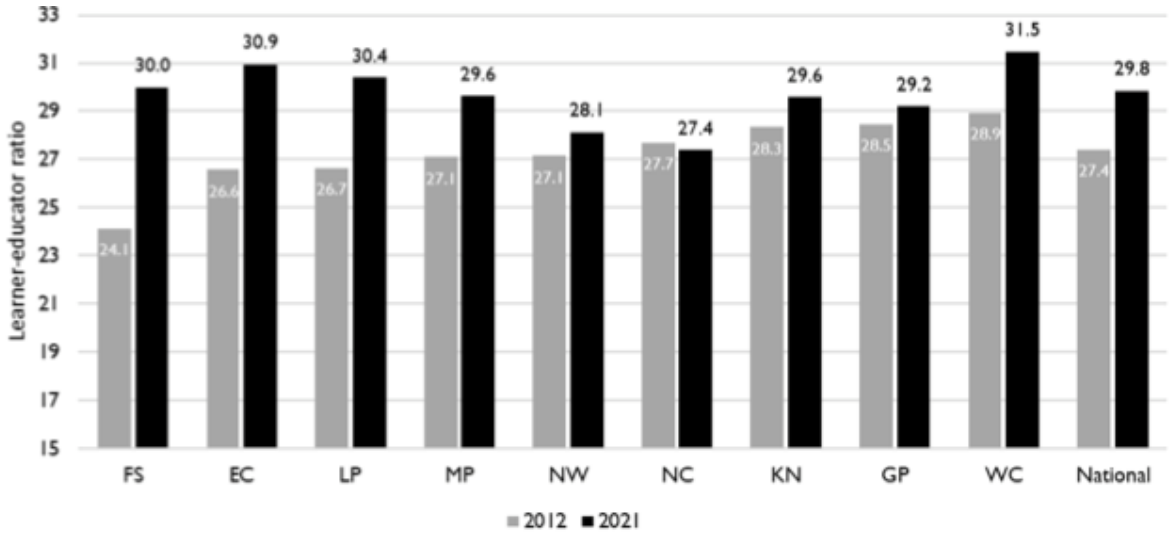



**Figure 4.8: The difference in the learner-to-public-educator rations in South Africa from Grade 1 to 12 in public schools from 2012 to 2021**

Source: Soekoe (2021).

> *"In the end of the day, the learners are the ones who get disadvantaged in such a big class because they do get lost. You feel so responsible for every learner so if you have a big class and you go home and realise that you didn't get to some learners it actually just breaks your heart. Again, it is so possible that this can happen to me again."*

Figure 4.7 shows us how the number of learners to teacher has increased in recent years but the number of teachers is not increasing leading to overcrowded classrooms.

Climate change affects households, especially lower-income households and when there is an extreme weather event like floods, a heatwave or extreme cold, it affects these households the most. These events lead to food scarcity, loss of infrastructure, loss of crops, increases in vector-borne diseases and workers losing their jobs (UNESCO, 2015). Families are compelled to relocate from their homes and surroundings in search of employment opportunities resulting from climate change. This relocation often requires them to move to a different town, leading to learners enrolling in new schools. Consequently, this adds to the numbers of learners in a classroom. The migration process is an emotional journey for the learner, involving distress and the challenge of adapting to a new school environment where things are done differently, along with the task of making new friends (Jones et al., 2011).

All the climatic events means that families move to new cities and towns and these learners need to find schools that are close to their area of residence. This means that there are extra learners in the classroom which puts pressure on the teacher and the classroom environment. The learners continue to lag behind because the teacher is unable to address the individual needs of each learner. The gap between these challenges is substantial, and the classroom size does not permit personalised one-on-one attention for every student.

Mrs Book explained this challenge in following statement when asked about the different levels in her classroom:

> *"In the end of the day, the learners are the ones who get disadvantaged in such a big class because they do get lost. You feel so responsible for every learner so if you have a big class and you go home and realise that you didn't get to some learners it actually just breaks your heart."*

I know that learners and their academic success is the most important outcome of school, but one also need to remember that teachers also go through different emotions and the effect of climate change affects them as well. If a teacher's mood is influenced by climate change, their teaching will also be influenced, and impacts the learners' performance. If there is an increase in temperature, it not only affects the learners who get hot and bothered but also the teacher. This will have an impact on the teacher's mood and desire to keep on teaching with the same amount of enthusiasm which indirectly affects the learner's academic performance as they will not be getting the full learning experience (Hough & Counts, 2023).

> *"There are some days where I feel like I should stop teaching. You don't understand, there are times in the term where I so tired every day. I get home and I am so tired of always saying keep quiet or listen to me or just focus on your work or leave each other alone. There are also days where I am physically exhausted and feel like I have not done my job properly as a teacher either."*

Teachers have to deal with many different issues in their school day with learners and adding to this pressure they have high workloads, large classroom sizes, disruptive students, administrative pressure and pressure that they put on themselves to succeed. In addition, spending the entire day in a hot classroom, handling learners grappling with the consequences of climate change, taking care of oneself amidst the

negative impacts of changing weather patterns, highlights that teachers also contend with pressure and anxiety. If teachers are feeling under pressure and stressed, this would reflect on their work and how they treat the learners and how they teach the work that needs to be taught. To create a positive classroom environment and teach successfully, teachers also need to be wary of their mental health and reactions to the environment.

#### 4.2.2.4 Summary of findings

##### *4.2.2.4.1 Theme 1: Positive and negative impact that climate change has on the learner's behaviour and academic performance*

This study found that Mrs Book experienced and reported on the different negative impacts that climate change had on her learners' behaviour and academic achievements. In Theme 1, Mrs. Book explained that she was teaching in a rural, low-income community and that these learners were greatly impacted by the extreme weather changes happening due to climate change. Mrs. Book noticed aggressive behaviour from her boys in summer and stated that they struggled to stay focused on the extremely hot days. She mentioned that the girls were tired and would speak more on these days. She also mentioned that there were more humid days in summer than there had been before in Graaff-Reinet and the girls seemed to struggle more on the days when it was extremely humid; however, research contradicts this statement as it shows that girls accept humid weather better than boys.

There was a massive water shortage crisis resulting in the community and school being without water for many days. The absenteeism rate increased greatly over these days and all the learners struggled to do their work and were very restless. Since there were fewer learners at school and the ones who were there struggled, Mrs Book had plan to reteach this work and fit this into her busy planning schedule. When the temperature started to fluctuate in autumn where there were both hot and cold days, learners struggled to adapt to these circumstances and were restless and not focused which hindered their academic success.

The amount of sunlight decreases as the season gets closer to winter, with load shedding increasing when the electricity was off in the morning, she could not start with schoolwork straight away which resulted in learners being disruptive from the

beginning of the day as it was out of their normal routine. This took time away from teaching in the day which means that there was less time for teaching a concept. When temperatures dropped, the girls struggled to focus on their work and were talkative throughout the day. The best temperature for the boys and girls regarding their behaviour being calm and focusing on their schoolwork was 23° Celsius. Boys were aggressive on rainy, hot days and when there was a sudden change in temperature.

The study found that the absenteeism rate was very high in winter. This was not only because learners were sick, but because it was still dark in the mornings for learners to walk to school, school uniforms could not dry because of the weather and learners do not have enough warm clothes for these cold days. The learners who missed these school days did not get the full teaching experience as the teacher did not have time to go back over work she had already taught. Thus, these learners fell behind.

Spring was the season that Mrs. Book struggled the most with regard to disruptive behaviour, learners speaking out of turn, boys being aggressive, and the boys not being focused at all. The girls were more talkative, but they would still focus on their work. It is evident that Mrs. Book encountered numerous challenges related to negative behaviour and academic performance issues. However, it appears that the boys were more vulnerable to climatic events, facing greater disadvantages as they missed out on educational content and the chance to fully participate in planned lessons. The girls seemed to be more talkative in humid weather and when it was cold, they struggled to get going in the classroom.

4.2.2.4.2 Theme 2: Different strategies implemented by teachers during adverse weather conditions

Extreme weather conditions lead to many different problems in the classroom; for example, the learners could not go outside for break times to release their energy and take a break out of the classroom, but it also affected their ability to focus on their work in academic time. Break time is very important for learners to get a break from the formal teaching and alter their mindset for the next lesson. Movement is also very important and when learners go outside into the fresh air and move around, it has a positive impact on the learner's academic achievement. When the weather does not allow for learners to go outside, the teacher needs to have different activities in place like puzzles, stretching exercises, group games and arts and crafts. Learners need to

get a break from the feeling of formal education in the classroom so that they can regroup and refresh their mindset.

When it was extremely hot, Mrs. Book also mentioned that learners were sleepy, demotivated and struggled to concentrate. Teachers need to change their lesson plans on these days and need to slow down the pace and give frequent brain break activities throughout the lesson. Extreme cold weather also impacts the learners' behaviour and academic performance. Learners' brains focus more on the cold than on what is being taught. The teacher needs to do movement activities to get the blood flowing and warm learners up. Rainy weather that leads to floods affects learners negatively as their attention is more focused on what is happening outside which means they are not focusing on what is being taught. Because of the negative impact of extreme weather events on learners, teachers need to change their plan on those specific days. If they do not, they will need to reteach the work, or the learners will not have learnt anything resulting in poor academic marks on that specific section. It is advisable to adopt a more deliberate pace in teaching, ensuring thorough comprehension, rather than simply proceeding through the material according to a predetermined lesson plan.

*4.2.2.4.3 Theme 3: Challenges faced by teachers*

Mrs. Book explained that she struggled most with learner discipline where the learners did not listen in class and when work was being explained they were speaking to one another. Extreme weather temperatures had a negative impact on learners' ability to stay focused which explains why learners could not stay focused for long and were disruptive. Mrs Book felt that this hindered her teaching time and her time management. Increased disruptive behaviour within the class led to incomplete coverage of the curriculum, forcing the teacher to rush the teaching process. Consequently, learners were deprived of the complete learning experience. Some students encountered difficulty completing their assignments, resulting in a further decline in their academic progress. The teacher may not always be able to provide adequate support to learners who are struggling, contributing to their continuous academic decline.

When it is extremely hot, learners were more easily irritated and struggled to control their emotions, which made them disruptive in class and impacted the environment in a negative manner. Bullying and aggression increased. When it was extremely hot,

learners tended to be more aggressive. Mrs. Book noticed that this seemed to be happening among the boys.

Mrs. Book also mentioned that another challenge was the number of learners who did not come to school daily. Learners missed a lot of work when they did not come to school, which meant that they fell behind academically and did not always catch up. When it was very hot or very cold, the learner absenteeism rate was very high since learners could not always come to school. Learners who walked to school did not come to school when it was raining and missed school because their clothes could not get dry when there was a lot of rain.

Load shedding also presented challenges as when the electricity went off in the mornings, there was a delay in Mrs. Book's day as she could only start working later. The load shedding increased when there was a high demand for electricity. When it is hot, communities use more electricity by using fans or air conditioning systems which means that Eskom cannot generate enough power. The same concept applies in winter when the communities are using various heating appliances to keep warm. Climate change is creating extreme weather conditions which result in a bigger demand for electricity and an increase in load shedding times.

When there was load shedding, Mrs. Book could not use a fan to move the air around and learners struggled with headaches, heat stroke and lethargy which all impacted their behaviour and academic performance negatively. A water shortage crisis in Graaff-Reinet meant that the school closed early which took academic time away and learners were dehydrated and struggled to concentrate. Overcrowded classrooms were also a challenge that Mrs. Book faced. There seem to be more and more families relocating to this community but there are no new teacher posts being made available.

Finally, Mrs. Book grappled with the diverse academic levels among her students, making it challenging to attend to each learner individually. This situation evokes a sense of guilt among teachers. Additionally, the impacts of climate change add an extra layer of pressure and anxiety for teachers, as they strive for the success of their learners amidst the myriad challenges they face.

#### 4.2.2.5 Case 2: Concluding remarks

Looking at what Mrs. Books experienced over the four seasons, one can see that there are many different challenges for teachers. Climate change has a direct negative impact on the learners' behaviour and academic performance. Teachers need to change their teaching approaches on the days when there are extreme weather changes and how the learners are reacting to the situation on the day. They need to make sure that they are getting the best out of the learners academically in these specific situations, rather than trying to just get through the work and losing the learners in the lesson.

There are various external problems that arise in the schooling system due to climate change which are beyond the teachers and learners' control and teachers need to adapt and change their lessons accordingly. This study also concludes that the learners' behaviour is more disruptive and aggressive in these extreme weather conditions which contribute to the learners' poor performance.

### 4.2.3 Case 3: Mrs. Warm from Summer Primary School

#### 4.2.3.1 Theme 1: Positive and negative impact that climate change has on the learner's behaviour and academic performance

The impact of climate change affects everyone in the world, but rising global temperatures have the greatest impact on children and people that live in rural areas, in poverty and in low-income communities (Hussaini, 2023). Mrs Warm explained where her learners were from:

> *"The community that my learners live in, is known as one of the communities where the people struggle the most in Graaff-Reinet. There are some learners who live in shacks and parents are unemployed. There are also some learners who home circumstances are not as bad as others, but the school is situated in a rural area where poverty, unemployment and overcrowding in households is high."*

Mrs Warm's learners were more vulnerable to the impacts that climate change has on their lives and school journey.

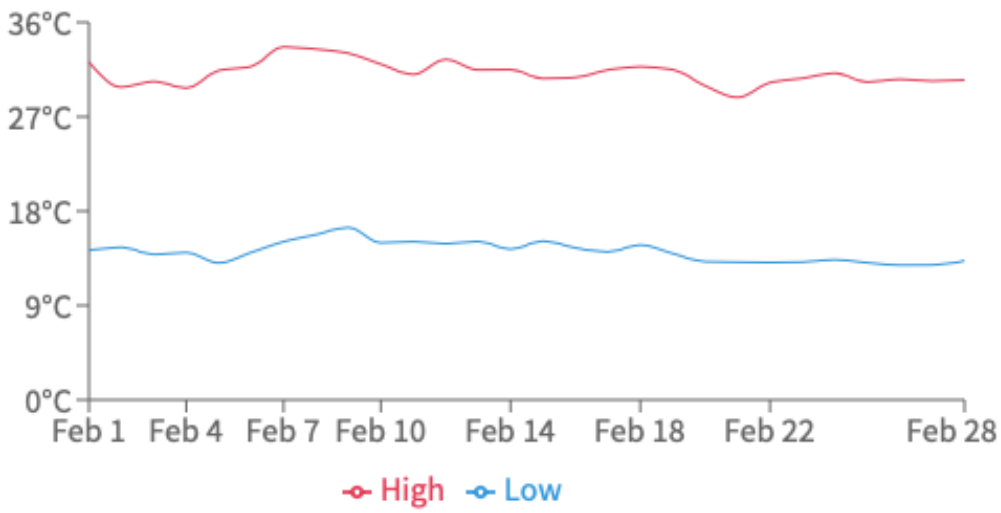



**Figure 4.9: The temperature in Graaff-Reinet in February 2023**

Source: (Travelchime Inc., 2023)

Graaff-Reinet is known for its very hot summers where temperatures rise to over 35° Celsius (Travelchime Inc., 2023). Ruwoko (2023) reported how climate events like heatwaves, floods and fluctuations in temperatures have a negative impact on learners' health, academic performance and attendance in schools. Figure 4.9 shows visually how the weather in February is over 30° Celsius constantly with days where the temperature increased to well over 30°.

In South Africa, due to climate change over the last 100 years, the temperature has increased by 2° Celsius which increases temperatures at some places to over 35° Celsius which is not the normal pattern of weather for some of these places (Cele & Ramathuba, 2020). This also results in wildfires and droughts occurring which have a great impact on people's lives. This increase in temperature affects learners in schools as this extreme heat reduces their concentration which affects their ability to learn and take in information. It also causes dehydration with some learners fainting, and it makes learners more aggressive (Cele & Ramathuba, 2020).

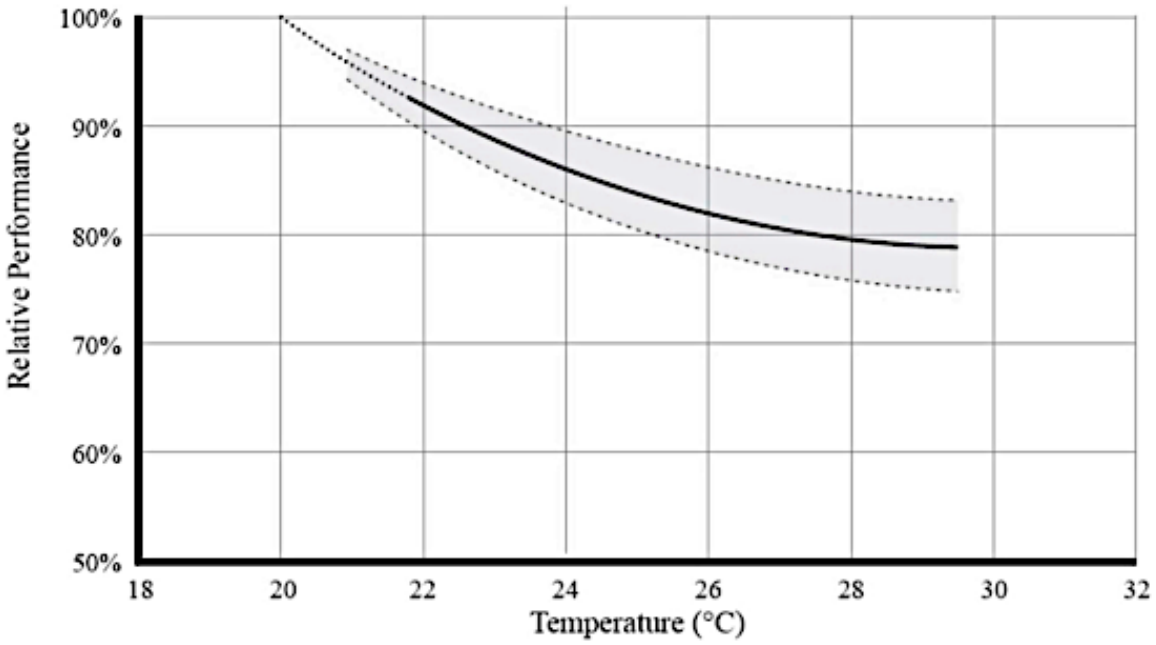



**Figure 4.10: The performance, more specifically, the speed that schoolwork was completed in relationship with the classroom temperature**

Source: Wargocki et al. (2019)

Figure 4.10 shows that the learners work the best when the temperature is at 20° Celsius. As the temperature increases, the speed at which learners complete their work decreases. If learners are not finishing their assignments and performing at their full potential, it can be inferred that the material covered in warmer temperatures may not be comprehended and retained as effectively as it would be at 20°. Given that climate change is causing an increase in the Earth's temperature, learners are likely to encounter progressively hotter days. As indicated by the graph, this ongoing trend foreshadows a continual decrease in their performance, adversely affecting their academic performance.

Wargocki et al. (2019) explained that in extreme heat, learners struggle to stay focused on their work in class and the speed at which they work decreases the warmer it gets. Mrs Warm explained this exact trend with her learners:

> *"In summer, I noticed that the girls would come to school calm and focused, but on the hot days after break, their concentration would decrease and they would be more talkative. The boys struggled with the heat, and they were very lethargic where they*

*would sometimes fall asleep resulting in missing work. Boys were very unfocused, restless and talkative in the summer month when it was very hot."*

This is what Mrs Warm explained was happening in her class in February when it was very hot. As the temperature increases, learners lose their focus as the heat affects their concentration levels and ability to stay focused for long periods of time. This exerts a detrimental effect on the academic performance of learners, as they are not performing at their optimal level, and the comprehension of the taught concepts is compromised. Consequently, learners are falling behind, and the teacher may not always have the opportunity to revisit and reteach the material due to the need to progress through the curriculum (Wargocki et al., 2019). I perceive the situation as follows: the rise in temperature attributed to climate change leads to extreme heat conditions. If the temperature did not increase so much, learners would not experience as much lethargy, and their concentration levels would remain higher. Consequently, learners would be able to sustain focus for longer periods, facilitating a quicker and easier grasp of the curriculum content.

Janse Van Vuuren (2022) reported that Graaff-Reinet had a long drought period from 2015 through to 2020, and the town is still experiencing the aftermath of the drought. The drought came with many negative impacts on the town and farmers in the area. As mentioned in Case 1, the reason for this severe drought was climate change. The town is not using dam water, but borehole water. The demand from the town is very high and the boreholes cannot keep the reservoirs full which creates water shortages. There are days when some areas do not have water for a couple of hours, but there are times when places do not have water for days on end. In times of extreme heat, learners tend to become dehydrated easily, and their concentration is adversely affected by the intense heat resulting from climate change. The shortage of water, another consequence of climate change, exacerbates these conditions (Janse Van Vuuren, 2022). The impact of load shedding further exacerbated this situation, as the electricity outage prevented the boreholes from pumping water into the storage facilities. Consequently, these reservoirs gradually emptied during power cuts, resulting in minimal to no water pressure in town, particularly in high-lying areas (Du Toit, 2021).

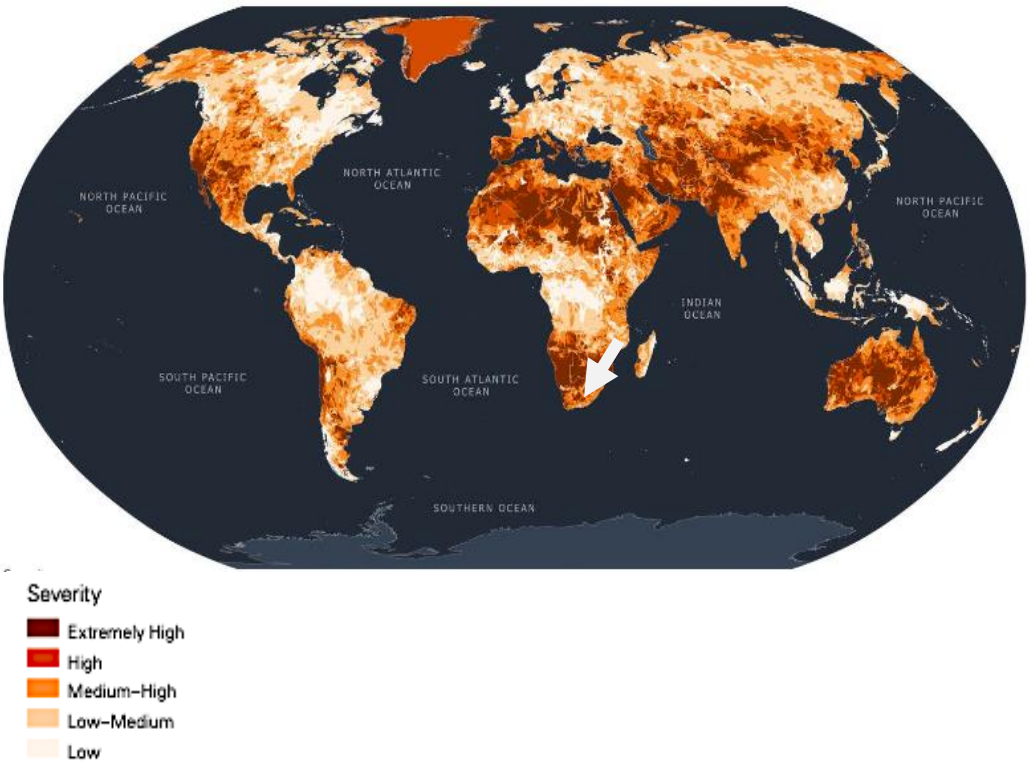



**Figure 4.11: The levels of water scarcity in the world**

Source: UNICEF (2021)

Figure 4.11 shows the water scarcity levels in the world. The arrow on the map indicates where Graaff-Reinet is situated in South Africa. Water scarcity is defined as a lack of available water to meet the demand of a specific population. Droughts that cause water scarcity, are getting longer and longer and the water availability is getting less and less. As the temperature rises, the moisture in their air evaporates which means that there is less water for people to drink and use. Going hand in hand with this, higher temperatures increase the demand for water. However, “for Children, water is life” (UNICEF, 2021, p. 31). Figure 4.11 illustrates that South Africa’s has an extremely high level of water scarcity. Severity in parts of South Africa is higher than others. which has a negative impact on the country and in this case, the town of Graaf-Reinet (Shepherd, 2021). Droughts and extreme heat are the main reason why the water levels are falling which is a direct result of climate change (UNICEF, 2021).

Mrs Warm explained how the water shortage and extreme heat affected her learners:

> *"There was no water for a week in this month. It was horrible as it was extremely hot with temperatures between 34 and 38 degrees on these days. All of the learners that came to school where talkative, unfocused, lethargic, restless and would work extremely slowly. There were also many learners absent from school over this week due to the fact that they did not have water at home either so school clothes could not be washed, and the learners are also sweaty and dirty from the heat."*

Over the last few years (8 years to be exact from 2015 to 2023), Graaff-Reinet has experienced humid weather, where the normal weather patterns show that Graaff-Reinet had a dry heat (Travelchime Inc., 2023). February has been reported to have the highest humidity percentage out of all the months and this change in weather pattern is due to the effects of climate change (Travelchime Inc., 2023). Mrs Warm experienced the following with her students with regard to the hot and humid weather;

> *"When the weather was hot and humid, it seemed to affect the girls more in a negative manner as they worked slower and were not as focused on their work, and they were more talkative. The boys were also talkative and struggled to keep their concentration on their work."*

Woods (2015) explained that when learners experience humid weather, they struggle to internally cool themselves down which can be detrimental for the learners' health and concentration levels. I can see that Mrs Warm's learners reacted to humid weather in a negative way and the learners lost their concentration on these days which meant that their academic performance was affected negatively.

Cimons (2023) reported that when the weather fluctuates from extreme heat to cold or vice versa, learners struggle to handle these changes internally which results in learners getting sick more frequently as their immune systems cannot handle the changes in temperature. Will (2022) explained that our bodies can adapt to these weather changes, but when the weather changes happen so quickly from one to another, learners struggle with this change, and it affects their ability to keep focused for a long period of time and they struggle to sit still. Clayton et al. (2023) mentioned that the psychological effects on learners when the weather fluctuates can make learners more hyperactive which can make learners more anxious as this makes them unable to concentrate for long periods of time and finish the tasks that have been set out. This leads to learners having a low self-esteem which in the long run results in

learners having mental health struggles; for example, depression (Clayton et al., 2023). I can see that the results of weather fluctuations on learners' psychological wellbeing can have long-term negative effects. Mrs Warm explained how the fluctuation in weather affected the boys and girls in her class:

> *"This month the weather also changed from extreme heat the one day, to very cold weather the next and then rainy weather would also occur. There were days where it was 34 degrees and the next day it was rainy and 14 degrees. The learners struggled when this happened. The boys and girls were restless, talkative and struggled to stay focused on their work and what is being taught. I also struggled on these days."*

Will (2022) explained that these weather fluctuations have increased over the last few decades (30 years). All the learners struggled over these days, especially in their academic performance as they could not stay focused and missed out on important information.

Johnson (2023) said that when someone is feeling hot and bothered because they are getting warm, their mood is affected. Learners struggle to regulate their body temperatures, so this makes it even more difficult for them to try and keep their emotions in place and their focus on their work. According to Johnson (2023), in conditions of extreme heat, learners tend to become more irritated and annoyed, leading to heightened impatience with each other. This, in turn, results in an escalation of aggression and conflicts among them. Berger and Jerry (2023) explained that as the temperature increases, extreme heat disrupts learners' sleep and changes their sleeping patterns. When learners do not get sufficient sleep, it aggravates stress and anxiety in learners which creates emotional stress. Learners find it challenging to maintain their body temperature, especially during extreme heat. Consequently, they face difficulties in managing their emotional states, making it hard for them to address problems calmly. This can lead learners into a state of panic and anxiety, negatively impacting their mental health (Berger & Jerry, 2023).

> *"Boys are more aggressive than girls especially warmer days over 34 degrees. But they were also calmer and well behaved on the days when it was between 17 and 24 degrees."*

Examining Mrs. Warm's encounters with heightened aggression among boys on warmer days and considering Johnson's (2023) explanation of how extreme heat can

increase aggression, I posit that the boys' increased aggression towards each other is influenced by the extreme heat associated with climate change. This behaviour negatively impacts the learners' self-worth and their perceptions of their capabilities. Ma et al. (2022) explained that in extreme heat, learner behaviour becomes more irritable and aggressive which opens the door to bullying. Whether the learner is the bully or the victim, this can make learners depressed and has a negative impact on learners' mental health. This results in learners missing school and, in more severe cases, learners may commit suicide. There has been a significant rise in the number of learners engaging in substance abuse as temperatures increase, indicating a noteworthy trend among learners. This has lasting consequences on their lives, with the most extreme outcome being the risk of death (Ma et al., 2022).

In month of May in Graaff-Reinet, the temperatures start decreasing and there are more overcast days (Weather Spark, 2023). The morning temperatures start cooling down, but the days are still warm (Weather Spark, 2023). Mrs Warm explained what she experienced in the autumn in May:

> *"The weather was cool in the mornings and there were a few overcast days, the girls were focused in the mornings but started being restless and talkative on the overcast days. Sickness have started and learners are absent due to illness. Weather is fluctuating from cool, sunny and overcast."*

The weather in autumn changed on a regular basis. Amondo et al. (2023) determined that when the weather fluctuates, it has a direct impact on learners' intellectual performance and behaviour in the class. Mrs Warm explained how the learners reacted to the fluctuating weather in autumn:

> *"Girls start being more talkative on the warmer days especially when there is a cold day the day before. The boys are more aggressive and restless on these days as well and both girls and boys are unfocused on these days especially when there is a hot day over 30 degrees but the day before was 16 degrees Celsius."*

Swaim (2022) explained that when temperature is 21° Celsius or slightly under, learners tend to be calm and their concertation levels are more settled but if the temperature gets too cold, learners will start feeling tired and less focused. Mrs Warm supports this statement with her observation of her learner's behaviour and concentration levels:

*"Weather changed to cooler weather and girls thrived on this and were focused and calm when the weather was between 20 and 23 degrees Celsius."*

Figure 4.10 supports the statement made by Mrs Warm about the learners being focused and calm when the temperature was between 22 and 24° as this graph shows that the learners peak at 20° and they are still focused when it reaches 22°.

In autumn, it starts getting lighter later in the morning as mentioned in Case 2. Eskom has implemented load shedding due to the high demand for electricity. In autumn, the weather varies drastically from extremely hot to extremely cold but on the hot days, people use more electricity by using appliances to cool themselves down and in winter when it is extremely cold, people use appliances to warm themselves up. This cycle increases the demand for electricity which Eskom cannot provide leading to load shedding. These extreme weather conditions would not happen if climate change was not where it is today; therefore, I can conclude that climate change affects temperatures which leads to people using more electricity and the consequence of load shedding. Mrs Warm explained how morning load shedding affected her day with her learners:

*"It is relatively dark in the mornings the closer we get to winter. When there is loadshedding in the mornings, my class is incredibly dark, and I cannot switch the lights on. This changes my routine that I have with the learners as we can only start working later when it starts getting lighter. This disrupts learners and they are incredibly talkative, and it is a mission to get their attention back even when the electricity is back on, and they can see."*

I have discussed how climate change influences the load shedding schedule, and it is evident that learners are adversely affected. Their disruptive behaviour persists, irrespective of the day's weather pattern, impacting their entire day. This delay in starting their work results in a loss of focus, negatively affecting both their academic achievement and comprehension of the lesson being taught.

Swaim (2022) explained that when it is rainy and overcast, the days are darker which has told the brain that it is time to rest which results in learners not keeping their focus for long in the classroom as their brains switch off and learners feel more lethargic and passive. Mrs Warm explained what happened to her class when it rained:

*"We had a few a rainy days after each other and the learners were more focused on what the weather was doing outside and less on the work that needs to be done."*

The Centre for Disaster Philanthropy (2022) explained that when we think of climate change, people tend to think only of extreme heat, but extreme cold is also a result of climate change. Burkart and Stanaway (2021) clarified that climate change is creating a dip in the jet stream which creates strong winds above the earth surface and moves over long distances affecting many countries. In short, there is a change in atmospheric circulation which changes the weather patterns resulting in more moisture in the air which in turn creates colder weather. The changes happen in the Arctic and across the Poles, but this has a ripple effect on the weather patterns across the whole world (Burkart & Stanaway, 2021). Therefore, we can see that although climate change is warming the earth's surface up, the result of extremely cold weather is also linked to the effects of climate change (Burkart & Stanaway, 2021). The cold weather impacts learners in a negative way with regard to their behaviour and academic performance. We can now see that extreme cold weather is also climate change therefore we can understand how learners' behaviour and academic performance is being affected at school.

Energy5 (2023) explained that cold weather impacts learners' behaviour in different ways namely:

- When it is extremely cold, there is a decrease in learners' outdoor activity which limits learner movement and decreases the opportunity for active play and for burning off the necessary energy as they would on other days.
- When learners spend more time indoors at school, they become physically inactive.
- Learners can suffer from Seasonal Affective Disorder (SAD) which is when the cold weather affects their mood so negatively that they show symptoms of depression and mood instabilities.
- Learners tend to get sick more often in winter, which impacts their behaviour as they are feeling uncomfortable which makes them more irritable and lethargic.

Mrs Warm observed the following regarding her learner's behaviour in Winter in the month of July:

> *"Girls were more talkative on the colder days and struggled to stay focused for longer periods of time. When the mornings were extremely cold, the boys and girls were restless but if it got warmer after break, they seemed to adjust and were more focused and quieter."*

One can see that cold weather affected learners in many ways. Mrs. Warm's observations about her class align with this, as learners tended to be more talkative, struggled to remain seated due to the cold hindering the release of their energy, exhibited static behaviour affecting their ability to sustain focus, and experienced fluctuating moods. I always thought that learners would be more focused and calmer in winter, but the above findings show that extremely cold weather also affects learners negatively. If the learner's behaviour is negatively affected, their academic performance is also affected negatively because if learners are annoyed, irritated or lethargic, they will not be giving their full attention to their work which decreases their academic performance. Wainwright (2022) explained that various symptoms are indicating a pattern of psychological effects on learners exposed to extreme cold weather, including post-traumatic stress, depression and anxiety. If learners are already suffering from mental health illnesses, cold weather makes the symptoms worse (Wainwright, 2022). Learners can get SAD which happens when it starts getting colder and darker which disappears as it gets warmer, but the learners' emotional state is affected negatively in these months having long-term effects on the learners' mental health (Wainwright, 2022). As mentioned above, extremely cold weather is also an aftermath of climate change which means that there are more cold fronts that arise in winter which negatively affect the learners' behaviour and ability to stay focused.

Mrs Warm explained her concern about poor school attendance over this month as follows:

> *"The number of learners coming to school decreases a lot in winter. Learners do not come to school when it is too cold outside, when it is extremely dark in the mornings when they have to walk to school, learners are sick and school clothes cannot dry in these circumstances. If it is raining, the number of learners drastically drop as learners have to walk to school and this has the opportunity to make learners sick. Learners*

*miss school which means that they are missing out on work and falling more behind academically."*

Jones et al. (2011) reported that the effect of climate change impacts learners who are in rural areas more than others. There are many reasons why these learners do not go to school, but climate change affects these learners greatly. When there is extreme rain or cold, learners' houses get destroyed or damaged resulting in their inability to go to school as they might not have dry or appropriate clothes to go to school in (Jones et al., 2011).

Bega (2023) wrote that the floods that occurred in 2022 in KwaZulu-Natal were one of the most catastrophic natural disasters ever recorded in this area in terms of how many lives were lost and the impact it had on the economy. This natural disaster claimed lives of 459 people and destroyed more than 4 000 homes and left 40 000 people homeless. Bega (2023) reported that not only could many learners not reach their schools due to roads and bridges being washed away but also that learners could not go to school due to the impact that the flood had on their personal lives as they lost family members, their homes and all their personal belongings.

**Figure 4.12: A road that has been destroyed in KwaZulu-Natal due to the floods in 2022**

Source: Str/EPA-EFE/Shutterstock (2022)

Figure 4.12 shows how the flood washed a road away making it impossible for the people who live on the one side to reach the other side. I can perceive the potential impact on learners, as they may be physically unable to reach their intended destination. The emotional consequences of this isolation would likely be negative,

causing learners to feel abandoned and aware that they were missing school. This emotional instability can affect their overall well-being.

**Figure 4.13: A woman standing at her front door of her house after the flood caused flood damage to the surrounding houses**

**Source:** Reuters (2022)

Figure 4.13 illustrates the devastation caused by this severe weather event in a rural community. Homes were swept away, leaving those in standing structures isolated without access to food, adequate shelter, or essential materials for their livelihoods (IFRC, 2022).

**Figure 4.14: A river that overflowed resulting in hundreds of shacks and homes damaged due to the floods in KwaZulu Natal in 2022**

Source: Thwala (2022)

Figure 4.14 shows us how these rural communities were affected. It shows how the overflowing river destroyed homes and made it impossible for people to get to each other and that these learners would struggle to get help. For those affected by this flood, it is apparent that impacted learners would face challenges attending school. Even if they managed to attend, their emotional well-being would likely be negatively affected, given their concerns about home circumstances and the traumatic experiences they have undergone. Consequently, it can be inferred that their mental focus on school and learning would be compromised (IFRC, 2022).

**Figure 4.15: A school in KwaZulu-Natal affected by the flood in 2022**

Source: Dlungwana (2022)

Figures 4.13. 4.14. and 4.15 illustrate how the learners' home circumstances were negatively affected by extreme weather conditions, in this case, flooding. Furthermore, over 630 schools were affected by this extreme weather event and 101 of these schools were not reachable (Dlungwana, 2022). One can see the damaging effect that the schools had because of the flood especially the damage to their infrastructure. Not only would these schools be closed for months to clean up and rebuild, but learners also could not go to school and fell behind in their work. Some teachers passed away, which would have affected learners emotionally and they would need to go for counselling. There were learners who lost family members, homes and all their possessions. These learners experienced a massive traumatic situation, and they would first have to be able to get through the negative emotional strain that comes with this. Education would not be first on the list for many of these families as they would first have to get their lives back on track (IFRC, 2022).

Bega (2023) mentioned that the reason for the extensive flooding that occurred in KwaZulu-Natal has been reported to be due to climate change induced by human activity. He also mentioned that it is highly likely that such events would happen in the near future and not just in this area, but all over South Africa. The images and explanations above depict the significant impact of extreme floods on households, particularly those in rural areas. It is evident that all learners residing in these regions would face obstacles in attending school due to the substantial influence of climate change on their lives. It would likely take several months for these learners to return to school and resume a semblance of normalcy in their lives. There is a direct negative impact that this has on learners in all aspects: their school performance, their emotional state, their physical environment and their mental health.

When there was an increase in rain, there were learners who only had enough money for one uniform. If this uniform does not dry in time for the next day, learners miss school. The diseases linked to climate change increase in these areas and learners are very vulnerable and can easily get sick which means they miss school as well. Many of these reasons are beyond the learners' control because of the environment they live in and how climate change impacts their lives (Jones et al., 2011). The problem is the learners are losing out on a lot of academic time and to catch this up is extremely tricky. They fall more and more behind and, at times, learners drop out of school because they struggle to catch up. All because climate change has created extreme weather conditions which makes it difficult for these learners to function properly and have a successful academic journey so that they can get themselves out of this system.

At the end of winter, Mrs Warm noticed the following about the wind:

> *"The wind was not as bad this month as it has been which showed me that the boys were a lot less aggressive, and they fought less as well. When there was a warmer wind that arose, the boys were restless, but they stayed relatively focused, but the girls were more talkative on these days and lost their focus."*

Jarrett (2023) explained that there is no scientific research that links strong winds to negative behaviour traits for learners; instead learners are less determined and less active on these days which then affects the learner's motivation to stay focused in class and affects their concentration levels which makes the learners more talkative.

The wind has clear physical effects on learners and these effects increase learners' negative behaviour and concentration levels. Jarrett (2023) also explained that climate change is increasing wind speed which means that extreme weather conditions will continue.

Willis (2016) reported that spring should have a positive effect on learners' energy and moods but with climate change that is changing the weather patterns and weather fluctuating so much, the positive effects of the normal spring weather patterns are not felt. The evenings are gradually becoming darker later, and mornings are getting brighter earlier, impacting learners' sleep patterns. This alteration in sleep patterns results in learners feeling drowsy and lethargic, leading to difficulty maintaining concentration for extended periods. Additionally, adapting to this change takes time for learners' bodies, but the frequent changes in weather patterns make this adjustment process more prolonged. Consequently, the extended time for learners to adapt to these seasonal changes contributes to an overall negative outcome in the classroom.

Mrs Warm made the following statement about what she experienced in the season Spring over the month of October:

> *"Spring is such a difficult month for me personally. It feels like I was disciplining all learners the whole time. It was as if they could not get into their routine as the weather pattern was not being stable. There were days when it was hot and then when it was cold. The girls struggled in the beginning but seem to adapt easier. The boys were aggressive, talkative and unfocused most of the month."*

Mrs Warm made the following statement about the extreme weather patterns that occurred at the end of the month of October:

> *"There was also a strange weather pattern that happened this month which I think even took me by surprise and I could feel that I was struggling so I could only imagine how the learners were struggling. We had spring days where the weather was warm gradually getting hotter but then we got a massive cold front at the end of the month where it was snowing in the surrounding areas which affected the learners greatly."*

Evans (2023) reported about the drastic weather changes that occurred over South Africa at the end of October in 2023. He explained that the temperature was following the normal pattern that it normally did in October where it gradually starts increasing,

but the extreme cold front that occurred so late in the month was not part of the normal weather patterns and this happened because climate change is getting worse year by year. Mrs Warm's statement shows that this sudden change in temperature, affected the learners negatively and I believe that any work that was done on those days, had to be retaught which takes time away from other work that should have been taught while trying to catch up. This means that teachers are not able give the full lesson and learner miss the opportunity go through the work slowly and learners' academic performance is impacted negatively.

4.2.3.2. Theme 2*:* Different strategies implemented by teachers during adverse weather conditions

Lala and Hagishima (2023) reported that primary school learners are the most vulnerable to extreme weather conditions which damages their development, wellbeing, learning outcomes and behaviour. Extreme weather conditions result in learners having mood swings, being aggressive, losing concentration in class and speaking more in the classroom (Barkin et al., 2021). When the weather conditions outside are not ideal, learners start acting out in the classroom. Some of these reactions are beyond the learners' control and teachers should try and adapt their teaching strategies to support learners' behaviour on these days. According to Barkin et al. (2021), some strategies when dealing with learners who are speaking in class and being disruptive are:

- Teachers need to keep calm and control their emotions before confronting learners about their behaviour.
- Teachers need to make sure that they are explaining and addressing the behaviour and not picking on the learner personally.
- Teachers need to make sure that they are sticking to their own class rules and the consequences that have been predetermined.

Teachers need to adapt to the learners in these situations and change their teaching strategies. For example, when learners are talking to each other and not focusing on the teacher in front as it is a hot day and their concentration levels are not where they normally are, teachers should change their teaching strategy to group work which allows learners to be more talkative but about the specific topic that is being dealt with.

When the behaviour of learners impedes progress, with constant reprimanding from the teacher and acting out due to the cold weather, the teacher should consider modifying the lesson to incorporate movement-based activities; for example, using bean bags or hopscotch, using their body parts to show different instructions, mirror mirror, sensory dance and reducing written activities (Cchiaro, 2022).

Break time is very important for learners as it enhances their physical activity, boosts concentration, provides a respite from schoolwork, fostering a refreshed attitude toward their tasks. Moreover, it minimises disruptive behaviour in the classroom and contributes to teaching learners how to interact with each other, cultivating essential social skills (Gildharry, 2023). When learners go outside and get a break from the classroom environment, on their return to the classroom, it is as if their brains have been reset and they have new motivation for the work that is going to be taught (Gildharry, 2023). Zarotis (2020) reported about the impact that movement has on learners' motivation and concentration levels and break time is the perfect opportunity for learners to get the benefits of movement without doing formal teaching. If learners cannot go outside for breaks, Zarotis (2020) suggested the following strategies:

- Put music on and let learners dance and move to the music. In this way, learners are moving and having fun.
- Allow learners to draw or colour in while talking to their peers. This is not the time for silence as learners need to get rid of excess energy.
- Make sure that different board games are available for learners.
- Get learners to do different exercises like yoga that can be found online.
- Allow learners to interact with each other and move around in the classroom and do not let learners sit at their desks the whole time.

My personal point of view is that break times are very important in the development process of the learner and when the weather is extremely cold, extremely hot or there are severe winds resulting in learners not being able to go outside, teachers need to allow learners to take a break from the formal classroom setup even though they cannot go outside. Teachers need to change the classroom environment for that

specific time so that learners can escape from the formal classroom environment and give their minds time to reset for the next lesson.

Ali et al. (2022) explained that teachers experience many different situations daily. Every learner is unique, presenting a challenge for teachers. However, these learners can also be influenced by extreme weather conditions, and teachers must be mindful of this. It is crucial for teachers to think innovatively and consider alternative approaches when addressing such situations. Johnson (2005) defined teaching out-of-the-box as when teachers are creative and use their imagination to approach a lesson or situation. When considering instances where learners are more preoccupied with external factors during rain or become frustrated and act out in extreme heat, teachers should contemplate how to collaborate with the situation. Instead of engaging in conflicts or arguments with learners on such days, it is more constructive to work together to address the challenges. Ali et al. (2022) explained that teachers need to find a way to get through to learners when they are not keeping their focus, but teachers need to make sure that they still stick to the rules of the class and keep the goal of the lesson in mind. When learners show different negative characteristics due to extreme weather conditions, teachers need to make sure that they slow things down and adapt to where the learners are on that specific day. Teachers must be ready to adjust their lesson plans in real-time. Alternatively, if they have access to weather forecasts and information on how their class may react on a particular day, they should proactively plan their lessons accordingly (Ali et al., 2022). Bell (2023) provided some examples:

- Facilitating collaborative group work, wherein one learner assumes the writing role, enables students to leverage their individual strengths to complete assignments.
- Encouraging active learner participation.
- Using songs and videos as supplementary materials to enhance learner engagement.
- Incorporating movement-based teaching methods to convey concepts to learners.

- Implementing a decelerated teaching approach when learners feel overwhelmed and experience concentration lapses, ensuring they have ample time to grasp the subject matter.

- Employing varied lesson styles consistently to sustain learners' focus and interest.

When the weather conditions interfere with the normal routine in the classroom and hinders the learning process, the teachers need to make sure that they keep all their learners actively involved in lessons, discussions, activities and break times. This is the ideal but when the extreme weather conditions are affecting the learners' behaviour and academic performance, teachers need to be more observant of how the learners are reacting and feeling as this is something that the learners do not have control over, so the teacher needs to compensate for this challenge. Mrs Warm stated how she felt about the learners' reactions to extreme weather conditions as follows:

> *"The more I started looking out for different relationships between the weather and the learner's behaviour and academic performance it made me more mindful on how to treat the learners on these hot days because I noticed that it might be something out of their control. I want to see how I can help the learners in any way possible and start understanding the learners better."*

4.2.3.3 Theme 3: Challenges faced by teachers

Wangdi and Namgyel (2022) described disruptive behaviour that hinders teachers teaching process and the learners' learning process and creates a negative classroom environment for everyone in the classroom. They defined disruptive behaviour as inappropriate behaviour that has a negative impact on the teacher's ability to teach the work and learners' learning process. Barkin et al. (2021) explained that hot temperatures affect learners in many different ways, namely:

- There is a decrease in energy and motivation levels to listen and stay focused in the classroom.

- Learners are more irritable and restless which makes learners prone to having tantrums, becoming more frustrated and having negative mood swings.

- Hot nights disrupt the sleep patterns of learners, causing them to wake up more frequently due to excessive heat. Consequently, learners experience fatigue, resulting in a reduced tolerance for stress and heightened irritability during the day.
- Learners are also dehydrated as they lose a lot of fluid on hot days. When learners are dehydrated, their cognitive abilities, mood fluctuations and their whole wellbeing are affected negatively.

Mrs Warm explained how disruptive behaviour affected her classroom, as follows:

> *"My number one challenge is the learners' disruptive behaviour in class and during break times. You are constantly playing policeman, well policewoman if you may and this just takes time away from teaching and everyone falls more and more behind. Like not only the learners but I get far behind in my admin work and get through what is needed from me from the department."*

It is evident that hot temperatures have a direct link to learners misbehaving in the classroom and not staying focused. This rise in temperature is because of climate change so I can conclude that the learners would not be as disruptive in the classroom if the temperatures remained stable. The learners' behavior is directly influenced by the weather, thereby impeding the teacher's ability to cover the curriculum. The learners' academic performance suffers because the need to rush through the curriculum limits their educational experience.

Energy5 (2023) explained that the cold weather also impacts learners' behaviour and motivation to keep their concentration on their work in class. When it is cold, learners tend to react in the following ways:

- Learners are less actively involved in discussions and their movement decreases which means they do not get rid of excess energy which makes them restless and talkative.
- The learner's moods also fluctuate leading to lethargy and SAD.
- The learner's irritability is also increases, and the learners have more behavioural outbursts.

- The learners' disruptive behaviour impacts their learning performance and concentration levels.

Mrs Warm explained another challenge which is also linked to disruptive behaviour:

> *"Adding to the disruptive behaviour the learners are constantly chatting while working which slows everything down and one does not get through what is required making you feel like you are always playing catch with the curriculum goals and what is expected from you. You know, adding to this, the learners can't get your best attention when doing the specific concept being covered because you are always stopping in the middle of your sentence to get their attention, and this is totally just learners just being naughty and being disruptive and this is something that makes me so tired at the end of the day! The learners get so lost in the system and this is not always because they cannot do the work but because they are just talking and not listening when the work is being done."*

Reading the above statements from Mrs Warm and other researchers, I can conclude that the extreme heat and extreme cold weather has a negative impact on learner behaviour in the classroom and their academic performance. These situations are occurring because of the effects of climate change on the weather patterns. I can see that the learner's disruptive behaviour in class and learners speaking out of turn, is influenced by the extreme weather patterns being hot or cold weather. When learners keep on talking to their peers and shouting out, this creates disruptive behaviour so one can look at these two challenges hand-in-hand. The learners exhibit adverse reactions to the frequent and extreme weather conditions. One could argue that if these conditions were less severe and occurred less frequently, the learners would experience a more positive outcome. This suggests that learners would be able to maintain focus for longer durations, positively influencing their academic performance, in contrast to the current negative impact.

Gupta (2021) stated that people's bodies are not built to handle heat and humidity especially over 35° Celsius and it is even worse for young children as they are more vulnerable to the effects of heat and humidity. He found that extreme heat increases aggression, lowers cognitive ability and finally decreases work productivity. The heightened temperatures caused by climate change seem to contribute to increased irritability among learners, leading to name-calling, conflicts and physical altercations.

Moreover, this negative behaviour also has an adverse effect on their academic performance, as they divert their attention away from their studies to engage in negative interactions with each other. Zhang et al. (2021) explained bullying as a distinct type of aggression characterised by repetitive actions with the intention of causing harm to another individual. There has been a discernible rise in instances of bullying in schools over the past few years, and this trend is manifesting at increasingly younger ages. Mrs Warm explained how bullying is coming into her classroom as follows:

> *"Uhm another thing that has also been creeping in is bullying. This is something that is so concerning to me because learners then are always fighting which means that you have to deal with more things in the class! Children are becoming too ugly to each other, so you are having to work through those emotional situations and trying to help everyone involved and it also gets pushed into the class and these children do not need this extra drama and they are so small. Flip, when I was at school at this age, you were all friends and bullying was only known to me, for the bigger children but now it is just getting worse and worse, and I feel so sorry for these children."*

Adding to this, learners can also be more sensitive to what is being said to them as they are struggling to deal with the extreme weather, and we already know that younger children struggle a great deal to regulate their body temperature which means that the learners over-react in the situation which leads to fighting and arguing with one another. When learners are fighting with each other, it takes time away from their focus in class which means they fall behind, and the teacher has to take time away from her lesson to deal with the situation at hand which means less time is available for teaching (Harvard Health, 2019). Bullying and fighting is occurring more frequently in Mrs Warm's class, and it is taking away teaching time in the classroom and learners are being disadvantaged. One can see that extreme weather made learners more aggressive, annoyed, over-sensitive and argumentative. Thus shows that climate change has a direct impact on these learners' behaviour towards each other resulting in bullying and fighting. Furthermore, this behaviour also has an impact on the learner's schoolwork as they are less focused, and the teacher has to take time out of the lesson to sort the situation out and stop learners from fighting which means that her focus is not on what needs to be taught. The main contributor to all the above circumstances is climate change.

Chersich and Rees (2019) mentioned that the effect of temperature on learners' academic performance is not just influenced on the specific day, but over the whole year. The more learners there are in a class, the more the temperature in the classroom increases which is something that the learners deal with every day during the summer months. Chersich and Rees (2019) reported in a study involving 18 different schools that learners were in overcrowded classrooms where the temperature was over 30° Celsius every day. These learners test score results were 20% lower than learners who were in a classroom where the temperature was 20° Celsius, and these classrooms were also not overcrowded.

> *"You just lose so many learners the bigger your class is, and it is not right on these learners or the teacher, well this is what I feel. Learner's focus is not on what is being taught and there is a constant buzz around the classroom. Learners are constantly walking around and restless."*

The exposure to heat in overcrowded classrooms also affects teachers, making them more lethargic and irritable. Consequently, they may not deliver their best in teaching a specific concept, leading to learners missing out on a comprehensive lesson. This, in turn, impacts their academic achievement, as the extreme heat affects the teacher's capacity to provide effective instruction (Chersich & Rees, 2019). Teachers are also affected mentally by the heat in the classroom due to overcrowding, poor ventilation in the classroom and having to stay focused.

UNESCO (2020) used the term "climate displaced persons" to refer to families who have to move to another location due to the impact of climate change. This can be a gradual environmental change like the sea levels slowly rising which, over time, results in people having to move their homes and change schools. This is normally something that the families can prepare for and do research on where they need to go (UNESCO, 2020). Fast onset displacement can occur due to sudden events such as floods or fires, compelling families to relocate immediately to a new community. This swift and unexpected upheaval necessitates starting over, finding new schools for their children, and often presents families with challenges, including potential unemployment (UNESCO, 2020). The main relationship between climate displacement and education is that learners need to be placed in new schools that are close to where these families have had to move. Sometimes these schools are already full, but they have to accept

these learners as they cannot deny children an education. This means that classrooms are getting fuller and fuller resulting in overcrowding.

Mrs Warms explained how teachers struggle with overcrowded classrooms, as follows:

> *"Learners just got lost in the system because it was impossible to give you attention and focus on every learner every single day and help those learners who are really struggling and needs some extra attention. Let's even look at the learners who are a little stronger, they also get left behind because you struggle to get through to them and give them work to challenge them, so you actually end up doing little bit this side and little that side which is for me doing a half job."*

It shows that when the classrooms are overcrowded; the temperature increases; there is poor ventilation; there is a drop in concentration; learners and teachers are lethargic; there is a drop in school attendance due to heat illnesses; and learners are more irritable and more talkative (Chersich & Rees, 2019). An overcrowded classroom comes with its own challenges, but adding extreme heat to this scenario makes the situation and results much worse for both the teachers and the learners. The learners' behaviour becomes more irritable, they are more talkative and they cannot concentrate for long periods of time which has a negative effect on their academic performance. Teachers also find it difficult to keep focused on the work that needs to be taught and having to deal with learners being disruptive and talkative. No one wins in this situation and every scenario has negative affects due to the rising in temperatures because of climate change.

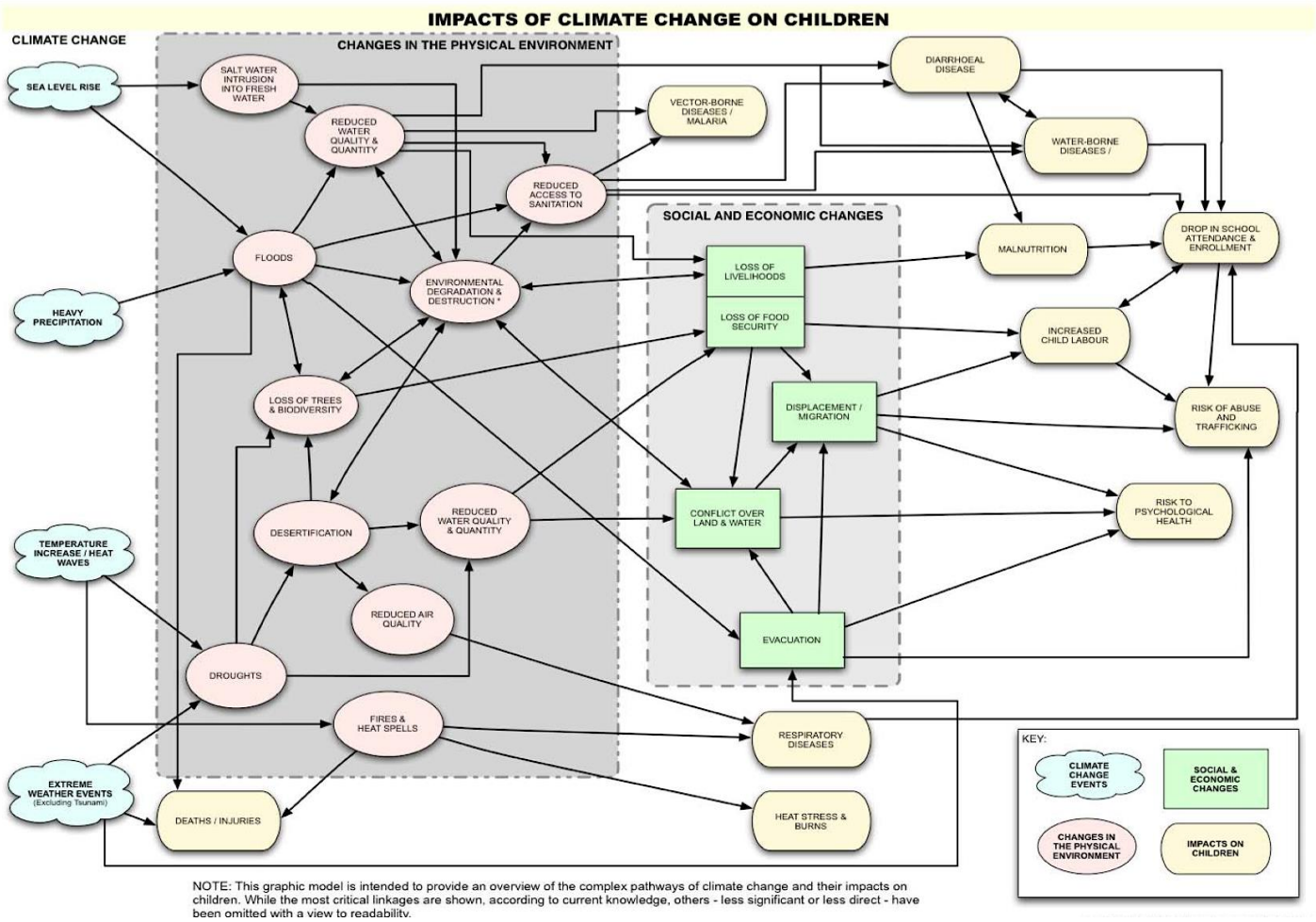



**Figure 4.16: Primary impact that climate change has on children**

Source: Jones et al. (2011)

Figure 4.16 depicts the different climate change events that occur; how these events change the physical environment and social and economic changes; and how they affect children.

The impact of overcrowded classrooms extends to learners' school attendance. Inadequate ventilation, elevated temperatures, close proximity among learners and the potential spread of germs in such an environment can result in heat-related illnesses, the transmission of sickness, and learner absenteeism due to demotivation caused by unfavourable learning conditions. This means that learners miss out on work that is being taught and fall behind. Mrs Warm explained what she experienced regarding learner absenteeism as follows:

> *"I cannot remember when last I had a full class. The learners are missing school for various reasons like they do not have clean clothes when there is no water to wash, some learners only have one set of clothes, so they miss every second day to wash them. The support from home is not always present, so learners do not come to school because parents are not involved and when it is dark, there is no one to wake them up for school. Learners miss school when it is dark because they do not want to walk to school in the dark and when the weather is extremely hot for a few days or cold, learners tend to miss a day of school in this time as well. It is such a struggle especially when we are busy with assessments because learners miss writing assessments and miss the work that is included in the assessment."*

Hussaini (2023) explained that the changes in temperature, heat stress, heat-related illnesses, increase in diseases, floods, fires, droughts and environmental degradation are all impacts of climate change. All these events lead to learners missing school which makes it harder for learners to keep up with their peers and impact the learner's academic performance in a negative manner. He mentioned that these factors affect families from a low-income households such as those in Mrs Warm's learners.

Figure 4.16 illustrates the various consequences of climate change on learners. By examining these impacts collectively, it becomes apparent how they adversely influence learners, with the majority of these factors contributing to dropout rates and attendance issues in schools. The actual climate change event (for example, sea levels rising, heavy

precipitation, temperature increasing, extreme weather events) all impact the physical environment, causing floods, reduction in water quality and quantity, droughts, heat spells, reduction in air quality and reduction of accessibility to sanitation. Furthermore, these events impact the social and economic changes where there is a loss of livelihood, loss of food, migration and evacuation. Finally, the learners are impacted by diseases and heat-related illnesses, and school dropout levels increase.

#### 4.3.3.4 Summary of findings

##### *4.3.3.4.1 Theme 1: Positive and negative impact that climate change has on the learner's behaviour and academic performance*

Mrs Warm explained that her learners came from a low- to no-income community and many of these learners came from struggling home circumstances and the impact of climate change is worse for the learners that come from these communities. In summer, when there was extreme heat, the learners struggled to stay focused for long periods of time and would be talkative as well. The boys would be extremely aggressive and very sleepy. Extreme heat has a negative impact on the learner's behaviour, and it makes them hot and bothered which results in the learners being more irritable and less focused. There was a time when there was no water for a few days and the learners struggled as they were dehydrated and could not stay focused. In In addition, there were also many learners who were absent from school which meant that these learners missed work and start falling behind.

When it is very humid, learners struggle to internally cool themselves down which results in learners working more slowly and speaking more in class. Humid weather is not the normal summer weather that occurs in Graaff-Reinet, but climate change impacts resulted in this weather pattern which affects the learners negatively. When weather fluctuates from very hot to very cold or vice versa learners are extremely restless and cannot finish their work. This weather fluctuation is a direct result of climate change. As the weather started cooling down in autumn, the girls were more focused and calmer, but the weather fluctuations impacted the learners' very negatively during this month (May) and they all struggled to stay focused on their work throughout the day. As the season

continued, the temperature decreased and when it reached 22° Celsius, learners were very focused and calm. Mrs Warm also struggled with load shedding and the darker mornings which made learners disruptive for that day as it was out of their routine. When there were a few cold and rainy days, learners were more focused on what was going on outside and not in the classroom. Extreme cold weather is an after-effect of climate change and the girls were more talkative and the boys were more restless when it was cold. The learners' school attendance in winter was very poor for various reasons but they missed school which meant that they fell behind academically and struggled to catch up. Even though there is no scientific research available to support what Mrs Warm experienced with regard windy weather, the learners were aggressive and irritable. The way that the wind affected the learner's moods resulted in them not staying focused for long periods of time. During the month of October in spring, learners faced significant challenges due to erratic weather patterns, attributed to climate change. The constant changes in weather made it difficult for learners, particularly the boys, to adapt. This resulted in a lack of focus, restlessness and increased aggression. Consequently, the teacher encountered difficulties in covering all the necessary content, leading to the need to rush through the material.

*4.3.3.4.2 Theme 2: Different strategies implemented by teachers during adverse weather conditions*

Learners are the most vulnerable to adverse and extreme weather conditions and teachers need to adapt their lesson plans accordingly, otherwise learning will be slow and at times will have to be repeated which takes more time away from teaching and learning. When learners exhibit negative behaviours in response to extreme weather conditions, teachers should maintain their emotional composure, address the undesirable conduct without becoming personally involved with the learners, and consistently enforce class rules and consequences. Break time is very important for learners' brain development and the more learners move, the better it is for their cognitive development. There are times when learners cannot go outside due to adverse weather conditions and the teacher needs to apply different strategies to get the benefits that break times give learners even though they do not go outside. Some of these strategies found in this study are to play

music and have a dance party, drawing and colouring in pictures, playing board games, doing exercises in class. Learners should move around in the class and not sit at their desks the whole time. This study also found that teachers need to start thinking creatively when adverse weather starts impacting the learners' behaviour and learning process. The teacher needs to be prepared by looking at what the weather predictions are for the week and with the knowledge of how that specific weather pattern impacts the learners change and adapt the lesson plan to get the most out of the learner. Teachers need to realise that sometimes the way that these learners are reacting regarding their behaviour and academic performance, is not always within their control and teachers need to try and guide these learners in different ways to still have a successful outcome.

*4.3.3.4.3 Theme 3: Challenges faced by teachers*

Mrs Warm struggled with disruptive behaviour in her classroom especially when there was extreme heat brought by climate change. This extreme heat affects the learners' behaviour negatively as they are more irritated and less focused, and the boys are more aggressive and want to fight with each other on a regular basis. When the extreme cold weather occurs, learners are more talkative and they do not focus on their work. The teacher has to reprimand them more which results in academic time being missed out on and learners falling behind. Learners struggle to deal with the extreme heat which makes them more irritable resulting in aggressive and bullying behaviour. The impacts of the heatwave are not only immediate but have also intensified over the years, resulting in an overall negative effect on learners' academic performance. This study found that teachers are also impacted by the heat as they also get hot and bothered and get irritated and demotivated to give their all without even noticing this which means that the learners do not get the full lesson experience.

Mrs Warm also struggled with overcrowded classrooms. When it is very hot, the temperature in these classrooms increases to a stifling temperature which has a negative impact on the behaviour and academic performance of the learners. Mrs. Warm faced significant challenges with students exhibiting poor school attendance, primarily influenced by climate change factors such as increased rainfall and extreme heat. This situation arises because not all learners have adequate clothing, water shortages occur

due to drought, and learners miss school when heavy rain affects their homes, or their clothes are not dry. When these learners are absent from school, they miss substantial coursework, making it challenging to fully make up for the missed content with each individual learner. Consequently, these learners may struggle to grasp the concepts, as the teacher must proceed with the curriculum. This often leads to learners falling further behind, and in some cases, dropping out because they cannot keep up with the class.

#### 4.3.3.5 Case 3: Concluding remarks

After analysing what Mrs Warm experienced every month of the four seasons, it is clear that climate change has a negative impact on the learners' behaviour and academic performance in many ways and the learners cannot control these behavioural changes or loss of concentration. Teachers need to try and change and adapt their teaching lessons when these extreme weather conditions occur to make the learners' academic journey successful. Teachers need to start thinking creatively to keep these learners involved and focused on their work even when the extreme weather conditions are affecting them. Teachers experience many challenges that are directly or indirectly affected by climate change, all resulting in negative outcomes for the learner's academic achievement and success. Learners' school performance is decreasing at an alarming rate as a result of the different effects that climate change brings to learners' lives.

This study settles the debate if there is an effect between climate change and learners' behaviour and academic performance. It shows that there is an effect, and it is a negative one. Learners are more talkative, restless, talkative, aggressive and unfocused and they lose their concentration when these extreme weather events occur, and this has a negative impact on the learners' lives and on their academic success. Thus, this study found that extreme heat increases aggression, lowers cognitive ability and ultimately impacts academic progress.

# CHAPTER 5: SUMMARY, RECOMMENDATIONS AND CONCLUSION

## 5.1 INTRODUCTION

This chapter summarises the researcher's findings on input from the three Grade 3 teachers who participated in the face-to-face interview process and their personal observations in their schools in Graaff-Reinet. Several recommendations are noted, conclusions are drawn which are based on the findings that have been collected in the prior chapters.

## 5.2 STUDY OVERVIEW

Chapter 1 explained the purpose of the study, namely, to investigate the effect that climate change variations have on Foundation Phase learners' behaviour and academic performance at schools in the Eastern Cape town of Graaff-Reinet. The aims and objectives, research questions and sub-questions were all set out. Information was collected by the teachers from selected schools in Graaff-Reinet for each of the following months (February, May, July and October) according to seasons (Summer, Autumn, Winter and Spring). This information that was collected helped the researcher to achieve the objectives and aims of the study.

The literature on how climate change affects learners' behaviour and their academic performance was reviewed in Chapter 2. This chapter explained the South African education system, defined climate change, highlighted the psychological effects of climate change in education and explained the effects that climate change has on people's mental health. Adding to these topics, the weather and human behaviour studies, climate change adaptations and mitigation and the effects on education, the ideal temperature for learning, and biometeorology were discussed. The theoretical framework was a combination of the TPB and SCT.

This chapter concluded that climate change was a global crisis and affected everyone across the world in many ways. There have been extreme cases where people have lost their lives due to the extreme weather events. The literature explained that children and older people were the most vulnerable to the impacts of climate change. Learners cannot

regulate their own body temperature which means that they struggle to adapt to the changes in weather. The temperature is increasing year by year and there have been physical impacts on school infrastructure with many of these schools closing for long periods of time. There is much research on the effects of climate change on adults' psychology, health and lives, but there is minimum research available on how climate change affects learners' behaviour and their academic performance at school.

Chapter 3 explained that qualitative research was used in this study, followed by a discussion of the interpretivist paradigm. The three teachers and three different schools that were used in collecting the data were selected by convenience sampling. The data was collected and analysed by using face-to-face interviews, and an observation checklist which was completed by each teacher. Once the data had been collected, keeping with the ethical considerations required, the researcher used thematic analysis and deductive coding to analyse the data. The researcher interpreted the data that was analysed and used themes to draw the conclusions from the data.

The results that were collected from the teachers were presented and discussed in Chapter 4. The data was presented under different themes that emerged from the data collection process. The outcomes from each teacher were documented and deliberated upon, focusing on the data derived from teachers' observations regarding the behaviour and academic performance of learners in each season. Themes encompassing various strategies that teachers can use during extreme weather events, along with the challenges encountered in the classroom, were thoroughly examined in this study.

## 5.3 SUMMARY OF EACH CASE STUDY FINDINGS PER THEME

### 5.3.1 Theme 1: Positive and Negative Impacts that Climate Change has on Learner's Behaviour and Academic Performance

#### 5.3.1.1 Case 1: Mrs. Ready from Boat Primary School

Mrs. Ready observed in the summer months that the learners were more lethargic and restless especially after break time and the boys' behaviour and academic performance traits were worse than the girls. Figure 4.11 shows as the temperature increases, the

learners performance decreases. She also noticed that the boys would be more aggressive in the extreme heat and would constantly want to fight with each other. The study found that in humid weather, the girls were talkative and would not stop speaking to each other. On these days, the boys were restless, talkative, disinterested in working and their concentration levels were very low. When there was extreme heat and humidity, the learners struggled to stay focused on their work and their behaviour was aggressive, talkative and lethargic. Lala and Hagishima (2023) affirmed Mrs. Ready's observations by elucidating that the information they gathered from 335 primary school teachers focused on the impact of climate change, particularly heat waves, on the health, learning and well-being of primary school learners. They found that the heat hinders the learners' academic performance, and the learners were extremely lethargic and annoyed with each other. She explained that there were many different events (e.g., different sporting and cultural events) that led to a loss of teaching time and she was also absent from school which means that a student teacher would take her class and on these days the learners were uncontrollable, and more schoolwork was missed. In autumn, she felt that the weather suited her learners better than summer. Especially the girl's behaviour and concentration levels were high, but when hot days occurred randomly, the girls were restless and not focused. Overcast days led to a struggle from the beginning of the day where the learners, more specifically the boys, were restless and unfocused. Nuttelman (2022) reported that extreme cold weather was just as detrimental as extreme heat. Mrs Ready's observation was that, in winter, on the extreme cold days, the boys were disruptive and restless, and the girls were talkative and worked slowly. Mrs. Ready thought that on these cold days the learners would have been calm and focused, but her observations proved this not to be true. The study also found that learner attendance decreased in winter as well where learners were sick and would miss a lot of schoolwork. Learners also could not come to school as some only had one set of school clothes and, after washing, the clothes would not dry in time for the next day. When the wind blew, the boys were very aggressive and started fighting with each other, but the girls were incredibly lethargic and did not keep their focus. Spring was a major struggle for the teacher and the learners as the weather was constantly changing and fluctuating which resulted in inconsistent learners' behaviour and concentration levels. Swanson and Witte

(2022) wrote that the optimum temperature for learners to show optimal performance at school was between 23 and 24° Celsius. Mrs Ready's experience was in line with Swanson and Witte's (2022) statement. She noticed that when the temperature was between 22-25° Celsius, learners were well-behaved, calm and focused in the classroom. She felt that the girls adapted to the weather changes and extreme weather events better than the boys and the boys struggled throughout the weather patterns.

5.3.1.2 Case 2: Pencil Primary School – Mrs. Book

According to Mahlokwane (2023), individuals residing in informal and rural settlements, with limited resources, facing poverty, and belonging to low-income families, are particularly susceptible to the impacts of climate change, especially among younger children. Mrs. Book explained that the learners in her classroom came from difficult home circumstances and low to no income households. Mahlokwane's (2023) explanation of those who were the most vulnerable to climate change supports Mrs Book's explanation. As in Case 1, in summer, Mrs. Book observed that the boys were aggressive and fought with each other especially when the temperature increased to 32° Celsius and above. In extreme heat, the learners were lethargic, talkative and struggled to stay focused and struggled with their work from the beginning of the day. She noticed when it was humid, the girls were influenced negatively where they would work extremely slowly and were very talkative as seen in Case 1. Mrs Book's observation reflected Aizenman's (2023) findings that extreme heat made learners more aggressive towards each other which negatively impacted their social behaviour and their ability to concentrate on their schoolwork.

A major struggle occurred when there was no water at the school due to a water shortage crisis. Many learners were absent during this time and the learners who were at school were dehydrated and not focused at all in the classroom. Figure 4.4 illustrates how the drought caused the water shortage and the negative impact the water shortage has on learners at school. As the weather started cooling down in autumn, the girls were focused and calm but as the temperature increased throughout the day, they became restless and unfocused. She explained that in autumn, the weather would fluctuate from extreme heat

to extreme cold and the learners would struggle on these days. The boys would struggle the most with this change and they were restless and not focused at all. Mrs. Book was not at school for a few days due to illness and the teacher who took her class reported that the learners were difficult in terms of their behaviour and concentration – the weather was overcast and hot on these days. Mrs. Book commented that when it was overcast and windy, the girls struggled with their work ethic and kept on talking where the boys were calm and focused in the morning, but after break they were more restless and could not stay focused for long. During autumn, the mornings began to get light later, coinciding with an increase in the load shedding schedule. When load shedding occurred in the mornings, Mrs. Ready could not start writing the work on the board as she normally would, given the darkness in the classroom. Consequently, her learners became restless and disinterested in their work from the start, disrupting their routine and posing challenges throughout the day. Figure 4.7 shows how the daylight hours change in the seasons. In winter, when the weather brought about very low temperatures, the girls were talkative and unfocused. The boys ran around at break times and were calm in the class, but they were still talkative. When the temperature reached to 23° Celsius, all the learners were calm and focused, and she felt that on these days the learners were the best behaved and concentrated the longest. In the rainy weather, Mrs. Book explained that the boys were restless and could not keep their focus in the class. Her learner absenteeism was very high in winter and reasons that she received were that on some mornings, it was too dark for the learners to walk to school, they did not have dry clean clothes and some learners stayed away because they were getting too cold. Mrs. Book observed that when the wind blew, the boys were aggressive, disruptive and would not keep their concentration on their work. Although Mrs Book mentioned how her learners reacted to wind, Jarrett (2022) contradicted her observation by mentioning that there was no scientific explanation that windy weather affects learners' academic achievement. The girls were also impacted negatively, but the boy's behaviour and academic performance was influenced extremely negatively. Spring was the month when she felt the learners struggled the most as, when the temperatures fluctuated, the boys were incredibly aggressive and unfocused, and the girls were restless and talkative.

5.3.1.3 Case 3: Mrs Warm from summer primary school

Mrs Warm stated that her learners came from a rural area where poverty, unemployment and overcrowding was high. She explained that, in summer, she noticed that the girls could start the day calm and focused but after break they were talkative and unfocused as seen in Case 1 and 2. All learners were lethargic, and some would fall asleep which meant that the work that was covered was not learnt properly. Figure 4.10 shows how the temperature increases in February in Graaff-Reinet. Mrs Warm explained that the water shortage crisis in town was affecting learners negatively. The temperatures were extremely hot and the learners who were at school were talkative, lethargic, unfocused and their progress was extremely slow. Janse Van Vuuren (2022) detailed that Graaff-Reinet experienced an extended drought lasting seven years, and the town's water shortage was directly attributed to this drought. The underlying cause of the drought was identified as climate change. Mrs. Warm further described how the water shortage had impacted her learners and their academic progress. Due to the community not having water, learners were absent from school because the water was off for a week so the learners' clothes could not be washed, and the learners could not clean themselves either.

In hot and humid weather conditions, her girls were affected very negatively as they worked slowly and were extremely talkative. The boys were also talkative and could not concentrate for long, but the girls' traits seemed to be worse as the boys. In autumn, the weather changed from extreme heat one day to extreme cold the next which impacted the learners negatively as they were restless, talkative and could not stay focused on their work and these days affected Mrs. Warm negatively as well. She observed that the boys were very aggressive when the weather was extremely hot, but they were calmer when the weather cooled down to 17 to 24° Celsius. In autumn, the weather started cooling down and there were overcast days as well. The girls were more focused in the morning but then they were restless and talkative as the days progressed. When there were days when it was extremely hot one day and then extremely cold the next, the girls were more talkative and restless, and the boys were aggressive and not focused at all. The days when Mrs. Warm noticed that the learners were calm and could concentrate the longest was when it was between 22 and 24° Celsius. When the electricity would get switched off

due to load shedding, she would struggle to start working straight away in the mornings as her classroom was too dark. She noticed that this disrupted her learners as they were more talkative and would not stay focused for the whole day as it was out of their routine. When it rained, the learners seemed to be more focused on the weather outside and less on what was happening in the classroom. In winter, when it was extremely cold, the girls were more talkative and could not stay focused for long periods of time and when it was extremely cold in the mornings, the girls were restless but as it got warmer, they adjusted and were more focused. Wong (2023) wrote that when it was rainy, learners could not move around and take part in their normal school activities which made them feel anxious and demotivated them from staying focused to learn in the class. Adding to this, he mentioned that it changed learners' moods to be negative, disruptive and depressed. During winter, Mrs. Warm noticed the most significant decline in her learners' attendance. This was attributed to factors such as extreme cold, which sometimes made it too dark for learners to walk to school, illnesses, and delays in drying their school clothes for the next day. She highlighted that learners increasingly missed school, resulting in setbacks to their academic progress. Figure 4.8 shows how climate change impacts education which all results in learners dropping out of school or poor school attendance which impacts their academic performance negatively. Mrs. Warm observed that when the wind started blowing, the boys' aggression increased and the girls were more talkative and could not stay focused for long. Spring was a very difficult month for Mrs. Warm as she felt that she was disciplining her learners constantly and she felt that this was because the weather was fluctuating, and learners struggled to adapt to these conditions. Cimons (2023) supported Mrs Warm observation by stating that learners struggled to regulate their body temperature when fluctuating weather occurred. She also mentioned that she struggled this month with the fluctuating weather patterns. She noticed that the girls seemed to adapt more easily as the month went on, but the boys were aggressive, talkative and could not stay focused.

#### 5.3.1.4 Similarities and differences amongst the cases

There are some similarities between the three teachers' observations. They all observed the following

- In the summer months all the learners were lethargic and struggled to stay focused when there was extreme heat.
- All the boys were aggressive and wanted to fight with each other when there was extreme heat.
- When the weather was humid, all the girls were influenced negatively by being talkative and not being focused on their work in the class. The humid weather affected the girls more than it affected the boys.
- When the weather fluctuated as much as it did in autumn, the learners were talkative, restless and their concentration levels were low.
- As it started getting light later and the load shedding schedule increased it affected their teaching time negatively as they could not write on the board before a specific time as it was too dark for the learners to see. The learners were disruptive and struggled to stay concentrated for the whole day when this happened.
- In winter the learners would have been calm and focused, but they were all proven wrong as the learners were disruptive, talkative and would not focus for long periods of time in the classroom.
- Learners' attendance decreased in winter.

Mrs. Book and Mrs. Warm were affected by the water shortage crisis as school closed earlier at times, learner attendance decreased and the learners who were at school struggled with dehydration and could not stay focused.

While there few differences among the three teachers, Mrs. Ready pointed out the impact of various sports events and workshops on her learners' learning process. Learners tended to skip school if they weren't participating, and it took time for them to return. Additionally, on the days Mrs. Ready was absent for workshops, the weather was often hot and humid, resulting in learners not receiving completing lessons as expected. She was also the only teacher that mentioned that in autumn, her girls were calm on the cooler days. Mrs. Ready mentioned that the water shortage crisis did not have a massive impact

on the class as in the other schools but some of her learners did not attend school because they did not have clean clothes because there was no water at home to wash them. Mrs. Book was the only teacher that mentioned when it was overcast, her boys were calm and focused in the morning but her observation matched the other teachers after break. Although Mrs. Ready's learners' school attendance decreased in winter, the reasons that she gave were more focused on learners being ill than their home circumstances and the impact that climate change had on their lives.

### 5.3.2 Theme 2: Different Strategies Implemented by Teachers during Adverse Weather Conditions

#### 5.3.2.1 Case 1: Mrs. Ready from Boat Primary School

Kroeker (2022) wrote that learners benefit physically, socially and cognitively from going outside for their break time and it helps their academic performance. Mrs. Ready explained the challenges that occurred when learners could not go out for break times and how difficult it was to keep the learner's attention focused on schoolwork. When there were bad winds, heavy rain, extreme heat, bitter cold and extreme humidity learners cannot always go out for break times to release their energy and get the benefits of going outside for break times. The teacher needs to have different strategies available for the learners to get a brain break from the formal teaching. Mrs. Ready explained that a teacher needs to make sure that all learners feel included no matter their religion, home circumstances or the level that they are on academically. Chakraborty (2023) explained that teachers needed to make sure that learners felt supported, communicated appropriately with parents and learners and the teacher must get to know their learners on a personal level and be able to relate to what they were going through. She explained that break times were not only for the learners but also for the teachers to get a chance to speak to other teachers and they also need to get a brain break from teaching.

#### 5.3.2.2 Case 2: Pencil Primary School – Mrs. Book

Youngman (2023) mentioned how important brain breaks were for learners and how important it was for learners to get a break which is something that Mrs. Book realised after keeping her learners inside as punishment. Mrs. Book explained that she would keep

learners in her class for break times as punishment when they would not listen, but after a while she realised that keeping them inside would negatively affect their behaviour and academic performance for the rest of the day. She explained that when there were adverse weather conditions and the learners were not able to go out for break time, she had to do different activities in the classroom allowing learners to have a break from formal teaching activities. On the hot days, teaching was a struggle and Mrs Book found herself repeating herself. She noticed that the learners did not show a great understanding on what was being taught and they were disruptive. Teachers need to adapt and change their teaching styles on the days when the weather is affecting the learners negatively to make sure that they do not have to do double work. Mrs Book explained that in winter when there was extreme cold, it felt as if her learners was on a go-slow and were more talkative and she realised that she had to arrange different brain breaks in the classroom and get the learners moving around to get them more focused. When it rained, her learners were looking outside the classroom and were incredibly noisy on these days. When this happens, the teacher needs to change the lesson so that learners are actively involved and not allow learners to daydream. Brookman-Byrne (2023) explained that teachers must find ways to allow learners to refocus and give their minds a break if learners cannot go outside. Teachers should enhance their understanding of how learners respond to extreme weather conditions and adjust their teaching strategies accordingly. Recognising that negative behaviour and loss of concentration are sometimes beyond the learners' control, teachers should explore diverse approaches to modify the classroom environment, ensuring academic benefits for everyone.

#### 5.3.2.3 Case 3: Mrs. Warm from Summer Primary School

Lala and Hagishima (2023) explained how primary school learners are the most affected by extreme weather conditions. I have noticed that extreme weather affects learners in various ways and teachers need to gain more knowledge about this topic and change their teaching strategies accordingly and they need to use innovative strategies to support these learners when they reacted negatively to these conditions. Gildharry (2023) mentioned how important the teachers' reactions to challenging situations are. Teachers need to make sure that they keep their emotions under control when dealing with learners'

behaviour/ They also need to address the behaviour and not the learner personally. The teacher needs to stick to their own rules and follow through on their consequences so that learners know where they stand and what will happen if they misbehave (Ali et al. 2022). Teachers can increase learners' movement and physical activity to improve their concentration and give the learners brain breaks needed to give learners a chance to refresh their brains. Bell (2023) mentioned different strategies that teachers can use if learners cannot go outside for break time which has many advantages. Teachers need to have different board games, play music to get them moving, let learners draw and allow learners to interact with each other and let them know that they are having a break. Teachers need to change and adapt to the situations that occur in their classrooms as the learners struggle to adapt to the impact of climate change on their behaviour and academic performance. The teacher needs to take the responsibility to make is easier for learners to keep their concentration and their emotions in check (Ali et al., 2022). Mrs. Warm expressed the need to shift her mindset when learners exhibited disruptive behavior and lack of focus, recognising that it was beyond their control. She felt the importance of identifying ways to support learners in achieving success even when adverse weather conditions negatively affected them.

5.3.2.4 Similarities and differences amongst cases

All teachers mentioned the importance of break time for the learners and for them. They mentioned that there were different activities that needed to be in place for the learners when they could not go outside. All teachers acknowledged that they must look at the different characteristics that occur when adverse weather conditions occur and need to try and meet the learners halfway. They mentioned that teachers must gain more knowledge about how climate change affects the learner's behaviour and academic performance and try to be prepared on these days.

Mrs Warm was the only one that mentioned teaching out-of-the-box and how teachers needed to adapt their whole teaching strategy on the days when adverse weather occurred so that learners could get the most out of the lesson that was being taught. Mrs Ready also mentioned how teachers need to make every learner feel included in the lessons and how each learner reacted differently to the situation.

### 5.3.3 Theme 3: Challenges Faced by Teachers in the Classroom

#### 5.3.3.1 Case 1: Mrs Ready from Boat Primary School

Kroeker (2022) clarified that bullying is on the rise among younger learners, and physical fights occur more frequently in this age group compared to older learners. Mrs Ready explained that learners, especially boys, bullied each other and fought with each other a lot more than before. She mentioned that learners were disruptive in class and that she spent more time trying to get learners to calm down and listen to her than teaching. Adding to disruptive behaviour, discipline was another big challenge, and it seemed to be getting worse every year and she needed to take more time away from academic time to deal with these situations. Her biggest challenge was helping every learner in her class especially those who were really struggling and who were far behind. She explained how time was the biggest problem as teachers needed to get through the required work, but must also make sure that the learners understood the topic properly. Adding to this, she mentioned that it took so much time out of the lesson to get learners settled, calm and ready to learn that she sometimes felt that nothing was working and the learners were not absorbing anything. Hussaini (2023) mentioned that learners were more disruptive in extreme weather conditions which had a negative effect on their behaviour in the classroom and their academic performance. Mrs Ready explained that when the class size started increasing, it was very difficult for the teacher to get to all the learners focused at the same time and to give them individual attention. She also detailed the challenges posed by mandatory workshops, highlighting that when another teacher covered the work at a slower pace, learners exhibited increased disruption and lack of focus on those days. Consequently, the teacher had to reteach the planned material, further contributing to time constraints. She also described the challenges posed by load shedding, particularly as the seasons changed, resulting in later daylight in the morning. The increased load shedding schedule, especially when this happened in the morning, hindered visibility of the board for learners, causing delays in teaching time. This disruption at the beginning of the day contributed to overall challenges in learners' behaviour and academic performance. She mentioned that the town had a water shortage, but the effects of the water crisis had not directly affected her school. However, there were learners who did

not come to school as in their area they did not have water for a couple of days, so they did not have clean clothes, or they had not been able to wash themselves appropriately. Kearney et al. (2022) explained that when the temperature is below 15° Celsius, learners stayed away more frequently from school which meant that these learners missed out on schoolwork and fell behind. Learners were absent from school on a regular basis and there was not always enough time to reteach the work that had been taught while they were away. She also mentioned that there were school events that result in a loss of teaching time. Furthermore, learners did not come to school regularly in winter. Figure 4.3 illustrates a child's vulnerability to climate change and how it impacts their lives. Educational trends represented in Figure 4.3 showed that the attendance of learners was decreasing.

5.3.3.2 Case study 2: Pencil Primary School – Mrs. Book

Herman et al. (2022) reported that disruptive behaviour and discipline had a negative effect on the classroom environment and took away academic time because teachers must deal with situations that arose first. Mrs Book's biggest challenge in her classroom was the learners' discipline where they did not listen to her, and they were constantly shouting out and being disruptive. She found that the boys were the biggest culprits. She has also noticed that bullying and fighting had increased over the last few years especially with the boys. She explained that this was a situation that she must deal with and took away teaching time. She mentioned that learners took a lot of time to finish their work and she could not get to all the learners who were struggling or to the learners who could be given more work as they understood the topic. The time that was available to get the specific work done, was insufficient when having to deal with the different levels in the classroom. Learner absenteeism was a great challenge in Mrs Book class. When it was hot, learners sweated more and only had one uniform and there were times when there was no water so uniforms could not be washed. This is one example of why the learners missed school. Load shedding was also a struggle for Mrs Book as she could not start working straight away meaning that her learners did not finish the work that was required for that day. She also mentioned that when there was extreme heat, there was no way of colling the classroom down. Zali (2023) stated that extreme heat had a major impact on

learners' health, concentration, dehydration and behaviour. The negative effects of extreme heat on learners were compounded when considering the additional impact of a water shortage, as explained by Mrs. Book. The water shortage crisis significantly affected Mrs. Book, especially during a week when there was no water. This led to learners not attending school, experiencing dehydration, lacking motivation to work, and struggling to concentrate for extended periods. Consequently, learners fell further behind academically, placing increased pressure on the teacher to cover the necessary curriculum. Figure 4.12 visually shows that Graaff-Reinet's level of severity of water scarcity is extremely high. Another challenge for Mrs Book was overcrowded classrooms as the learners got lost in the system as the teacher could not get to everyone and learners fell more behind academically. Figure 4.9 shows how the number of learners has increased over the last nine years per teacher. She also mentioned the negative effects on her as a teacher and the guilt feelings when learners did not listen. She said she was constantly telling learners to behave and listen to her.

5.3.3.3 Case 3: Mrs. Warm from Summer Primary School

Mrs Warms main challenge was that learners were disruptive which took away her teaching time and learners fell behind as she needed to deal with poor behaviour constantly. Wangdi and Namgyel (2022) supported Mrs. Warm's experience of disruptive behaviour by reporting that disruptive behaviour hindered learners' academic success and decreased teachers' teaching time. She described how learners consistently engaged in conversation during class when they were supposed to be working and listening. This created challenges for her in completing the required work, and the learners did not receive the teacher's full attention and instruction due to the constant need to address disruptive behaviour. All these factors influenced the learners' learning process negatively as they fell behind. Mrs Warm also noticed that bullying and fighting, especially among the boys was increasing and she needed to constantly get involved and help sort out these situations which took away teaching time. Managing an overcrowded class presents a significant challenge, as learners may become disruptive. The larger the number of learners in the class, the more likely they are to wander around and engage in conversations with each other, diverting their attention from the tasks at hand. Siyoba

(2023) reported that overcrowded classrooms are a pressing issue in South Africa and learners miss out on quality teaching which means that their academic performance is influenced negatively. She explained that all learners were affected negatively as those who were stronger academically missed out on work that challenged them and the learners who struggled did not get the necessary attention to understand the work that was being taught. Hussaini (2023) stated that there were many different reasons why learners' absenteeism increased, namely, heat stress, temperatures increasing, heat-related illness, increase in diseases, extreme cold, fires and damage to infrastructure. Mrs Warm reported that absenteeism was a huge challenge as learners were missing school due to their home circumstances.

I found that every teacher is facing challenges related to disruptive behaviour; maintaining discipline; dealing with learners who work at a slower pace and fail to complete their assignments; addressing the diverse academic levels of students; ensuring full engagement of all learners; managing attendance issues; handling an increase in bullying and fighting among male students; and coping with time constraints to cover all the required curriculum. Two of the teachers mentioned load shedding and the water shortage as a crisis in their interviews, while the other teacher mentioned this in her observation sheet. All teachers spoke about how overcrowded classrooms affected the learners' academic performance and how the learners were more talkative when there were more learners in the classroom.

The teachers' challenges are all linked to one another, even though these teachers are teaching in different schools. Teachers are struggling with the same problems with regard to the learners and getting these learners to the level where they need to be. Time constraints affected their teaching times. The only difference that was reported was that Mrs Ready mentioned that the amount of time that she lost in class time due to external factors from the school and the department was a challenge for her.

## 5.4 ANSWERS TO THE QUESTIONS

### 5.4.1 Research Sub-Question 1: What Patterns in Behaviour and Academic Performance is shown by Learners as a Result of Climate Change?

5.4.1.1 Findings

Each teacher found in their observations that there was a relationship between climate change and behaviour and academic performance in their classrooms. This relationship has a negative impact on the learners' behaviour and their academic performance. The weather patterns changed drastically due to the impact of climate change over the seasons and with each season, the learners displayed different behaviour patterns. In summer, the learners were generally lethargic and could not stay focused which resulted in their academic achievement being affected negatively. The boys were also more aggressive, and they were constantly fighting when there was extreme heat. In autumn, the weather started getting cooler but there were extremely hot days as well and learners struggled to adapt to these changes. They would be restless and talkative and struggle to listen and be focused in the classroom. The learners struggled to adapt to the fluctuation in weather, especially the girls. In winter, the teachers thought the learners would be calm and focused, but it was the opposite. The girls struggled when it was very cold, and they were restless and wrote slowly. When the wind blew, the boys were very aggressive and would fight with each other and, in the class, they were talkative and kept on shouting out. Spring was a difficult season for all the learners and the teachers. The weather went from one extreme to the other and the learners' concentration levels were very low, they were disruptive and restless throughout the season.

The TPB was supported as the learners showed different behaviour traits that the teacher picked up on and the teacher used this information to change the classroom routine which helped change the learners' reaction to what was happening around them from a negative to a positive. learners' behavior and academic performance without the learners being conscious of these changes. Climate change alters weather patterns, impacting learners' behaviour and academic performance, and they require support as they may not be aware of these changes. Teachers, being in direct contact with the learners, can more

easily discern these changes and modify the learning environment accordingly. Additionally, teachers can communicate these observations to parents, enabling them to respond appropriately at home, mirroring the strategies employed by teachers in the school setting. If the parents are aware of the changes that occur when there is adverse weather, they can support the learner when work has to be done at home in order to succeed.

5.4.1.2 Recommendations

Teachers should be aware of the different characteristics that the different extreme weather patterns have on the learners' behaviour and academic performance. They need to expand their knowledge on the different concepts and how the learners react to these specific weather extreme events. Furthermore, the teachers need adapt their teaching styles and lesson plans on these specific days and look up the weather patterns ahead of time and adapt their teaching strategies accordingly to make sure that the learners' learning process is successful.

### 5.4.2 Research Sub-Question 2: Which Teaching Strategies are used by Teachers during Adverse Weather Conditions.

5.4.2.1 Findings

There were positive results when learners could go outside for break time, but when there was adverse weather, this was not always possible, so teachers need to put different plans in place when this weather occurs. Learners' behaviour is impacted differently when there are extreme weather events. Teachers need to make sure that they do not react negatively in such situations to make it worse. Lessons need to be adapted to the situation and to what the learners can achieve on that specific day. Some of these adaptations can be slowing the pace down, brain breaks, learning through movement and keeping learners actively involved in the lesson. Teachers need to start teaching creatively to adapt to what the learners are going through and how they react to the circumstances that climate change has brought about. Both of the theoretical frameworks that were followed in this study focus on change and finding the link between the learners' behaviour and academic performance and climate change.

When looking at TPB, the teacher needs to change their teaching style and plan according to how the learners react to the change in adverse weather conditions. The teachers would have found the link between how the learners react and adapt accordingly which will change the learners' behaviour and academic performance positively. The teachers needs to change their teaching strategies accordingly to the learners' behaviour and academic performance change due to the effects of climate change so that the learners can be successful in their academic journey. The teacher plays a major role in the learners' journey and the changes that the teacher makes directly influences the learners' journey. The teacher needs to inform parents about how to change the learning environment according to how the learners react to the climate change so that learners can be successful.

5.4.2.2 Recommendations

Teachers need to be active learners and they need to research different methods to keep learners engaged when they lose their focus and start misbehaving in class instead of disciplining them all the time. They should also create different intervention plans for their lessons for when these events occur. Teachers need to change their lesson plans according to how the learners are behaving and how their concentration levels are on that day and slow down when needed. It is better to make sure that learners understand what is being covered even if it is less than what needs to be covered rather than going through all the work without the learners understanding. Lastly, teaching is never the same every single day and learners are not the same so teachers need to always be prepared to change and adapt to their surroundings and learners.

### 5.4.3 Research Sub-Question 3: What are the Main Challenges faced by Teachers in the Classroom as a Result of Climate Change?

5.4.3.1 Findings

The teachers mentioned the following challenges that they struggled with:

- Learner discipline.
- Disruptions in the classroom.

- Learners who spoke to each other while the teacher was teaching in front of the classroom.
- The amount of time that was available to teach and that the learners worked at a slow pace.
- Managing the diverse academic levels among learners, ensuring the completion of the required curriculum, and confirming comprehensive understanding of the taught material by all learners.
- Bullying and fighting have increased especially among the boys.
- The water shortage crisis that is happening in the town where, at times, there was no water in specific areas for a week and learners were dehydrated and did not have clean clothes to come to school in, so these learners stayed away.
- When the weather starts changing and it gets darker later in the morning and the load shedding schedule increases, the classrooms are dark in the morning so teachers cannot start doing work when they would normally.
- The increasing classroom overcrowding results in learners becoming more lost in the system, making it challenging for the teacher to reach every student. Moreover, a higher number of learners in the classroom contributes to elevated temperatures, creating discomfort and hindering concentration.
- The learners' school attendance is decreasing for various reasons and many of these reasons are beyond the learners' control. However, they are directly influenced by climate change.

5.4.3.2 Recommendations

Teachers need to try their best to keep learners constantly active in the learning process so that they do not give the learners time to start being disruptive in the classroom. When learners do misbehave and break the rules, teachers need to keep to their classroom rules and consequences. Educators must enhance their comprehension of the reasons

behind learners' reactions, considering whether learners have emotional control in the given circumstances, and adjust the environment accordingly. When students exhibit disruptive behaviour, teachers should adopt a slower pace, clearly communicate that the behaviour is unacceptable, establish expectations for the students, and encourage learners to express any concerns they may have. Schools should adopt a proactive approach to absenteeism, addressing the underlying causes rather than solely reprimanding students. Recognising that reasons for non-attendance may be beyond the students' control, such as environmental factors and the influence of climate change, schools should seek to understand and support learners. In instances of water shortages at school, if students have access to water at home, encouraging them to bring a few bottles and cups to help combat dehydration can contribute to maintaining optimal concentration levels during such periods.

## 5.5 CONTRIBUTION TO THE BODY OF KNOWLEDGE

This study contributed to the existing knowledge in relation to the impact that climate change has on learners' behaviour and academic performance and how it affects learners living conditions. Furthermore, with regard to the challenges that teachers were facing, different strategies to implement during adverse weather events were also addressed. Thus, this study was successful in answering the main research question: How does climate change affect the Foundation Phase learners' behaviour and academic performance?

The researcher noticed that there was a lack of resources available on how climate change specifically affected Foundation Phase learners' behaviour and academic performance. The research that is available is more focused on how climate change is affecting adults' mental health disorders. The information has been collected and different researchers have mentioned that there is a negative connection between the extreme weather events due to climate change and learners' behaviour and academic performance. This research supports and adds information for teachers to improve on their teaching strategies and help learners be successful in their academic journey. This study found that extreme weather conditions increase aggression, lowers cognitive prowess and finally decreases work productivity.

## 5.6 LIMITATIONS

There were some limitations in this study, namely:

- The amount of time taken to gather information was limited to one month every season.
- The research was conducted only in one place and not in different places across the country.
- A mixed-method approach could provide additional information about the topic to strengthen the data that has been collected.
- Only three teachers were asked to gather the information needed.
- Only Grade 3 learners were used in the research and not all the learners in the whole Foundation Phase.

## 5.7 RECOMMENDATIONS FOR FURTHER RESEARCH

This study recommended the following for future research studies which still needs to be conducted to understand the impact of climate change has on Foundation Phase learners' behaviour and academic performance:

- Further research should include Grades 1 and 2 in the Foundation Phase.
- More teachers should be involved in gathering information and more schools in the area should be included.
- The timeframe for the research should be spread over each month of the school year.
- Further research can be done on what teachers can do to be prepared in the classroom for the change in children when the impact of climate change does occur.

## 5.8 CONCLUSION

This study researched how climate change affects the Foundation Phase learners' behaviour and academic performance. More specifically, Grade 3 learners were observed

by their teachers to answer the main research question which was: How does climate change affect the Foundation Phase learners' behaviour and academic performance? The aims and objectives were stated and the data was collected by means of face-to-face interviews and teacher observations over one month in every season. The data was analysed and interpreted which allowed the researcher to organise the findings of the study. Even though the research found a relationship between climate change and learners' behaviour and academic performance, the teachers need to find different strategies to implement to help learners still be successful in the learning process on these days when this happens.

For additional research purposes, teachers need to research additional information about the different weather patterns that have arisen over the past years and they need to be prepared when the extreme weather patterns happen. In addition, teachers need to investigate different strategies and ways to enhance these learners' academic learning process without compromising the curriculum. Also, schools that are affected by the water shortage crisis need find different means to address this to make sure that learners are not missing out on the necessary academic time because there is no water. The learners' attendance is decreasing, teachers and schools need to follow up on these learners and try their best to get them back to school to get back on track with regard to their academic progress.

The recommendations will help schools and, more specifically, the teachers to respond appropriately to the impact of climate change on the learners and try their best to help the learners be successful at school and make these situations easier for everyone. One can understand that learners are not in control of their emotions and behaviour when extreme weather conditions occur but teachers need to keep their emotions under control and not give learners more of a reason to misbehave and not stay focused in the classroom. Knowing why learners react the way they do and what affects learners' concentration levels can help the teacher and the learner to be successful in their learning journey. When teachers have the necessary knowledge on why the learners are reacting the way that they do, they can foresee the situation before it becomes a problem and redirect the behaviour to be productive without unpleasantness and struggle.

## REFERENCES


Aaron, S. B. (2019). Strategies to bring diversity into the classroom. *Hey Teach!* https://www.wgu.edu/heyteach/article/strategies-bring-diversity-classroom2008.html

AccuWeather. (2024). *Graaff-Reinet, Eastern Cape, South Africa Satellite Weather Map | AccuWeather*. https://www.accuweather.com/en/za/graaff-reinet/297554/satellite/297554

AfricaNews. (2023, January 25). Heatwave kills eight in South Africa - Govt. *Africanews.* from https://www.africanews.com/2023/01/25/heatwave-kills-eight-in-south-africa-govt/

Aizenman, N. (2023, August 7). Does heat make us more aggressive? Researchers put it to the test. *NPR*. https://www.npr.org/2023/08/07/1192557911/does-heat-make-us-more-aggressive-researchers-put-it-to-the-test

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Ajzen, I. (2005). *Attitudes, personality and behavior* (2nd ed.). Open University Press.

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology & Health, 26*(9), 1113–1127. https://doi.org/10.1080/08870446.2011.613995

Alberto, I. C., Jiao, Y., & Zhang, X. (2021). Too hot or too cold to study? The effect of temperature on student time allocation. *Economics of Education Review*, *84*, 102152. https://doi.org/10.1016/j.econedurev.2021.102152

Alfredsson, L., Armstrong, B. K., Butterfield, D. A., Chowdhury, R., de Gruijl, F. R., Feelisch, M., Garland, C. F., Hart, P. H., Hoel, D. G., Jacobsen, R., Lindqvist, P. G., Llewellyn, D. J., Tiemeier, H., Weller, R. B., & Young, A. R. (2020). Insufficient sun exposure has become a real public health problem. *International Journal of*

*Environmental Research and Public Health*, *17*(14), 5014. https://doi.org/10.3390/ijerph17145014

Alhamad, H., & Donyai, P. (2021). The validity of the theory of planned behaviour for understanding people's beliefs and intentions toward reusing medicines. *Pharmacy, 9*(1), 58. https://doi.org/10.3390/pharmacy9010058

Alharahsheh, H. H., & Pius, A. (2020). A review of key paradigms: positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences,* 39–43. https://doi.org/10.36348/gajhss.2020.v02i03.001

Ali, A., & Gracey, D. M. (2013). Dealing with student disruptive behavior in the classroom – A case example of the coordination between faculty and assistant dean for academics. *Issues in Informing Science and Information Technology*, *10*, 6–9. https://doi.org/10.28945/1793

Ali, E. A. W., Maher, H. M., & Saad, M. G. (2022). Thinking out of the box: Educational applications. *Journal of Research in Education and Psychology*, *37*(1), 783–790. https://mathj.journals.ekb.eg/

Amondo, E. I., Nshakira-Rukundo, E., & Mirzabaev, A. (2023). The effect of extreme weather events on child nutrition and health. *Food Security*, *15*(3), 571–596. https://doi.org/10.1007/s12571-023-01354-8

Archer, E., Du Toit, J., Engelbrecht, C. J., Hoffman, M., Landman, W. A., Malherbe, J., & Stern, M. (2022). The 2015-19 multi year drought in the Eastern Cape, South Africa: it's evolution and impacts on agriculture. *Journal of Arid Environments*, *196*, 104630. https://doi.org/10.1016/j.jaridenv.2021.104630

Atkinson, D., & Ingle, M. (2009). A multi-causal analysis of local economic development: The example of Graaff-Reinet, Eastern Cape. *A multi-causal analysis of local economic development: The example of Graaff-Reinet, Eastern Cape*. https://www.aridareas.co.za/wp-content/uploads/2015/Papers/Atkinson%20D%20-%20A%20multi-causal%20analysis%20of%20local%20economic%20development.pdf

Baines, E., & Blatchford, P. (2019). Full report - School break and lunch times and young people's social lives: a follow-up national study. *ResearchGate*. https://www.researchgate.net/publication/362944096

Baines, E., & Blatchford, P. (2023). The decline in break times and lunchtimes in primary and secondary schools in England: Results from three national surveys spanning 25 years. *British Educational Research Journal*, *49*(5), 925–946. https://doi.org/10.1002/berj.3874

Baines, E., Blatchford, P., & Golding, K. (2020). Recess, break times, and supervision. *The Encyclopedia of Child and Adolescent Development*, 1–11. https://doi.org/10.1002/9781119171492.wecad268

Balbus, J., Luber, G., Bole, A., Crimmins, A. R., Glass, G. E., Saha, S., Shimamoto, M. M., Trtanj, J. M., & White-Newsome, J. L. (2018). *Chapter 14: Human health. impacts, risks, and adaptation in the United States: The fourth national climate assessment, Volume II.* https://doi.org/10.7930/nca4.2018.ch14

Balingit, A. (2023, May 22). Everything you need to know about head cold. *Medical News Today*. from https://www.medicalnewstoday.com/articles/319573#summary

Ballotpedia. (2011, November 29). Academic performance. *Ballotpedia*. https://ballotpedia.org/Academic_performance

Banerjee, A., & Chaudhury, S. (2010). Statistics without tears: Populations and samples. *Industrial Psychiatry Journal*, *19*(1), 60. https://doi.org/10.4103/0972-6748.77642

Bardocz, P. (2019, May 14). *South Africa - Highly detailed editable political map with labeling.* https://www.istockphoto.com/vector/south-africa-highly-detailed-editable-political-map-with-labeling-gm1148982957-310469319

Barkin, J. L., Buoli, M., Curry, C. L., Esenwein, S. A., Upadhyay, S., Kearney, M. B., & Mach, K. (2021). Effects of extreme weather events on child mood and behavior.

*Developmental Medicine & Child Neurology*, *63*(7), 785–790. https://doi.org/10.1111/dmcn.14856

Basson, G. R., Bosman, E., & Vonkeman, J. (2022). Reservoir sedimentation mitigation measures to deal with a severe drought at Graaff-Reinet, South Africa. *E3S Web of Conferences*, *346*, 03012. https://doi.org/10.1051/e3sconf/202234603012

BBC News. (2022, April 18). KwaZulu-Natal floods: South Africa army sends 10,000 troops. *BBC News.* https://www.bbc.co.uk/news/world-africa-61113807

Bega, S. (2023, April 18). Scientists say the April 2022 floods in KZN are the most catastrophic natural disaster recorded in province. *The Mail & Guardian*. https://mg.co.za/the-green-guardian/2023-04-13-scientists-say-the-april-2022-floods-in-kzn-are-the-most-catastrophic-natural-disaster-recorded-in-province/

Bekkouche, Y. (2023, January 30). *Rainy days and learning outcomes: Evidence from sub-saharan Africa*. https://hal.science/hal-03962882

Bell, D. (2023, September 19). Free thinking: why is it so powerful for students to learn outside the box? *Copenhagen International School*. https://www.copenhageninternational.school/free-thinking-why-is-it-so-powerful-for-students-to-learn-outside-the-box/#:~:text=Learning%20outside%20of%20the%20box,who%20learn%20in%20this%20way.

Berger, M., & Jerry, M. (2023, May 15). Heat health awareness: Why it's important for persons with substance use disorders and mental health conditions, Caregivers and health care providers. *SAMHSA*. https://www.samhsa.gov/blog/heat-health-awareness-why-its-important-persons-substance-use-disorders-mental-health

Berman, R., & Guildford, A. (2022, June 27). Climate change affecting children even before birth. *Medical News Today*. https://www.medicalnewstoday.com/articles/climate-change-affecting-children-even-before-birth

Bidassey-Manilal, S., Wright, C. Y., Kapwata, T., & Shirinde, J. (2020). A study protocol to determine heat-related health impacts among primary schoolchildren in South Africa. *International Journal of Environmental Research and Public Health*, *17*(15), 5531. https://doi.org/10.3390/ijerph17155531

Bingham, A.J., & Witkowsky, P. (2022). Deductive and inductive approaches to qualitative data analysis. In C. Vanover, P. Mihas, & J. Saldaña (Eds.), *Analyzing and interpreting qualitative data: After the interview* (pp. 133-146). SAGE.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, *9*(2), 27–40. https://doi.org/10.3316/qrj0902027

Bozkuş, K. (2020). Examining the problems faced by teachers: The case of Şanlıurfa. *Journal of Theoretical Educational Science*, *13*(3), 505–529. https://doi.org/10.30831/akukeg.623710

Braswell, M. (2018, July 6). *Hot weather lowers students' ability to learn, new study finds*. UCLA Luskin. https://luskin.ucla.edu/hot-weather-lowers-students-ability-to-learn-new-study-finds

Briones, S. K. F., Dagamac, R. J. R., David, J. D., & Landerio, C. A. B. (2022). Factors affecting the students' scholastic performance: A survey study. *Indonesian Journal of Educational Research and Technology*, *2*(2), 97–102. https://doi.org/10.17509/ijert.v2i2.41394

Brookes, E. (2021, July 21). The theory of planned behavior. *Simple Psychology.* https://www.simplypsychology.org/theory-of-planned-behavior.html

Brookman-Byrne, A. (2023, September 15). *The importance of school break times*. *BOLD*. https://bold.expert/the-importance-of-school-break times/

Brown, T. (2022, May). Climate change. *National Geographic Society.* https://education.nationalgeographic.org/resource/climate-change/

Burkart, K., Bräuer, M., Aravkin, A. Y., Godwin, W. W., Hay, S. I., He, J., Iannucci, V. C., Larson, S. L., Lim, S. S., Liu, J., Murray, C. J. L., Zheng, P., Zhou, M., & Stanaway, J. D. (2021). Estimating the cause-specific relative risks of non-optimal temperature on daily mortality: a two-part modelling approach applied to the Global Burden of Disease Study. *The Lancet*, *398*(10301), 685–697. https://doi.org/10.1016/s0140-6736(21)01700-1

Burke, S. E. L., Sanson, A. V., & Van Hoorn, J. (2018). The psychological effects of climate change on children. *Current Psychiatry Reports, 20*(5). https://doi.org/10.1007/s11920-018-0896-9

Burns, N., & Groove, S. (2013). *Understanding nursing research*. W B Saunders Company. https://philpapers.org/rec/BURUNR

Busetto, L., Wick, W., & Gumbinger, C. (2020). How to use and assess qualitative research methods. *Neurological Research and Practice*, *2*(1). https://doi.org/10.1186/s42466-020-00059-z

BusinessTech (2023, November 14). Bleak outlook for load shedding in South Africa. *BusinessTech*. R https://businesstech.co.za/news/energy/731057/bleak-outlook-for-load-shedding-in-south-africa/

Byishimo, B. (2021, January 6). Comfort in the classroom: How weather affects learning. The New Times. https://www.newtimes.co.rw/lifestyle/comfort-classroom-how-weather-affects-learning

Caboz, J. (2019, October 20). Dramatic satellite images show Graaff-Reinet's supply dam drying up – and three other SA dams on the verge of running empty. *News24*. https://www.news24.com/news24/bi-archive/dramatic-satellite-images-show-graaff-reinets-supply-dam-drying-up-and-three-other-sa-dams-on-the-verge-of-running-empty-rhenosterkop-nqweba-middel-letaba-tzaneen-2019-10

Carr, E. M., Zhang, G. D., Ming, J. H. Y., & Siddiqui, Z. (2019). Qualitative research: An overview of emerging approaches for data collection. *Australasian Psychiatry*, *27*(3), 307–309. https://doi.org/10.1177/1039856219828164

Cele, A., & Ramathuba, M. (2020). Guide to extreme heat planning in South Africa for the human health sector. In *National Department of Health*. Department Health Republic of South Africa. https://www.health.gov.za/wp-content/uploads/2022/06/National-Heat-Health-Action-Guidelines.pdf

Center for Disaster Philanthropy. (2022, December 2). *Ice, snow and extreme cold*. https://disasterphilanthropy.org/resources/extreme-cold/#:~:text=Both%20unseasonable%20and%20extreme%20cold,Earth's%20North%20and%20South%20poles.%20%E2%80%A6

Chakraborty, A. (2023, May 10). *Preventing students' disruptive behaviour in the classroom - Teacher Magazine*. Teacher Magazine. https://www.teachermagazine.com/in_en/articles/preventing-students-disruptive-behaviour-in-the-classroom

Chersich, M. F., Scorgie, F., Wright, C. Y., Mullick, S., Mathee, A., Hess, J., Richter, M., & Rees, H. (2019). Climate change and adolescents in South Africa: The role of youth activism and the health sector in safeguarding adolescents' health and education. South African Medical Journal, 109(9), 615. https://doi.org/10.7196/samj.2019.v109i9.14327

Cianconi, P., Betrò, S., & Janiri, L. (2020). The Impact of Climate Change on Mental Health: A Systematic Descriptive review. *Frontiers in Psychiatry*, *11*. https://doi.org/10.3389/fpsyt.2020.00074

Cimons, M. (2023, February 23). Sunny highs to shivering cold: Wild weather swings take a health toll. *Washington Post*. https://www.washingtonpost.com/wellness/2023/02/23/weather-temperature-changes-

illness/#:~:text=Sudden%20weather%20changes%20make%20us,possible%20infection%2C%E2%80%9D%20Pien%20said.

Ciucci, E., Calussi, P., Menesini, E., Mattei, A., Petralli, M., & Orlandini, S. (2010). Weather daily variation in winter and its effect on behavior and affective states in day-care children. *International Journal of Biometeorology*, *55*(3), 327–337. https://doi.org/10.1007/s00484-010-0340-2

Clarke, B., Otto, F., Stuart-Smith, R., & Harrington, L. (2022). Extreme weather impacts of climate change: an attribution perspective. *Environmental Research: Climate*, *1*(1), 012001. https://doi.org/10.1088/2752-5295/ac6e7d

Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of Anxiety Disorders*, *74*, 102263. https://doi.org/10.1016/j.janxdis.2020.102263

Clayton, S., Manning, C., Hill, A. N., & Speiser, M. (2023). *Mental Health and Our Changing Climate Children and Youth Report 2023*. Washington, D.C.: American Psychological Association and ecoAmerica. https://www.apa.org/news/press/releases/2023/10/mental-health-youth-report-2023.pdf

Climate Data. (2023). Graaff-Reinet climate: Weather Graaff-Reinet & temperature by month. *Climate Data.* https://en.climate-data.org/africa/south-africa/eastern-cape/graaff-reinet-9526/

Common Child Behavior Problems and Their Solutions. (2020, October 1). *Verywell Family*. https://www.verywellfamily.com/common-child-behavior-problems-and-their-solutions-1094944

Concern Worldwide. (2022, August 3). Climate change is one of the biggest threats to education — and growing. Concern Worldwide. https://www.concernusa.org/story/education-and-climate-change/

Conversation, T. (2022, April 22). Warnings for floods in SA: Planning for future climate change. The South African.

https://www.thesouthafrican.com/lifestyle/environment/flooding-weather-forecast-systems-kzn-floods/

Courier, C. (2021, July 14). The influence of weather on students' academic performance.- *The Clinton Courier*. https://www.theclintoncourier.net/2021/07/14/the-influence-of-weather-on-students-academic-performance-2/

Creswell, J. W. (2022). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). SAGE.

Crimmins, A., Gamble, J., Easterling, D., Kunkel, K., Saha, S., & Sarofim, M. (2016). Ch. 1: Introduction: Climate change and human health. In *The impacts of climate change on human health in the United States: A scientific assessment.* https://doi.org/10.7930/j0vx0dfw

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A. J., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, *11*(1). https://doi.org/10.1186/1471-2288-11-100

Daisy Solutions. (2023, April 24). *When loadshedding hits SA schools. Daisy Business Solutions*. https://daisysolutions.co.za/the-bullpen/when-loadshedding-hits-sa-schools.html

Davies, D. (2023, June 6). Extreme heat: Tips to keep kids safe when temperatures soar. *HealthyChildren.org.* https://www.healthychildren.org/English/safety-prevention/at-home/Pages/Protecting-Children-from-Extreme-Heat-Information-for-Parents.aspx

Davies, R. (2022, January 19). South Africa – Dozens evacuate floods in KZN. *Floodlist*. https://floodlist.com/africa/south-africa-floods-kzn-north-west-province-january-2022

De La Sablonnière, R. (2017). Toward a psychology of social change: A typology of social change. *Frontiers in Psychology*, *8*. https://doi.org/10.3389/fpsyg.2017.00397

DeCuir-Gunby, J. T., Marshall, P. A., & McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field Methods*, *23*(2), 136–155. https://doi.org/10.1177/1525822x10388468

Department of Education. (1997). *White Paper 5: Early childhood education.* Government Printers.

Department of Education. (2014). *School governing bodies*. Government Printers.

Development Bank of Southern Africa. (2023). The impact of water and sanitation challenges on education. *Development Bank of Southern Africa.* https://www.dbsa.org/article/impact-water-and-sanitation-challenges-education#:~:text=Failing%20to%20offer%20potable%20water,when%20struck%20by%20preventable%20illnesses

Dlungwana, M. (2022, April 20). Pupils help clean flooded school. *Daily Sun.* https://www.snl24.com/dailysun/news/pupils-help-clean-flooded-school-20220420

Donaldson, R., & Marais, L. (2012). Small town geographies in Africa: experiences from South Africa and elsewhere. In *Nova Science Publishers eBooks*. https://aridareas.co.za/wp-content/uploads/2015/03/Small-town-geographies.pdf

Dörnyei, Z., & Muir, C. (2019). Creating a motivating classroom environment. In *Springer international handbooks of education* (pp. 719–736). https://doi.org/10.1007/978-3-030-02899-2_36

Du Toit, J. (2021, October 26). Gift of the Givers - At work in the Karoo. *Karoo Space*. https://karoospace.co.za/gift-of-the-givers/

Dudovskiy, J. (2022). *An ultimate guide to writing a dissertation in business studies: A step-by-step assistance* (6th ed.). Research Methodology. http://research-methodology.net/about-us/ebook/

Dunfey, T. S. (2019, May 29). What is social change and why should we care? *Southern New Hampshire University.* https://www.snhu.edu/about-us/newsroom/social-sciences/what-is-social-change

Eduspot. (1990). *How does weather affect student behaviour and outcomes?* https://eduspot.co.uk/article/weather-affects-student-behaviour/

eNCA. (2023, January 23). Northern Cape heatwave claims at least eight lives. ENCA. https://www.enca.com/news/8-farmworkers-die-nc-heatwave

Energy5. (2023, November 2). The effects of temperature extremes on children behavior. *Energy5*. from https://energy5.com/the-effects-of-temperature-extremes-on-children-behavior

Engel, K. (2022, December 14). Unusual storm in the Cape washed away houses and roads with widespread flooding. *IOL*. https://www.iol.co.za/capeargus/news/unusual-storm-in-the-cape-washed-away-houses-and-roads-with-widespread-flooding-130daf7b-8dcc-4fc8-af91-97a268c594ac

Escobar, F. B., Velasco, C., Motoki, K., Byrne, D. V., & Wang, Q. J. (2021). The temperature of emotions. *PLOS ONE*, *16*(6), e0252408. https://doi.org/10.1371/journal.pone.0252408

Essa, E. L., Hilton, J. M., & Murray, C. I. (1990). *The relationship between weather and preschoolers' behavior.* (pp. 32–36). Children's Environments Quarterly.

Evans, G. W. (2019). Projected behavioral impacts of global climate change. *Annual Review of Psychology*, *70*(1), 449–474. https://doi.org/10.1146/annurev-psych-010418-103023

Evans, J. (2023, October 30). Spring comes unsprung: Weather in SA swings from sweltering hot to bitterly cold. *Daily Maverick*. https://www.dailymaverick.co.za/article/2023-10-30-spring-comes-unsprung-weather-in-sa-swings-from-sweltering-hot-to-bitterly-cold/

Fleming, J., & Zegwaard, K. E.. (2018). Methodologies, methods and ethical considerations for conducting research in work-integrated learning. *International Journal of Work-Integrated Learning*, *19*(3), 205–213. http://files.eric.ed.gov/fulltext/EJ1196755.pdf

Fricker, T. (2021, August 20*). Children in South Africa at high risk of the impacts of the climate crisis* [Press release]. https://www.unicef.org/southafrica/press-releases/children-south-africa-high-risk-impacts-climate-crisis

Gildharry, C.-A. (2023, August 10). The power of breaks in school. *Teaching Channel.* https://www.teachingchannel.com/k12-hub/blog/breaks-school/#:~:text=That%27s%20why%20breaks%20in%20school,progress%20later%20with%20more%20energy.

Girod, M. (2008). Deepening understanding of the teaching and learning context through ethnographic analysis. *The Teacher Educator*, *43*(3), 216–237. https://doi.org/10.1080/08878730802055149

Goshua, A., Gomez, J., Erny, B., Burke, M., Luby, S., Sokolow, S., LaBeaud, A. D., Auerbach, P., Gisondi, M. A., & Nadeau, K. (2020). Addressing climate change and its effects on human health: A call to action for medical schools. *Academic Medicine*, *96*(3), 324–328. https://doi.org/10.1097/acm.0000000000003861

Govender, R., & Hugo, A. (2020). An analysis of the results of literacy assessments conducted in South African primary schools. *South African Journal of Childhood Education*, *10*(1). https://doi.org/10.4102/sajce.v10i1.745

Gupta, S. (2021, August 25). How extreme heat from climate change distorts human behavior. *Science News*. https://www.sciencenews.org/article/extreme-heat-climate-change-human-behavior-aggression-equity

Gutierrez, K., Blanchard, M., & Hoyle, K. (2017). Integrating technology: Weather versus climate. *Science Scope*, *041*(03). https://doi.org/10.2505/4/ss17_041_03_76

Harvard Health. (2019, November 5). *Heat is hard on the heart; simple precautions can ease the strain*. https://www.health.harvard.edu/blog/heat-is-hard-on-the-heart-simple-precautions-can-ease-the-strain-201107223180

Helldén, D., Andersson, C., Nilsson, M., Ebi, K. L., Friberg, P., & Alfvén, T. (2021). Climate change and child health: a scoping review and an expanded conceptual framework. *The Lancet Planetary Health*, *5*(3), e164–e175. https://doi.org/10.1016/s2542-5196(20)30274-6

Herman, K. C., Reinke, W. M., Dong, N., & Bradshaw, C. P. (2022). Can effective classroom behavior management increase student achievement in middle school? Findings from a group randomized trial. *Journal of Educational Psychology*, *114*(1), 144–160. https://doi.org/10.1037/edu0000641

Hetzler, P. (2017, February 24). An ill wind: The health effects of wind. *The Adirondack Almanack*. https://www.adirondackalmanack.com/2017/02/ill-wind-2.html#:~:text=The%20experiment%20concluded%20that%2C%20even,words%2C%20it%20blew%20no%20good.

Hofmeister, E. H. (2021). Nonparticipant student observation of faculty classroom teaching. *Journal of Veterinary Medical Education*, *48*(1), 48–53. https://doi.org/10.3138/jvme.2019-0025

Hough, E., & Counts, N. (2023). How climate change affects our mental health, and what we can do about it. *www.commonwealthfund.org*. https://doi.org/10.26099/rk6r-ne98

Hussaini, M. H. A. (2023). Impact of climate on student education and their future development. *International Journal of Integrative Sciences*, *2*(4), 525–534. https://doi.org/10.55927/ijis.v2i4.3951

Hyndman, B., & Vanos, J. (2023). *Impact of extreme weather on school education:* Protecting School Communities.

IFRC. (2022). *South Africa: KwaZulu-Natal floods - emergency appeal no. MDRZA012 - Operational strategy.* https://reliefweb.int/report/south-africa/south-africa-kwazulu-natal-floods-emergency-appeal-no-mdrza012-operational-strategy

Janse Van Vuuren, C. (2021). More water frustrations. *Graaff-Reinet Advertiser*. https://www.graaffreinetadvertiser.com/News/Article/General/more-water-frustrations-202109150311

Janse Van Vuuren, C. (2022, November 17). Water crisis top priority. *Graaff-Reinet Advertiser*. https://www.graaffreinetadvertiser.com/News/Article/General/water-crisis-top-priority-202211160654

Janse, B. (2023, February 21). What is the theory of planned behavior model: Definition, theory and example. *Toolshero.* https://www.toolshero.com/psychology/theory-of-planned-behavior/

Jarrett, K. (2022). The utility of game-based approaches within the PE curriculum design and implementation process to develop “more knowledgeable others.” *Strategies*, *35*(3), 3–10. https://doi.org/10.1080/08924562.2022.2052774

Jarrett, C. (2023). Why do children go hyperactive when it is windy? *BBC Science Focus Magazine*. https://www.sciencefocus.com/science/why-do-children-go-hyperactive-when-it-is-windy

Javid, H. (2019, August 7). *How does weather affect student behaviour and outcomes?* Eduspot. https://eduspot.co.uk/article/weather-affects-student-behaviour/

Jiang, J., Wang, D., Liu, Y., Yu, X., & Liu, J. (2018). A study on pupils’ learning performance and thermal comfort of primary schools in China. *Building and Environment*, *134*, 102–113. https://doi.org/10.1016/j.buildenv.2018.02.036

Johnson, A. (2023, July 6). Here's why warm weather causes more violent crimes—From mass shootings to aggravated assault. *Forbes*. https://www.forbes.com/sites/ariannajohnson/2023/07/06/heres-why-warm-weather-causes-more-violent-crimes-from-mass-shootings-to-aggravated-assault/

Johnson, L. (2005). *Teaching outside the box: How to grab your students by their brain*. https://www.bookey.app/book/teaching-outside-the-box

Johnston, D. W., Knott, R., Mendolia, S., & Siminski, P. (2021). Upside-down down-under: Cold temperatures reduce learning in Australia. *Economics of Education Review*, *85*, 102172. https://doi.org/10.1016/j.econedurev.2021.102172

Jones, L., Martin, P., Standley, S., Kallman, K., Walker, D. J., Gelders, B., Mpandeli, S., Moremi, T., Laryea-Adjei, G., Viviers, A., Ferenz, M., Constabile, K., & Spalton, A. (2011). *Exploring the impact of climate change on children in South Africa.* http://reliefweb.int/sites/reliefweb.int/files/resources/SAF_resources_climatechange.pdf

Källmén, H., & Hallgren, M. (2021). Bullying at school and mental health problems among adolescents: a repeated cross-sectional study. *Child and Adolescent Psychiatry and Mental Health*, *15*(1). https://doi.org/10.1186/s13034-021-00425-y

Kamara, A. B. (2019). Winter effect on students: An experience case at Central China Normal University in Wuhan, Hubei Province. *European Journal of Education Studies*. https://doi.org/10.46827/ejes.v0i0.2289

Kazmierczak, A., & Carter, J. (2010). *Adaptation to climate change using green and blue infrastructure. A database of case studies.* 2010. https://www.escholar.manchester.ac.uk/uk-ac-man-scw:128518

Kearney, C. A., Benoit, L., Gonzálvez, C., & Keppens, G. A. (2022). School attendance and school absenteeism: A primer for the past, present, and theory of change for the future. *Frontiers in Education*, *7*. https://doi.org/10.3389/feduc.2022.1044608

Kemp, L., Xu, C., Depledge, J., Ebi, K. L., Gibbins, G., Kohler, T. A., Rockström, J., Scheffer, M., Schellnhuber, H. J., Steffen, W., & Lenton, T. M. (2022). Climate Endgame: Exploring catastrophic climate change scenarios. *Proceedings of the National Academy of Sciences, 119*(34). https://doi.org/10.1073/pnas.2108146119

Khatri, K. (2020). Research paradigm: A philosophy of educational research. *International Journal of English, Literature and Social Science*, *5*(5), 1435–1440. https://doi.org/10.22161/ijels.55.15

Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE Guide No. 131. *Medical Teacher*, *42*(8), 846–854. https://doi.org/10.1080/0142159x.2020.1755030

Kingwill, C. M. (2016). *Exploring foundation phase educators' behaviour management strategies for disruptive behaviour in a boys' school*. (MA Thesis. Stellenbosch University). https://scholar.sun.ac.za/bitstreams/8dd272ee-4d3e-4479-b390-f7fe5eeba7f2/download

Kleinjan, D. (2020). *Movement matters: The importance of incorporating movement in the classroom.* https://nwcommons.nwciowa.edu/education_masters

Kriel, C., & Livingston, C. (2019). Foundation phase learners' view of learning support and self-esteem. *South African Journal of Childhood Education*, *9*(1), 1–2. https://doi.org/10.4102/sajce.v9i1.679

Kroeker, K. (2022). Recess is not all fun and games. *BU Journal of Graduate Studies in Education*, *14*(1), 31–34.

Kulkarni, D. K. (2016). Interpretation and display of research results. *Indian Journal of Anaesthesia*, *60*(9), 657. https://doi.org/10.4103/0019-5049.190622

Kumar, A. (2022). Observation methods. *International Journal of Scientific Research*. https://www.researchgate.net/publication/360808469

Laas, A., & Boezaart, T. (2014). The legislative framework regarding bullying in South African schools. *Potchefstroom Electronic Law Journal*, *17*(6), 2667–2702. https://doi.org/10.4314/pelj.v17i6.12

Coplan, R. J., Gavinski-Molina, M. H., Lagacé-Séguin, D. G., & Wichmann, C. (2001). When girls versus boys play alone: Nonsocial play and adjustment in kindergarten. *Developmental Psychology*, *37*(4), 42. https://doi.org/10.1037/0012-1649.37.4.464

Lagacé-Séguin, D. G., & D'Entremont, M. L. (2005). Weathering the preschool environment: Affect moderates the relations between meteorology and preschool behaviors. *Early Child Development and Care*, *175*(5), 379–394. https://doi.org/10.1080/0300443042000270777

Lala, B., & Hagishima, A. (2023). Impact of escalating heat waves on students' well-being and overall health: A survey of primary school teachers. *Climate*, *11*(6), 126. https://doi.org/10.3390/cli11060126

Landauer, M., Juhola, S., & Klein, J. (2018). The role of scale in integrating climate change adaptation and mitigation in cities. *Journal of Environmental Planning and Management*, *62*(5), 741–765. https://doi.org/10.1080/09640568.2018.1430022

Lemon, L., & Hayes, J. (2020). Enhancing trustworthiness of qualitative findings: Using Leximancer for qualitative data analysis triangulation. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2020.4222

Levy, B. S., Sidel, V. W., & Patz, J. A. (2017). Climate change and collective violence. *Annual Review of Public Health, 38*(1), 241–257. https://doi.org/10.1146/annurev-publhealth-031816-044232

Limeri, L. B., Choe, J., Harper, H. G., Martin, H. R., Benton, A., & Dolan, E. L. (2020). Knowledge or abilities? How undergraduates define intelligence. *CBE—Life Sciences Education*, *19*(1), ar5. https://doi.org/10.1187/cbe.19-09-0169

Lowry, W. (2013). *Weather and life: An introduction to biometeorology*. https://financialplus.info/Weather-And-Life:-An-Introduction-To-Biometeorology%7CWilliam-P.-Lowry.cgi

Luenendonk, M. (2019, September 24). Theory of planned behavior: Definition, explained, examples. *Cleverism.* https://www.cleverism.com/theory-of-planned-behavior/

Ma, T., Moore, J., & Cleary, A. (2022). Climate change impacts on the mental health and wellbeing of young people: A scoping review of risk and protective factors. *Social Science & Medicine*, *301*, 114888. https://doi.org/10.1016/j.socscimed.2022.114888

Mabuza, E. (2019, October 1). *Hot under the collar: How heat prevents school kids from learning*. *TimesLIVE.* Retrieved July 20, 2022, from https://www.timeslive.co.za/news/south-africa/2019-10-01-hot-under-the-collar-how-heat-prevents-school-kids-from-learning/

McMillan, J., & Schumacher, S. (2009). *Research in education: Evidence-based inquiry* (7th ed.). Pearson.

Mahlokwane, J. (2023, May 30). *'Climate change will hurt the most vulnerable members of society if we fail to act' – UP student*. https://www.up.ac.za/biochemistry-genetics-and-microbiology/news/post_3154239-climate-change-will-hurt-the-most-vulnerable-members-of-society-if-we-fail-to-act-up-student-activist-

Mann, D. (2023). *Climate change will harm children's mental health: Report.* https://www.usnews.com/news/health-news/articles/2023-10-11/climate-change-will-harm-childrens-mental-health-report#:~:text=11%2C%202023%20(HealthDay%20News),the%20climate%20advocacy%20organization%20ecoAmerica.

Marais, P., & Meier, C. (2010). Disruptive behaviour in the foundation phase of schooling. *South African Journal of Education*, *30*(1), 41–57. https://doi.org/10.4314/saje.v30i1.52601

Martin, G., Reilly, K., Everitt, H., & Gilliland, J. A. (2021). Review: The impact of climate change awareness on children's mental well-being and negative emotions – a scoping review. *Child and Adolescent Mental Health*, *27*(1), 59–72. https://doi.org/10.1111/camh.12525

Master, W. (2022, July 13). How does climate change impact human health? Project Hope. https://www.projecthope.org/how-does-climate-change-impact-our-health/04/2022/

Mawila, D., Munongi, L., & Mabaso, N. M. (2023). Student teachers' preparedness to raise awareness about bullying among Grade R learners. *South African Journal of Childhood Education*, *13*(1). https://doi.org/10.4102/sajce.v13i1.1230

Maykot, J. K., De Oliveira, C. C., Ghisi, E., & Rupp, R. F. (2022). Influence of gender on thermal, air-movement, humidity and air-quality perception in mixed-mode and fully air-conditioned offices. *Sustainability*, *14*(15), 9722. https://doi.org/10.3390/su14159722

Mboweni, L. (2014). *Challenges and factors contributing to learner absenteeism in selected primary schools in Acornhoek*. (Master;'s dissertation. University of South Africa). https://uir.unisa.ac.za/bitstream/10500/13941/1/dissertation_mboweni_l.pdf

McAndrew, F. T. (2019, May 17). Hot and bothered: Does heat make people aggressive? *Psychology Today.* https://www.psychologytoday.com/za/blog/out-the-ooze/201905/hot-and-bothered-does-heat-make-people-aggressive

McCain, N. (2024, January 3). Ladysmith floods: Rescue teams end their search as death toll reaches 23. *News24*. https://www.news24.com/news24/southafrica/news/ladysmith-floods-rescue-teams-end-their-search-as-death-toll-reaches-23-20240103

McCain, N. (2022, September 20). Education sector concerned as impact of load shedding cuts down valuable teaching, studying time. *News24*. https://www.news24.com/news24/southafrica/news/education-sector-concerned-as-impact-of-load-shedding-cuts-down-valuable-teaching-studying-time-20220920

McCain, N. (2024, January 3). Ladysmith floods: Rescue teams end their search as death toll reaches 23. *News24*. https://www.news24.com/news24/southafrica/news/ladysmith-floods-rescue-teams-end-their-search-as-death-toll-reaches-23-2024010

McGill, R. M. (2015, November 17). Bad weather impacts on learning. *TeacherToolkit.* https://www.teachertoolkit.co.uk/2015/11/14/weather/#_

McKenzie, D., Madowo, L., Alberti, M., & Dewan, A. (2022, April 14). Over 300 killed after flooding washed away roads, destroyed homes in South Africa. *CNN.* https://edition.cnn.com/2022/04/13/africa/south-africa-rain-floods-climate-intl/index.html

McMillan, J., & Schumacher, S. (2009). *Research in education: Evidence-based inquiry* (7th ed.). Pearson.

Met Office Hadley Centre. (2021, July). *Met Office climate extremes dashboard*. https://climate.metoffice.cloud/extremes/dashboard.html

Meteoblue. (2023). *Simulated historical climate & weather data for Graaff Reinet*. https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/graaff-reinet_south-africa_1000543

Miles, D. A. (2019, July 1). *Research methods and strategies: Let's stop the madness Part 2: Understanding the difference.* https://www.researchgate.net/publication/334279571_ARTICLE_Research_Methods_and_Strategies_Let%27s_Stop_the_Madness_Part_2_Understanding_the_Difference_Between_Limitations_vs_Delimitations

Mlambo, S. (2021, April 14). Justice for Lufuno: Limpopo pupil dies by suicide after violent school bullying incident. *IOL*. https://www.iol.co.za/news/south-africa/limpopo/justice-for-lufuno-limpopo-pupil-dies-by-suicide-after-violent-school-bullying-incident-65bee33b-713a-4623-9585-3d0ab1bd52fd

Monama, T. (2022, April 25). KZN floods: Basic education dept arranges mobile classrooms as 72 schools remain inaccessible. *News24.* https://www.news24.com/news24/southafrica/news/kzn-floods-basic-education-dept-arranges-mobile-classrooms-as-72-schools-remain-inaccessible-20220425

Morecroft, M. D., Duffield, S., Harley, M., Pearce-Higgins, J. W., Stevens, N., Watts, O., & Whitaker, J. (2019). Measuring the success of climate change adaptation and mitigation in terrestrial ecosystems. *Science, 366*(6471). https://doi.org/10.1126/science.aaw9256

Morgan, H. (2022). Conducting a qualitative document analysis. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2022.5044

Munzhedzi, S., & Cele, A. (2018). Climate change and human health. *Department of Forestry, Fisheries and the Environment*. https://www.dffe.gov.za/sites/default/files/docs/factsheet_climatechange_health.pdf

National Centre for Environmental Health. (2023, March 20). *Spring weather*. *Centers for Disease Control and Prevention*. https://www.cdc.gov/nceh/features/springweather/index.html

Naveed, F. (2019, November 9). *Different theories of social change. Mass communication talk.* https://www.masscommunicationtalk.com/different-theories-of-social-change.html

Ndlela, M. (2021). *Challenges of foundation phase teachers to include learners with learning difficulties in mainstream schools* (Magister Educationis. University of Pretoria).

https://repository.up.ac.za/bitstream/handle/2263/83308/Ndlela_Challenges_2021.pdf?sequence=3

Ngcoya, Z. (2022, April 19). Floods ‘a blow’ to KZN schools. *IOL*. https://www.iol.co.za/mercury/news/floods-a-blow-to-kzn-schools-7f37afec-2624-48e7-b296-288d427fa730

Nkanjeni, U. (2023, April 11). Brace yourself for load-shedding ‘worst case scenario’ during winter, warns electricity minister. *HeraldLIVE*. https://www.heraldlive.co.za/news/2023-04-11-brace-yourself-for-load-shedding-worst-case-scenario-during-winter-warns-electricity-minister/

Norman, A. S., & King, J. R. (2020). Understanding and using trustworthiness in qualitative research. *Journal of Developmental Education*, 26–28.

Nuttelman, W. (2022, November 30). The time of the season for learning. *MindEdge.* https://www.mindedge.com/learning-science/the-time-of-the-season-for-learning/

O’Leary, Z. (2014). *The essential guide to doing your research project* (2nd ed.). SAGE.

O’Neill, B. C., Tebaldi, C., van Vuuren, D. P., Eyring, V., Friedlingstein, P., Hurtt, G., Knutti, R., Kriegler, E., Lamarque, J. F., Lowe, J., Meehl, G. A., Moss, R., Riahi, K., & Sanderson, B. M. (2016). The scenario model intercomparison project (ScenarioMIP) for CMIP6. *Geoscientific Model Development, 9*(9), 3461–3482. https://doi.org/10.5194/gmd-9-3461-2016

Oxford University Press. (n.d.). *Weather*. Oxford Learners Dictionaries. https://www.oxfordlearnersdictionaries.com/definition/english/weather_1?q=weather

Park, R. J., Behrer, A. P., & Goodman, J. (2020a). Learning is inhibited by heat exposure, both internationally and within the United States. *Nature Human Behaviour*, *5*(1), 19–27. https://doi.org/10.1038/s41562-020-00959-9

Parsons, T. (2018). Theories of society, *Vol. 2: Foundations of modern sociological theory* (Classic Reprint). Forgotten Books.

Phillips, T. (2022, January 28). Floods cast spotlight on education's climate risks. *The Mail & Guardian*. https://mg.co.za/environment/2022-01-30-floods-cast-spotlight-on-educations-climate-risks/

Plaatjies, C. B. R. (2022, October 4). Water supply in Dr Beyers Naudé Local Municipality affected by load shedding. *News24*. https://www.news24.com/news24/community-newspaper/komani-karoo/water-supply-in-dr-beyers-naude-local-municipality-affected-by-load-shedding-20221004

Popescu, G. (2014). Science, health and medical journals, full text articles and books. *Science Direct*. https://pdf.sciencedirectassets.com

Porras-Salazar, J. A., Wyon, D. P., Piderit-Moreno, M. B., Contreras-Espinoza, S., & Wargocki, P. (2018). Reducing classroom temperature in a tropical climate improved the thermal comfort and the performance of elementary school pupils. *Indoor Air*, *28*(6), 892–904. https://doi.org/10.1111/ina.12501

Porter, C. (2021, November 8). Education is under threat from climate change - especially for women. *University of Oxford.* https://www.ox.ac.uk/news/features/education-under-threat-climate-change-especially-women-and-girls

Prentice, C. M., Vergunst, F., Berry, H. L., & Minor, K. (2024, March 21). *School's out: how climate change is already badly affecting children's education*. The Conversation. https://theconversation.com/schools-out-how-climate-change-is-already-badly-affecting-childrens-education-225737#:~:text=Our%20review%20also%20highlights%20how,learning%20and%20lowers%20test%20scores.

Prins, C., Joubert, I., Ferreira-Prévost, J., & Moen, M. C. (2019). Disciplinary practices in the early grades: Creating culturally responsive learning environments in South Africa. *South African Journal of Education*, *39*(.), 1–7. https://doi.org/10.15700/saje.v39n3a1633

Pule, V., Mathee, A., Melariri, P., Kapwata, T., Abdelatif, N., Balakrishna, Y., Kunene, Z., Mogotsi, M., Wernecke, B., & Wright, C. Y. (2021). Classroom temperature and learner absenteeism in public primary schools in the eastern Cape, South Africa. *International Journal of Environmental Research and Public Health*, *18*(20), 10700. https://doi.org/10.3390/ijerph182010700

Randell, H. (2019, May 7). Climate change may weaken children's education in the tropics. *New Security Beat.* https://www.newsecuritybeat.org/2019/05/climate-change-weaken-childrens-education-tropics/

Readiness and Emergency Management for Schools. (2019). *Mitigation for schools and school districts*. REMS TA. https://rems.ed.gov/docs/Mitigation_Fact_Sheet_508C.pdf

Reuters, R. W. (2022). *Deadly floods wreak havoc in South Africa Updated 11:26 AM EDT, Wed April 20, 2022*. CNN.https://edition.cnn.com/2022/04/13/africa/gallery/south-africa-flooding/index.html

Rodríguez, L. A., & Welsh, R. O. (2022). The dimensions of school discipline: Toward a comprehensive framework for measuring discipline patterns and outcomes in schools. *AERA Open*, *8*, 233285842210836. https://doi.org/10.1177/23328584221083669

Rofiah, N. H., Kawai, N., & Nur Hayati, E. (2021). Key elements of disaster mitigation education in inclusive school setting in the Indonesian context. *Jàmbá - Journal of Disaster Risk Studies, 13*(1). https://doi.org/10.4102/jamba.v13i1.1159

Rojas, D. (2019, November 7). Climate adaptation vs. mitigation: What's the difference, and why does it matter? *Climate Reality Project.*

https://www.climaterealityproject.org/blog/climate-adaptation-vs-mitigation-why-does-it-matter

Romm, J. (2022). *Climate change: What everyone needs to know (what everyone needs to know.* (3rd ed.). Oxford University Press.

Royal Meteorological Society (2017) *Biometeorology: Weather and health.* https://www.rmets.org/metmatters/biometeorology-weather-and-health#:~:text=What%20is%20biometeorology%3F,conditions%20and%20temporary%20physiological%20changes

Russell, G. W., & Dua, M. (1983). Lunar influences on human aggression. *Social Behavior and Personality: An International Journal*, *11*(2), 41–46. https://doi.org/10.2224/sbp.1983.11.2.41

Ruwoko, E. (2023, March). Extreme heat is taking its toll on students and institutions. *University World News.* https://www.universityworldnews.com/post.php?story=20230301232242718

Ryan, I., Deng, X., Thurston, G. D., Khwaja, H. A., Romeiko, X. X., Zhang, W., Marks, T., Yu, F., & Lin, S. (2022). Measuring students' exposure to temperature and relative humidity in various indoor environments and across seasons using personal air monitors. *Hygiene and Environmental Health Advances*, *4*, 100029. https://doi.org/10.1016/j.heha.2022.100029

SABC News. (2023, January 20). Heatwave claims seven lives in Northern Cape. *SABC News*. https://www.sabcnews.com/sabcnews/five-people-die-of-heatstroke-in-northern-cape/

Saldaña, J. (2009). The coding manual for qualitative researchers. *The coding manual for qualitative researchers*. https://delvetool.com/blog/deductiveinductive

Salib, E., & Sharp, N. (2002). Relative humidity and affective disorders. *International Journal of Psychiatry in Clinical Practice*, *6*(3), 147–153. https://doi.org/10.1080/136515002760276072

Santos, R. M., & Bakhshoodeh, R. (2021). Climate change/global warming/climate emergency versus general climate research: comparative bibliometric trends of publications. *Heliyon*, *7*(11), e08219. https://doi.org/10.1016/j.heliyon.2021.e08219

Santosh, K. (2021, January 26). Paradigms of research - Positivism and Interpretivism. *Gyanko Vandar.* https://www.gyankovandar.com/2021/01/Paradigms-of-Research-Positivism-and-Interpretivism.html

Save the Children. (2023, July 18). *Five ways in which heatwaves threaten child rights, from education to daily meals – World* [Press release]. https://reliefweb.int/report/world/five-ways-which-heatwaves-threaten-child-rights-education-daily-meals

Sawyer, M. (2023, July 27). Children being exposed to high temperatures can quickly turn dangerous. *CBS News*. https://www.cbsnews.com/texas/news/children-exposed-to-high-temperatures-hot-cars-strollers-heat-related-illness/

Schermbrucker. (2021, July 22). *Learners in South Africa up to one school year behind where they should be*. Unicef. https://www.unicef.org/press-releases/learners-south-africa-one-school-year-behind-where-they-should-be

Schoepf, S., & Klimow, N. (2022). Collective case study. *Conceptual Analyses of Curriculum Inquiry Methodologies*, 252–266. https://doi.org/10.4018/978-1-7998-8848-2.ch012

Schwarz, G. (2022, November 5). 'It was like an apocalyptic movie': 20 climate photographs that changed the world. *The Guardian*. https://www.theguardian.com/environment/2022/nov/05/20-climate-photographs-that-changed-the-world

Scorgie, F. M. C. (2019, September 26). How climate crisis affects education in South Africa. *Daily Maverick.* https://www.dailymaverick.co.za/article/2019-09-26-how-climate-crisis-affects-education-in-south-africa/

Shepherd, L. (2021, October 20). Graaff-Reinet has ran dry in more ways than one - *The Daily Vox*. https://www.thedailyvox.co.za/graaff-reinet-has-ran-dry-in-more-ways-than-one/#:~:text=Graaff%2DReinet%20has%20been%20plagued,a%20loss%20of%20R70%20million.

Shukla, J. (2013). Extreme Weather Events and Mental Health: Tackling the Psychosocial Challenge. *ISRN Public Health*, *2013*, 1–7. https://doi.org/10.1155/2013/127365

Simon, M. K., & Goes, J. (2020). *Assumptions, limitations, delimitations, and scope of the study*. https://studylib.net/doc/8312011/assumptions---limitations-and-delimitations

Simons, P. (2019, March 16). Are winds to blame for bad behaviour? *The Times.* https://www.thetimes.co.uk/article/are-winds-to-blame-for-bad-behaviour-tk3qxxvzp

Siyoba, D. M.-J. (2023). *Assessing the effectiveness of the reading to learn approach in enhancing the comprehension of stories in an overcrowded under-resourced Grade 2 classroom*. (Master's thesis. University of Johannesburg). https://ujcontent.uj.ac.za/esploro/outputs/graduate/Assessing-the-effectiveness-of-the-reading/9924608607691

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Soekoe, N. (2021). *Understanding overcrowding in Gauteng's schools. No space for us.* https://equaleducation.org.za/wp-content/uploads/2022/03/equal-education-no-space-for-us-overcrowding-report-digital-sgl-page-compressed-20211015.pdf

South African Government. (n.d.). *Education*. from https://www.gov.za/about-sa/education

Stats SA. (2011). *Camdeboo municipality.* https://www.statssa.gov.za/?page_id=993&id=camdeboo-municipality

Str/EPA-EFE/Shutterstock. (2022). *Deadly floods wreak havoc in South Africa*. CNN. https://edition.cnn.com/2022/04/13/africa/gallery/south-africa-flooding/index.html

Stratton, S. J. (2021). Population research: Convenience sampling strategies. *Prehospital and Disaster Medicine*, *36*(4), 373–374. https://doi.org/10.1017/s1049023x21000649

Swaim, E. (2022, August 12). Yes, weather can affect mood and energy — and so can climate change. *Healthline*. https://www.healthline.com/health/mental-health/weather-and-mood#the-effects

Swanson, L. R. & Witte, A. L. (2022). *Optimal classroom learning environment: An NeMTSS research brief.* Nebraska Multi-tiered System of Support (NeMTSS).

Tandon, A. (2022, May 13). Climate change made extreme rains in 2022 South Africa floods 'twice as likely.' *Carbon Brief.* https://www.carbonbrief.org/climate-change-made-extreme-rains-in-2022-south-africa-floods-twice-as-likely/

The News Team (Ed.). (2018, December 6). *Safe schools report: The hidden crisis, the huge challenges and the actions needed to educate every child.* https://theirworld.org/news/safe-schools-report-reveals-crises-challenges-action-needed-to-educate-children/

Thomas, J. D., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, *8*(1). https://doi.org/10.1186/1471-2288-8-45

Thompson, A. K. (2022, November 18). Functionalism – An introduction. *ReviseSociology*. https://revisesociology.com/2016/09/01/functionalism-sociology/

Thwala, H. (2022, April 14). KZN Floods: Over 240 schools damaged by the recent floods. *IOL*. https://www.iol.co.za/news/education/schools/kzn-floods-over-240-

schools-damaged-by-the-recent-floods-bad96159-3ab5-49b4-827b-7a54a927431b

Travelchime Inc. (2023). *Graaff-Reinet, South Africa weather in February: average temperature & climate*. Wanderlog. https://wanderlog.com/weather/79422/2/graaff-reinet-weather-in-february

Tshinnane, R., Tshiovhe, T., & Monobe, R. J. (2017). Challenges regarding implementation of the redeployment policy in Limpopo Province, South Africa. *Journal of Social Sciences*. https://doi.org/10.1080/09718923.2017.1305562

Turek-Hankins, L. L., De Pérez, E. C., Scarpa, G., Díaz, R. R., Schwerdtle, P. N., Joe, E. T., Galappaththi, E. K., French, E. M., Austin, S., Singh, C., Siña, M., Siders, A., Van Aalst, M., Templeman, S., Nunbogu, A. M., Ford, L. B., Agrawal, T., & Mach, K. J. (2021). Climate change adaptation to extreme heat: A global systematic review of implemented action. *Oxford Open Climate Change*. https://doi.org/10.1093/oxfclm/kgab005

Turrentine, M. D. J. (2021, September 1). What is climate change? *NRDC*. https://www.nrdc.org/stories/what-climate-change

UNESCO. (2015). Putting climate change education into practice. In *Not just hot air* (pp. 25–29). United Nations Educational, Scientific and Cultural Organization. https://doi.org/10.54675/jezc9407

UNESCO. (2020). The impact of climate displacement on the right to education. In *Unesco Digital Library* (ED-2020/WS/32). https://unesdoc.unesco.org/ark:/48223/pf0000374966

*UNICEF Annual Report 2011*. (2011, June 1). UNICEF. https://www.unicef.org/reports/annual-report-2011

UNICEF. (2021). *The climate crisis is a child rights crisis.* https://www.unicef.org/reports/climate-crisis-child-rights-crisis

United Nations Children's Fund (UNICEF). (2021, August). *The climate crisis is a child rights crisis: Introducing the children's climate risk index.* https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf

United Nations. (2022). *What is climate change?* https://www.un.org/en/climatechange/what-is-climate-change

United Nations. (n.d.). *Causes and effects of climate change.* https://www.un.org/en/climatechange/science/causes-effects-climate-change

University of Oxford. (2022). Weather. In *Oxford Learners Dictionaries*. https://www.oxfordlearnersdictionaries.com/definition/english/weather_1?q=weather

Van Nieuwenhuizen, A., Hudson, K., Chen, X., & Hwong, A. R. (2021). The effects of climate change on child and adolescent mental health: Clinical considerations. *Current Psychiatry Reports*, *23*(12). https://doi.org/10.1007/s11920-021-01296-y

VanBuskirk, S. E., & Simpson, R. L. (2013). Meteorological variables and behavior of learners with autism. *Focus on Autism and Other Developmental Disabilities*, *28*(3), 131–137. https://doi.org/10.1177/1088357612475302

Vergunst, F., & Berry, H. L. (2021, September 22). Climate change is harming children's mental health – and this is just the start. *The Conversation.* https://theconversation.com/climate-change-is-harming-childrens-mental-health-and-this-is-just-the-start-168070

Wainwright, L. (2022, December 7). Expert reaction to impact of cold weather on human health. *Science Media Centre*. https://www.sciencemediacentre.org/expert-reaction-to-impact-of-cold-weather-on-human-health/

Wangdi, T., & Namgyel, S. (2022). Classroom to reduce student disruptive behavior: An action research. *MEXTESOL Journal*, *46–1*. https://www.researchgate.net/publication/359043459

Wargocki, P., Porras-Salazar, J. A., & Contreras-Espinoza, S. (2019). The relationship between classroom temperature and children's performance in school. *Building and Environment*, *157*, 197–204. https://doi.org/10.1016/j.buildenv.2019.04.046

Weather Atlas (2023, April). May weather - Autumn 2023 - Graaf-Reinet, South Africa. *Weather Atlas.* https://www.weather-atlas.com/en/south-africa/graaf-reinet-weather-may

Weather Spark. (2023). *Graaff-Reinet may weather, average temperature (South Africa)* https://weatherspark.com/m/90472/5/Average-Weather-in-May-in-Graaff-Reinet-South-Africa

Will, M. (2022, October 11). The school year is getting hotter. How does heat affect student learning and well-being? *Education Week*. https://www.edweek.org/leadership/the-school-year-is-getting-hotter-how-does-heat-affect-student-learning-and-well-being/2022/09

Willis, J. (2007). *Foundations of qualitative research: Interpretive and critical approaches.* 8. https://doi.org/10.4135/9781452230108

Willis, J. (2016, May 10). The science of spring: how a change of seasons can boost classroom learning. *The Guardian*. https://www.theguardian.com/teacher-network/2015/apr/02/science-spring-how-seasons-classroom-learning#:~:text=Encourage%20curiosity,take%20on%20more%20independent%20work.

Wong, J. (2023, February 10). How the weather affects student mental health and motivation. *The Mills Thunderbolt*. https://millsthunderbolt.com/how-the-weather-affects-student-mental-health-and-motivation/

Woods, C. (2015, July 31). 8 things you didn't know about humidity. *PBS NewsHour.* https://www.pbs.org/newshour/science/8-things-didnt-know-humidity

Woolfolk, A. (2014). *Educational psychology* (12th ed.). Pearson.

World Health Organisation. (2021, October 30). *Climate change and health*. https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

World Weather Online. (2022). *Graaff-Reinet climate weather averages*. https://www.worldweatheronline.com/graaff-reinet-weather-averages/eastern-cape/za.aspx

WorldWeatherOnline.com. (n.d.). Graaff-Reinet climate weather averages. https://www.worldweatheronline.com/graaff-reinet-weather-averages/eastern-cape/za.aspx

Yin, R. K. (2013). Validity and generalization in future case study evaluations. *Evaluation*, *19*(3), 321–332. https://doi.org/10.1177/1356389013497081

Yonkers, C. (2021, March 12). What is climate change and why does it matter? *Sustain Life.* https://www.sustain.life/blog/why-climate-change-matters

Youngman, E. (2023, August 10). The power of breaks in school. *Teaching Channel*. https://www.teachingchannel.com/k12-hub/blog/breaks-school/#:~:text=That%27s%20why%20breaks%20in%20school,progress%20later%20with%20more%20energy.

Zarotis, G. F. (2020). The importance of movement for the overall development of the child at pre-school age. *Journal of Advances in Sports and Physical Education*. https://doi.org/10.36348/jaspe.2020.v03i02.003

Zerr, T. (2017). *The relationship of barometric pressure and behaviour in two third grade classrooms.* https://www.proquest.com/openview/64172a164cda2cda52941a2457ca8293/1?pq-origsite=gscholar&cbl=18750

Zhang, X., Chen, X., & Zhang, X. (2024). Temperature and Low-Stakes cognitive performance. *Journal of the Association of Environmental and Resource Economists*, *11*(1), 75–96. https://doi.org/10.1086/726007

Zhang, Y., Li, Z., Tan, Y., Xi, Z., Zhao, Q., & Chen, X. (2021). The influence of personality traits on school bullying: A moderated mediation model. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.650070

## APPENDICES

## APPENDIX A: ETHICAL CERTIFICATE

UNISA university of south africa

**UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE**

Date: 2023/07/05

Ref: **2023/07/05/63900963/12/AM**
Name: Ms MJ Kreusch
Student No.:63900963

Dear Ms MJ Kreusch

**Decision:** Ethics Approval from 2023/07/05 to 2026/07/05

**Researcher(s):** Name: Ms MJ Kreusch
E-mail address: mia.kreusch@gmail.com
Telephone: 0724469814

**Supervisor(s):** Name: Prof. S.B. Msezane
E-mail address: msezaneb@unisa.ac.za
Telephone: 0733548165

**Title of research:**

**Climate change's effect on Foundation Phase learners' behaviour and academic performance in some of the Graaff-Reinet schools.**

**Qualification:** MEd Psychology Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2023/07/05 to 2026/07/05.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2023/07/05 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached.
2. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

3. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
4. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
5. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
6. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
7. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
8. No field work activities may continue after the expiry date **2026/07/05**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

*Note:*

*The reference number* **2023/07/05/63900963/12/AM** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

**Prof AT Motlhabane**
**CHAIRPERSON: CEDU RERC**
motlhat@unisa.ac.za

**Prof Mpine Makoe**
**EXECUTIVE DEAN**
qakisme@unisa.ac.za



University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

**APPENDIX B: REQUEST PERMISSION FROM DEPARTMENT**


t

No.16

Graaff-Reinet

6280

31 May 2023

**Request for permission to conduct research at Eastern Cape Department of Education Director Letter**

Title: Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom.

Date: 31 May 2023

Mr Fundile David

Tel: +27(0)40 608 4305

E-mail: nombuyekezo.nkwenkwezi@ecdoe.gov.za

Dear Mr Fundile David

I, Mia Kreusch am doing research under supervision of Professor S.B. Msezane a Professor in the Department of Adult, Community and Continuing Education towards a Master's Degree in Educational Psychology at the University of South Africa. We are inviting you to participate in a study entitled Climate Change's Effect on Foundation Phase learners' behaviour and academic performance in the classroom. The aim of the study is to investigate and evaluate the effects of changes in climate change pattern to learners' behaviour and their academic performance in schools. Your province has been selected

because it consists of the schools located in the area that this research will be collecting data from.

The study will entail interviews with teachers which will happen after school hours where the teachers involved will answer a few questions about the topic. The teachers will observe their learners on a daily basis for a month in July and a month in October where they will record the following: How many children are present, how many girls, how many boys, how did the girls behave on the day, how did the boys behave on the day and how focused were the girls and how focused were the girls. These questions will be answered by means of a checklist that each teacher will receive for the month. The benefit of this study is to gain a better understanding of the learners' reaction and academic performance traits and react to the learners' behaviour appropriately by making sense of the possible reason behind the behaviour and academic performance.

No risk is involved in this study. Participants in this research project is voluntary and confidential and should the participant willing to participate in this study, none of the information obtained will be disseminated to the public in a manner that identifies the school, teachers and learners. Participants are free to withdraw from the study if they feel they do not want to continue

There are no potential risks excepted in this research. The participants in this research is voluntary and all personal details will be kept confidential. Participants are free to withdraw from the study of they feel they do not want to continue. None of the personal information about the learners being observed will be made public to the researcher. All participants will receive document explaining the study and what is expected from the teachers, and they can sign a declaration of consent. This would mean the teacher participates in this study willingly and that it may withdraw from the research project at any time.

There will be no reimbursement or any incentives for participation in the research. Feedback procedure will entail once all the data has been analysed and reported on, each participant will receive a copy of the final study.

Yours truly,

Mia Kreusch

mia.kreusch@gmail.com/ 63900963@mylife.unisa.ac.za

Contact number: 0724469814

**APPENDIX C: PERMISSION FROM CIRCUIT OFFICE**


No.16

Graaff-Reinet

6280

31 May 2023

**Request for permission to conduct research at Sarah Baartman District**

Mr Malusi Kashe

District Manager

046 636 1484

E-mail : pholisa.guzana@ecdsd.gov.za

Dear: Mr Malusi Kashe

I, Mia Kreusch am doing research under supervision of Professor S.B. Msezane a Professor in the Department of Adult, Community and Continuing Education towards a Master's Degree in Educational Psychology at the University of South Africa. We are inviting you to participate in a study entitled Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom. The aim of the study is to investigate and evaluate the effects of changes in climate change pattern to learners' behaviour and their academic performance in schools. Your province has been selected because it consists of the schools located in the area that this research will be collecting data from.

The study will entail interviews with teachers which will happen after school hours where the teachers involved will answer a few questions about the topic. The teachers will observe their learners on a daily basis for a month in July and a month in October where they will record the following: How many children are present, how many girls, how many

boys, how did the girls behave on the day, how did the boys behave on the day and how focused were the girls and how focused were the girls. These questions will be answered by means of a checklist that each teacher will receive for the month. The benefit of this study is to gain a better understanding of the learners' reaction and academic performance traits and react to the learners' behaviour appropriately by making sense of the possible reason behind the behaviour and academic performance.

No risk is involved in this study. Participants in this research project is voluntary and confidential and should the participant willing to participate in this study, none of the information obtained will be disseminated to the public in a manner that identifies the school, teachers and learners. Participants are free to withdraw from the study if they feel they do not want to continue.

There are no potential risks excepted in this research. The participants in this research is voluntary and all personal details will be kept confidential. Participants are free to withdraw from the study of they feel they do not want to continue. None of the personal information about the learners being observed will be made public to the researcher. All participants will receive document explaining the study and what is expected from the teachers, and they can sign a declaration of consent. This would mean the teacher participates in this study willingly and that it may withdraw from the research project at any time.

There will be no reimbursement or any incentives for participation in the research. Feedback procedure will entail once all the data has been analysed and reported on, each participant will receive a copy of the final study.

Yours truly,

Mia Kreusch

mia.kreusch@gmail.com/ 63900963@mylife.unisa.ac.za

Contact number: 0724469814

**APPENDIX D: REQUEST TO SCHOOL PRINCIPAL**


No.16

Graaff-Reinet

6280

31 May 2023

**Request permission to conduct research in your school**

Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom.

Date: 30 May 2023

Dear Sir/Madam

I, Mia Kreusch am doing research under supervision of Professor S.B. Msezane a Professor in the Department of Adult, Community and Continuing Education towards a Master's Degree in Educational Psychology at the University of South Africa. We are inviting you to participate in a study entitled Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom. The aim of the study is to investigate and evaluate the effects of changes in climate change pattern to learners' behaviour and their academic performance in schools. Your province has been selected because it consists of the schools located in the area that this research will be collecting data from.

The study will entail interviews with teachers which will happen after school hours where the teachers involved will answer a few questions about the topic. The teachers will observe their learners on a daily basis for a month in July and a month in October where they will record the following: How many children are present, how many girls, how many boys, how did the girls behave on the day, how did the boys behave on the day and how focused were the girls and how focused were the girls. These questions will be answered

by means of a checklist that each teacher will receive for the month. The benefit of this study is to gain a better understanding of the learners' reaction and academic performance traits and react to the learners' behaviour appropriately by making sense of the possible reason behind the behaviour and academic performance.

No risk is involved in this study. Participants in this research project is voluntary and confidential and should the participant willing to participate in this study, none of the information obtained will be disseminated to the public in a manner that identifies the school, teachers and learners. Participants are free to withdraw from the study if they feel they do not want to continue

There are no potential risks excepted in this research. The participants in this research is voluntary and all personal details will be kept confidential. Participants are free to withdraw from the study of they feel they do not want to continue. None of the personal information about the learners being observed will be made public to the researcher. All participants will receive document explaining the study and what is expected from the teachers, and they can sign a declaration of consent. This would mean the teacher participates in this study willingly and that it may withdraw from the research project at any time.

There will be no reimbursement or any incentives for participation in the research. Feedback procedure will entail once all the data has been analysed and reported on, each participant will receive a copy of the final study.

Yours truly,

Mia Kreusch

mia.kreusch@gmail.com/ 63900963@mylife.unisa.ac.za

Contact number: 0724469814

**APPENDIX E: REQUEST TO PARTICIPANT**


No.16

Graaff-Reinet

6280

31 May 2023

Title: Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom.

DEAR PROSPECTIVE PARTICIPANT

My name is Mia Kreusch, and I am doing research under the supervision of Professor S.B. Msezane, a Professor in the Department of Adult, Community and Continuing Education towards a MED Environmental Education at the University of South Africa. We are inviting you to participate in a study entitled Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom.

WHAT IS THE PURPOSE OF THE STUDY?

The aim of the study is to investigate and evaluate the effects of changes in climate change pattern to learners' behaviour and their academic performance in schools. This study is expected to collect important information that could help teachers gain more information about their learners and how they react to specific circumstances out of their control and different strategies that they can use to deal with these changes in learners' behaviour and academic performance.

WHY AM I BEING INVITED TO PARTICIPATE?

You are invited because you are a Foundation Phase teacher more specifically, a Grade 3 teacher which is the grade that has been chosen in the study I obtained your contact

details from the principal of your school. There will be two other Grade 3 teachers from two other schools in Graaff-Reinet that will also be recording data.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

The study involves interviews and checklists from your observation. The interview will be face-to-face at a time that suits your schedule best which should take between one and two hours. The questions will be about your knowledge about this study and how you feel about the study. The checklist that you would need to fill in on a daily basis for a month in July and October is about the learners' behaviour and academic performance. The number of girls and boys present will also be filled in this checklist and their behaviour and academic performance separately. This is your observation for that day, so the filling in of the checklist should not take you longer than 5 minutes per day to complete.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

The benefits of taking part in this study is that the data that is being collected and then analysed, will be used to help teachers gain a better understanding about their learners and what impact external circumstances (climate change and weather) has on their behaviour and academic performance.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

There are no potential risks excepted in this research. It is your choice to take part in this study and all your personal details will be kept confidential. None of the personal information about the learners being observed will be made public to the researcher.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

Please note the following information about confidentiality: You have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your involvement in this research. Your name will not be recorded anywhere, and no one will be able to connect you to the answers you give. Your answers will be given a code number, or a pseudonym and you will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings The data that you will submit to me is known as anonymous data and this may be used for other purposes such as research report, journal articles and/or conference proceedings. Your name will not be used, or your schools name will not be made public. Please keep in mind that it is sometimes impossible to make an absolute guarantee of confidentiality or anonymity, e.g., when focus groups are used as a data collection method.

While every effort will be made by the researcher to ensure that you will not be connected to the information that you share during the focus group, I cannot guarantee that other participants in the focus group will treat information confidentially. I shall, however, encourage all participants to do so. For this reason, I advise you not to disclose personally sensitive information in the focus group.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard/filing cabinet in my personal homes safe in Graaff-Reinet. For future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. The hard copies will be shredded once the five years have passed, and the electronic copies will be permanently deleted from the hard drive using relevant software program.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

No payment or incentives will be given for participating in this study.

HAS THE STUDY RECEIVED ETHICS APPROVAL

This study has received written approval from the Research Ethics Review Committee of the REC, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Mia Kreusch on 0724469814 or e-mail mia.kreusch@gmail.com. The findings are accessible forever as it will be available online as well.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Mia Kreusch on 0724469814 or e-mail mia.kreusch@gmail.com.

Should you have concerns about the way in which the research has been conducted, you may contact Professor S.B. Msezane on 0733548165 or msezasb@unisa.ac.za.

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

_____

Mia Kreusch

**CONSENT/ASSENT TO PARTICIPATE IN THIS STUDY** (Return slip)

I, _____ (your name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the face-to-face interview.

I have received a signed copy of the informed consent agreement.

Researcher's Name & Surname (please print) Mia Kreusch

_____ 31 May 2023

Researcher's signature Date

**APPENDIX F: LETTER REQUESTING PARENTAL CONSENT FOR MINORS TO PARTICIPATE IN A RESEARCH PROJECT**


No.16

Graaff-Reinet

6280

31 May 2023

**Dear Parent**

Your child is invited to participate in a study entitled Climate change's effect on Foundation Phase learners' behaviour and academic performance in the classroom.

I am undertaking this study as part of my master's research at the University of South Africa. The purpose of the study to investigate and evaluate the effects of changes in climate change pattern to learners' behaviour and their academic performance in schools and the possible benefits of the study are the improvement of the teacher's knowledge of how climate change effects the learners' behaviour and academic performance and different strategies to help the teachers with this subject. I am asking permission to include your child in this study because this study focuses on Grade 3 learners. I expect to have 100 other children participating in the study.

If you allow your child to participate, I shall request him/her to:

- Be observed by his/her teacher daily for a month in July and a month in October. The answers are given through by the teacher overall and not individually for each learner.

Any information that is obtained in connection with this study and can be identified with your child will remain confidential and will only be disclosed with your permission. His/her responses will not be linked to his/her name or your name or the school's name in any

written or verbal report based on this study. Such a report will be used for research purposes only.

There are no foreseeable risks to your child by participating in the study. Your child will receive no direct benefit from participating in the study; however, the possible benefits to education are giving teachers more information about learners to make the learner as successful as possible. Neither your child nor you will receive any type of payment for participating in this study.

Your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly, you can agree to allow your child to be in the study now and change your mind later without any penalty.

The study will take place during regular classroom with the prior approval of the school and your child's teacher.

In addition to your permission, your child must agree to participate in the study and you, and your child will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the study will be stored securely on a password locked computer in my locked safe at my house for five years after the study. Thereafter, records will be erased.

The benefits of this study are to provide more information to the teacher about learners that can be used to understand the learner holistically. There are no potential risks in this study. There will be no reimbursement or any incentives for participation in the research.

If you have questions about this study, please ask me or my study supervisor, Prof S.B. Msezane, Department of Adult, Community and Continuing Education, College of Education, University of South Africa. My contact number is 0724469814 and my e-mail is mia.kreusch@gmail.com. The e-mail of my supervisor is msezasb@unisa.ac.za.

Permission for the study has already been given by the Eastern Cape Department of education, principal, teacher and the Ethics Committee of the College of Education, UNISA.

You are making a decision about allowing your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

| | | |
|---|---|---|
| Mia Kreusch | _____ | 31 May 2023 |
| Researcher's name (print) | Researcher's signature | Date: |

## APPENDIX G: INTERVIEW QUESTIONS

| Interview questions for Grade 3 educators: | Answers |
|---|---|
| How many years have you been teaching for? | |
| How many years have you taught Grade 3? | |
| How many children do you have in your class this year? | |
| What is the largest amount of children you have had in your class? | |
| What is your biggest challenge in the classroom? | |
| Have you ever thought about climate change affecting the children's behaviour? | |
| Have you ever thought about climate change affecting the children's behaviour? | |
| Are you interested about finding out if there is a relationship between climate change and the learners' behaviour and academic performance? | |

## APPENDIX H: OBSERVATION SHEET

Teacher

GIRLS Observation Sheet - Morning (7:00 - 10:00)

| Date: | Date | How many girls are | Behaviour trait | Neagtive Behaviour | Talkative | Restless | Aggressive | Fiddling with objects | Plaside | Positive behaviour | Calm | Behave (Follow rules) | Respectful | Acedemic Performance | Negative performance | Unfocused | Disinterested | Struggles to particiapte | Lethargic | Positive performance | Focused | Enthuastic | Participates | Teachers comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monday | | | | | | | | | | | | | | | | | | | | | | | | |
| Tuesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Wednesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Thursday | | | | | | | | | | | | | | | | | | | | | | | | |
| Friday | | | | | | | | | | | | | | | | | | | | | | | | |

Teacher

GIRLS Observation Sheet - Mid-Morning to afternoon (10.00 - 13:00)

| Date: | Date | How many girls are | Behaviour trait | Neagtive Behaviour | Talkative | Restless | Aggressive | Fiddling with objects | Plaside | Positive behaviour | Calm | Behave (Follow rules) | Respectful | Acedemic Performance | Negative performance | Unfocused | Disinterested | Struggles to particiapte | Lethargic | Positive performance | Focused | Enthuastic | Participates | Teachers comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monday | | | | | | | | | | | | | | | | | | | | | | | | |
| Tuesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Wednesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Thursday | | | | | | | | | | | | | | | | | | | | | | | | |
| Friday | | | | | | | | | | | | | | | | | | | | | | | | |

Teacher

BOYS Observation Sheet - Morning (7:00 - 10:00)

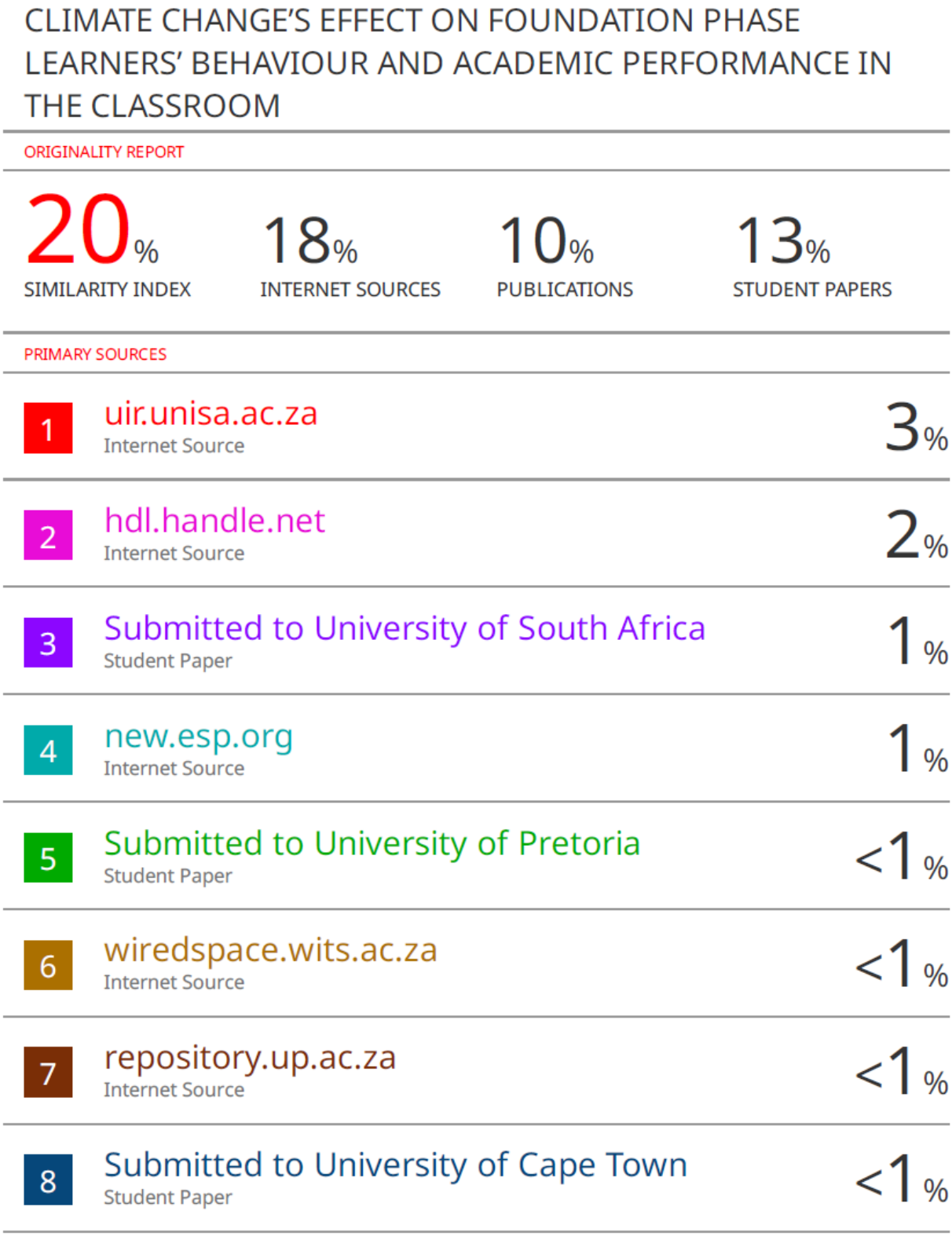
| Date: | Date | How many girls are | Behaviour trait | Neagtive Behaviour | Talkative | Restless | Aggressive | Fiddling with objects | Plaside | Positive behaviour | Calm | Behave (Follow rules) | Respectful | Acedemic Performance | Negative performance | Unfocused | Disinterested | Struggles to particiapte | Lethargic | Positive performance | Focused | Enthuastic | Participates | Teachers comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monday | | | | | | | | | | | | | | | | | | | | | | | | |
| Tuesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Wednesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Thursday | | | | | | | | | | | | | | | | | | | | | | | | |
| Friday | | | | | | | | | | | | | | | | | | | | | | | | |

Teacher

BOYS Observation Sheet - Mid-Morning to afternoon (10:00 - 13:00)

| Date: | Date | How many girls are | Behaviour trait | Neagtive Behaviour | Talkative | Restless | Aggressive | Fiddling with objects | Plaside | Positive behaviour | Calm | Behave (Follow rules) | Respectful | Acedemic Performance | Negative performance | Unfocused | Disinterested | Struggles to particiapte | Lethargic | Positive performance | Focused | Enthuastic | Participates | Teachers comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monday | | | | | | | | | | | | | | | | | | | | | | | | |
| Tuesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Wednesday | | | | | | | | | | | | | | | | | | | | | | | | |
| Thursday | | | | | | | | | | | | | | | | | | | | | | | | |
| Friday | | | | | | | | | | | | | | | | | | | | | | | | |

**APPENDIX I: TURNITIN REPORT**



CLIMATE CHANGE'S EFFECT ON FOUNDATION PHASE LEARNERS' BEHAVIOUR AND ACADEMIC PERFORMANCE IN THE CLASSROOM

ORIGINALITY REPORT

| 20% | 18% | 10% | 13% |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
|---|---|---|
| 1 | uir.unisa.ac.za<br>Internet Source | 3% |
| 2 | hdl.handle.net<br>Internet Source | 2% |
| 3 | Submitted to University of South Africa<br>Student Paper | 1% |
| 4 | new.esp.org<br>Internet Source | 1% |
| 5 | Submitted to University of Pretoria<br>Student Paper | <1% |
| 6 | wiredspace.wits.ac.za<br>Internet Source | <1% |
| 7 | repository.up.ac.za<br>Internet Source | <1% |
| 8 | Submitted to University of Cape Town<br>Student Paper | <1% |

## APPENDIX J: CONFIRMATION OF PROFESSIONAL EDITING


**Blue Diamonds Professional Editing Services (Pty) Ltd**

Polishing **your** brilliance

Email: jacquibaumgardt@gmail.com

Website: www.jaybe9.wixsite.com/bluediamondsediting


15 January 2024

**Declaration of editing**

**CLIMATE CHANGE'S EFFECT ON FOUNDATION PHASE LEARNERS' BEHAVIOUR AND ACADEMIC PERFORMANCE IN THE CLASSROOM**

by

**MIA JENNA KREUSCH**

I declare that I have edited and proofread this report. My involvement was restricted to language usage and spelling, completeness and consistency. I did no structural re-writing of the content.

I am qualified to have done such editing, being in possession of a Bachelor's degree with a major in English, having taught English to matriculation, and having a Certificate in Copy Editing from the University of Cape Town. I have edited more than 500 Masters and Doctoral theses, as well as articles, books and reports.

As the copy editor, I am not responsible for detecting, or removing, passages in the document that closely resemble other texts and could thus be viewed as plagiarism. I am not accountable for any changes made to this document by the author or any other party subsequent to the date of this declaration.

Sincerely,

**Dr J Baumgardt**
**UNISA: D. Ed. Education Management**
**University of Cape Town: Certificate in Copy Editing**
**University of Cape Town: Certificate in Corporate Coaching**

Professional EDITORS Guild 30 1993–2023
Promoting excellence in editing

**Jacqui Baumgardt**
Full Member
Membership number: BAU001
Membership year: March 2023 to February 2024
+44 789 514 6059
jacquibaumgardt@gmail.com
https://jaybe9.wixsite.com/bluediamondsediting
www.editors.org.za

ciep Intermediate Member