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Teachers' Perspectives on Climate Change Effects on Foundation Phase Learners' Behaviour and Learning

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Research Article

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Abstract

Climate change poses substantial problems to education systems around the world, and young children are particularly vulnerable to its repercussions. This qualitative case study aimed to evaluate the impact of climate-related weather changes on the behaviour and academic performance of Foundation Phase learners in primary schools in Graaff-Reinet, Eastern Cape, South Africa. Data were collected using three methods: face-to-face interviews, non-participant classroom observations and document analysis. The three Grade 3 teachers from three schools were the participants. The Theory of Planned Behaviour and Social Change Theory were the guiding theories. The results suggest that severe heat might cause tiredness, reduced focus, slower job completion and increased absenteeism whereas cold and overcast circumstances can lead to restlessness, disruptive behaviour and reduced engagement. Teachers cited insufficient instructional time, challenges in keeping learner focus and inadequate infrastructure capacity to cushion the effects of inclement weather. The study emphasizes the need for context-responsive instructional practices, enhanced school infrastructure, and teacher professional development focused on climate change adaptation. The findings contribute to the limited empirical literature on climate change and learning in early grades in South Africa and provide implications for practice for teachers, school leaders, and policymakers.

1. Introduction

Climate change is one of the most important global challenges that increasingly impact societies, economies, health systems and education (United Nations, 2022). In educational settings, learners' behaviour, concentration, emotional wellbeing, attendance and overall academic performance are affected by changing weather patterns such as extreme heat, cold, floods, droughts and strong winds (Santos & Bakhshoodeh, 2021; Vergunst & Berry, 2021). Foundation Phase learners are particularly susceptible as their capability to focus, regulate emotions, and actively engage in classroom activities is influenced by environmental discomfort and adverse weather conditions (Burke et al., 2018). Climate-related challenges, such as water shortages, flooding, overcrowded classrooms, and inadequate school infrastructure in South Africa, further exacerbate teaching and learning difficulties (Ngcoya, 2022; Phillips, 2022). This study thus explores teachers' perspectives on how climate change impacts Foundation Phase learners' behaviour and academic performance in Graaff-Reinet schools in the Eastern Cape Province. The Theory of Planned Behaviour and Social Change Theory (Ajzen, 2021) guide the study to further examine classroom management challenges and adaptive teaching strategies used by teachers to support learners during adverse weather conditions.

The purpose of this study was to investigate the effect that climate change variations have on Foundation Phase (Grade 3) learners' behaviour and academic performance at school which took place in an Eastern Cape town, Graaff-Reinet. As researchers and Foundation Phase teachers, we have noticed a noticeable pattern in learners' behaviour, academic performance, and climate change variations. By observation, on a hot day, learners seem to have little energy in class and work more slowly, whereas in winter, they seem more disruptive and louder. This sparked an interest and after a few discussions with

our Foundation Phase colleagues at the schools and other Foundation Phase teachers, it was clear to us that other teachers also noticed this. This anecdotal experience compelled us to take a step back and consider that, if we, as teachers, had a better understanding of this perception, we could better understand how learners learn and respond in specific situations. We could gain a better understanding of the child's situation to ensure successful learning in the classroom.

From what we noticed and discussed with teachers; poor behaviour was a common topic between teachers although the list of reasons differs from teacher to teacher. As researchers we 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 popular topic to discuss when temperatures rise or drop quickly (Santos & Bakhshoodeh, 2021). There are many instances in which climate is mistaken for weather, although the two are distinct. The main difference is that climate is measured over a long period, while weather is measured day to day (Brown, 2022). Climate specifically focuses on seasonal temperatures, average rainfall and different wind patterns for a specific area or the planet (Brown, 2022). The United Nations (2022) explained that, in general, climate change is a long-term change in temperatures and weather patterns. Everything on earth works as a system, meaning 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 atmospheric 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 buy, where we want to live, and the activities we want to participate in are all affected by the weather. If it is cold outside, a person will choose warm clothes rather than a swimming costume and flip-flops (Ciucci et al., 2010). How learners experience changes and various situations out of their control differs. 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 want to go inside. At times, when there is a change in the weather, their behaviour would change (Javid, 2019). Zhang et al. (2024) reported that increased weather conditions over the last eight years in China were associated with lower learners' exam marks.

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 beyond learners' control, yet it 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. Many factors influence learners' academic achievement, including mood. If a learner's mood is off, they will feel less motivated to do their work. Alfredsson et al. (2020) showed that insufficient sunlight, which provides Vitamin D, can negatively impact 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.

As researchers, we believe that climate change is a disruptive factor for learners' academic performance. Education is a crucial part of a learner's life and a country's economic growth, so the more teachers understand how climate change affects learners' performance, the better it will be for learners, the economy, and employment growth. Distraction is always present when the weather is bad, as learners tend to look out the window more and fail to 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 degrees Celsius, forcing schools to close and learners to miss out on schoolwork and development due to climate change (Prentice et al., 2024).

In our opinion, as Foundation Phase teachers, learners attend school every day and spend most of their time 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 learners. They noticed when their learners act out a little more on a specific day or if something is bothering them. Climate change will affect everyone negatively for a long time. We need to change our mindset and see how we, as teachers, can actively address the consequences of climate change for 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 that learners are louder on days when the sun is shining, have less energy when it is overcast, and speak less often when it is cold (Javid, 2019). In a study conducted in Johannesburg, Mabuza (2019) found that learners were struggling in schools due to various factors, including overcrowded classrooms, poorly ventilated classrooms, illness, poverty, and home circumstances. Climate change goes hand in hand with some of these issues. Climate change is not the only problem affecting academic performance in South Africa, but it seems to exacerbate these problems.

In this study, the researchers add to the limited body of knowledge available by focusing on the relationship between climate change and Foundation Phase learners' behaviour and academic performance. The research took place in Graaff-Reinet, Eastern Cape, South Africa. Through this

research, teachers will gain a deeper understanding 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.

Rationale and Objectives

The major challenges identified by teachers in the classroom are maintaining learners' active participation and managing learners' behaviour. They observed that weather conditions affect learners' behaviour, classroom dynamics and academic performance as well as make it difficult for learners to complete curriculum activities. This study aimed to investigate the impact of climate change patterns on learners' behavior and academic performance in schools. The study also aimed to examine the relationships among climate change, learner behaviour, and academic performance; identify the challenges faced by teachers; and suggest appropriate teaching strategies for unfavourable weather conditions. This study is important because it may help teachers, parents, and other stakeholders better understand learners' behavioural and academic responses to climate change.

2. LITERATURE REVIEW

Understanding Climate Change in Education

Climate change has become an important issue within education because it directly influences teaching, learning, learner wellbeing, and school functioning. The United Nations defines climate change as long-term changes in temperature and weather patterns that affect the environment and human life (United Nations, 2022). In the education sector, climate change is seen and affects school operations and the ability of learners to study effectively through severe temperatures, floods, droughts and changing weather conditions. According to the literature, climate change is becoming an increasing problem for teachers as learners' behaviours and academics are affected by bad weather (Santos & Bakhshoodeh, 2021). Brown (2022) further distinguishes between climate and weather, explaining that climate concerns long-term trends such as seasonal temperature and rainfall, whereas weather concerns daily atmospheric conditions. These changes in climate and weather affect learners' classroom experiences, levels of concentration, and emotional well-being.

This study further emphasises that climate change has psychosocial, physical, and pedagogical repercussions for learners. As Vergunst and Berry (2021) explain, children are quite vulnerable to the impacts of climate change. Heat waves and other environmental changes have detrimental consequences on sleep patterns, concentration, and learning. Burke et al. (2018) also believe that climate change causes mental health problems including anxiety, sadness, PTSD and behavioural problems in children. Climate-related disasters like as the floods in KwaZulu-Natal have caused substantial damage to schools, hindered access to education and caused distress among learners and teachers (Phillips, 2022; Ngcoya, 2022). Hence, this study consequently views climate change as an educational issue, requiring schools, teachers and communities to consider the impact of environmental conditions on learner behaviour, academic achievement and overall classroom experiences.

Climate Change and Learner Behaviour

The study finds that climate change has a major impact on student behaviour in the classroom. Teachers mentioned that pupils behave differently in relation to the weather conditions, especially on very hot, cold, windy or wet days. Javid (2019) mentioned that weather has a lot of influence on behavioural changes among learners sometimes without them being aware of reactions. “In hot weather, learners become lethargic and lose concentration, and they are less motivated to participate in classroom activities,” teachers said. On the other hand, when the weather is cold or windy, learners are more likely to be loud, disruptive, restless, and find it difficult to stay seated and focused. Barkin et al. (2021) further propose that bad weather restricts outdoor play during breaks, meaning learners cannot burn off surplus energy, and this in turn feeds into disruptive classroom conduct.

The results also appear to suggest a strong relationship between learner behaviour and emotional and psychological well-being. Popescu (2014) defines conduct as the way people respond and operate in daily situations. Morin (2020) mentions that difficult behaviour of learners is typically a sign of discomfort or frustration. Climate-related discomfort, therefore, influences how learners respond in the classroom. The study further notes that insufficient sunlight and adverse weather conditions negatively affect learners’ moods and motivation levels (Alfredsson et al., 2020). Teachers consistently reported that learners became distracted during adverse weather conditions, spent more time looking outside windows, and struggled to focus on teacher instructions (Park et al., 2020). These behavioural changes demonstrate that climate change not only affects the physical environment but also shapes learners' emotional regulation, social interaction, and classroom conduct.

Academic Performance and Climate Change

The study demonstrates that climate change negatively affects learners’ academic performance by disrupting concentration, motivation, attendance, and cognitive functioning. Woolfolk (2014) explains that academic performance is directly linked to learning processes and behavioural changes. Extreme temperatures and weather patterns can create an uncomfortable environment for learners and hinder their capacity to process knowledge and stay engaged with classroom activities. The study underscores that learners work slowly, become weary quickly, and find it difficult to pay attention in class during hot weather. This is further supported by Zhang et al. (2024), who found that as temperatures increased in China, learner examination results decreased. Likewise, Briones et al. (2022) argue that learners’ moods significantly affect academic achievement, as negative emotional states decrease motivation and productivity.

Climate-related disturbances also impair school attendance and continuity of learning. Prentice et al. (2024) found that in Sudan, schools had to shut down when temperatures rose above 45°C, leading learners to miss out on key educational work and developmental opportunities. In South Africa, flooding affected schools, roads, and bridges in KwaZulu-Natal, therefore, prohibiting learners from attending school and affecting teaching and learning (Phillips, 2022; Ngcoya, 2022). Randell (2019) further emphasizes that drought-related duties, such as gathering water or moving closer to water sources, may

lead rural learners to miss school. These interruptions cumulatively lead to a decline in academic achievement, as they cause learners to miss critical instructional time and make it difficult for them to maintain regular involvement in school activities.

Classroom Dynamics in Adverse Weather Conditions

This research indicates that bad weather significantly alters classroom interactions and the overall learning environment. Teachers stated that harsh weather circumstances had a significant impact on learner engagement, participation, energy levels, and classroom conduct. Learners were generally passive, weary, and unable to concentrate for lengthy periods during hot weather. Colder temperatures led to higher noise levels, restlessness, and disruptive behaviour (Javid, 2019). This study also revealed that unfavorable weather conditions increased classroom distractions as learners paid more attention to external environmental circumstances than to classroom work. According to Park et al. (2020), when the weather is bad, students gaze out of the windows, paying less attention to the teacher's directions and classroom activities.

Classroom dynamics were further impacted by physical and environmental constraints related to climate change. Mabuza (2019) noted that extreme weather conditions exacerbate learning environments, including overcrowded classrooms, sickness, poverty, poor ventilation, and inadequate school infrastructure. Climate change exacerbates current educational issues by making classrooms uncomfortable and challenging for learners and teachers alike. The study also highlighted that weather-related constraints during break time prevented learners from releasing energy outdoors, leading to increased behavioural issues in classrooms (Barkin et al., 2021). As a result, teachers struggled to maintain discipline, motivate learners, and complete the planned lessons in poor weather. These findings imply that climate change impacts individual learners and alters the collective classroom environment and teaching-learning exchanges.

Challenges in Teaching and Learning about Climate Change

Many obstacles to teaching and learning about climate change were mentioned by teachers in this study. One of the biggest problems was maintaining learner discipline and concentration in poor weather. The teachers reported that, whether temperatures were very high or very low, the pupils had difficulty staying on task, were easily distracted, and frequently lacked the ambition to finish assignments in the classroom. The survey found that teachers often found it challenging to complete curricular topics, as interruptions and behavioural issues in the classroom take up important teaching time. As Javid (2019) observed, teachers often noted that the weather seemed to correlate directly with learner behaviour and classroom efficiency.

Climate change also poses structural and socio-economic challenges that negatively impact education. Randell (2019) explained that extreme weather events can damage school buildings, roads, and transit systems, leading to school closures and interrupted learning. In South Africa, floods severely damaged schools in KwaZulu-Natal, preventing schools from reopening after the holidays (See Fig. 1) and limiting

learners' access to education (Phillips, 2022; Ngcoya, 2022). Furthermore, climate change exacerbates educational inequities because many schools already face overcrowding, inadequate ventilation, and limited resources (Mabuza, 2019). The research teachers also observed that learners' absenteeism increased under severe weather conditions, therefore making it difficult to maintain continuity in teaching and assessment. These problems illustrate that climate change influences the educational environment and the larger process of teaching and learning.

Theoretical Framework

As shown in Fig. 2, the study was guided by two theoretical frameworks, namely the Theory of Planned Behaviour (TPB) and Social Change Theory (SCT). Ajzen (2021) describes a theoretical framework as a formal structure that helps researchers understand and interpret a research phenomenon. The Theory of Planned Behaviour was used to explain how learners' behaviours and responses may change under different climatic conditions. According to Alhamad and Donyai (2021), TPB helps explain how individuals modify their behaviour in specific situations. The theory comprises the attitudes, subjective standards and perceived behavioural control that influence behavioural intents and acts (Janse, 2023). This study employed TPB to understand learners' behaviour and academic responses to shifting weather patterns and climate-related disruptions in the classroom setting.

The Social Change Theory complements the TPB by concentrating on the impact of social structures and interactions on human conduct in changing environmental conditions. De La Sablonnière (2017) defines social change as the process of change in human interactions, relationships, and social systems across time. Sociology functionalism within SCT says that institutions such as schools and families affect the behaviour of individuals and social stability (Parsons, 2018). For this study, SCT was used to understand the collective responses of teachers, schools, and parents to climate-related challenges affecting learners. Teachers were viewed as central social agents who influence learners' behaviour and support systems within the school environment. By combining TPB and SCT, the researcher was able to analyse both individual behavioural responses and broader social influences associated with climate change and learner academic performance.

3. RESEARCH METHODOLOGY

3.1 Research Paradigm, Approach, and Design

This study was based on the interpretivist paradigm and used a qualitative case study design to investigate learners' behaviour, interaction and academic performance with respect to changing weather conditions. A research paradigm offers a set of assumptions and philosophies that direct the research process (Creswell, 2022), whereas the interpretivist paradigm emphasises comprehension of individuals' perceptions and experiences in their social settings (Santosh, 2021). The qualitative approach was suitable as it allowed the researcher to investigate and interpret the experiences and the meanings attached to the participants' experiences of climate-related changes in learners' behaviour and academic

performance (Creswell, 2022). This study reflected key characteristics of qualitative research identified by McMillan and Schumacher (2009): natural settings, participant perspectives, context sensitivity, direct data collection, inductive data analysis, and rich narrative descriptions.

The researcher observed learners in their own classrooms, conducted face-to-face interviews, and tracked their experiences over time, enabling the researcher to identify themes and patterns related to climate conditions. The study also adopted a collective case study design, as described by Yin (2013) as an in-depth examination of a phenomenon within its real-life context. According to Schoepf and Klimow (2022), case studies involve analysing multiple cases to provide deeper explanations of a particular situation. The multiple schools and teachers enabled comparison across cases and created a broader understanding of how climate change influences learners' behaviour and academic performance.

3.2 Study Site

The study was conducted in Graaff-Reinet, a town in the Eastern Cape Province of South Africa, within the Great Karoo region, and surrounded by the Camdeboo National Park (Atkinson & Ingle, 2009). Graaff-Reinet is one of the oldest cities in South Africa, and experiences varied climatic conditions across seasons, with very hot summers and very cold winters (Graaff-Reinet Tourism, 2023). There are about 15 schools in the community, of which 3 were selected for the study. The researcher chose Graaff-Reinet as her place of residence because it was the community where she could more easily access schools for interviews and observations. The varying weather conditions in the area made the town suitable for investigating how climate change affects Foundation Phase learners' behaviour and academic performance.

3.3 Participants

As a qualitative study, three Grade 3 teachers from three separate primary schools in Graaff-Reinet participated. These teachers were selected because they work with Foundation Phase learners regularly and are best placed to detect changes in learner conduct and academic achievement under varied weather conditions. The researchers chose Grade 3 pupils precisely since one of us was also a Foundation Phase teacher and had firsthand experience with this age group. The participating teachers monitored learners in all Grade 3 topics, namely Mathematics, Home Language, First Additional Language and Life Skills, while recording behavioural and academic changes in relation to climate conditions.

3.4 Sampling Procedure

Participants and schools were selected for the study using convenience sampling. Convenience sampling is employed when participants are readily available and accessible to the researcher, as Stratton (2021) states. The researcher selected three schools from the 15 in Graaff-Reinet based on proximity and accessibility, enabling effective data collection and regular visits. Each school's Grade 3 teacher was included in the study. Two of the selected schools were quintile 3 schools, and one was a quintile 5 school, which allowed the researcher to compare distinct school contexts and student

circumstances. The sample technique enabled the researcher to gather extensive observations and experience on climate change, learner behaviour, and academic performance.

3.5 Data Collection Methods

3.6.1 Interviews, document analysis, and observations

Data collection is a systematic procedure for gathering information by researchers to gain first-hand knowledge of a specific issue (Carr et al., 2019). Various methods can be employed in this process. These include observations, interviews, surveys and document analysis. In this study, the researchers used observation, face-to-face interviews, and document analysis to evaluate the impact of climate change on learners' behaviour and academic achievement. The researchers were able to understand the happenings in the natural classroom setting through observation with minimal disruption (Kumar, 2022). Teachers first participated in face-to-face interviews, during which they shared their personal experiences and perspectives on climate change and learner performance. Thereafter, teachers completed daily checklists for one month in each season, recording learners' behaviour and academic performance twice daily. Since teachers interacted closely with learners, they were considered the most suitable observers. The researchers also acted as a non-participant observer, visiting the schools regularly while remaining detached from classroom activities to ensure naturalistic observation conditions (Kumar, 2022; Hofmeister, 2021).

Face-to-face interviews allowed the researchers to engage directly with participants, making it easier to understand teachers' feelings, attitudes, and experiences regarding the classroom impact of climate change (McMillan & Schumacher, 2009). Through these interviews, the researchers could also observe body language and other social cues, enriching the data collection process (Creswell, 2022). Interviews were recorded and transcribed to ensure accurate analysis of participants' responses. In addition, document analysis was used to interpret and organise information collected from teachers' observations and recorded experiences (Bowen, 2009). The researcher analysed these documents to identify recurring themes and relationships within the data while ensuring the authenticity and trustworthiness of the information (Morgan, 2022). Using multiple teachers from different schools also reduced the possibility of bias and provided broader perspectives on the same phenomenon. All interview and observation data were carefully examined to ensure relevance and support meaningful thematic analysis of the study findings.

3.6 Data Analysis

McMillan and Schumacher (2009) state that qualitative data analysis comprises several procedures, including organising, transcribing, coding, categorizing, and identifying patterns in the data. In this study, the data was analysed monthly in smaller sections, which assisted the researchers in identifying patterns and themes before drawing final conclusions and recommendations from the overall findings. In this study, interview notes were organised into categories and typed immediately after each interview. The researchers then coded meaningful sections of the data to identify participants' perspectives,

activities, relationships, and experiences. Similar codes were sorted into themes and categories, enabling the researcher to find patterns and linkages among participants' responses. To ensure the analysis's trustworthiness, triangulation and cross-analysis were also applied.

Thematic analysis is a qualitative method that identifies themes, patterns, and similarities within the data collected, such as field notes and interviews (Kiger & Varpio, 2020). Thematic analysis was undertaken according to the six-step process described by Thomas and Harden (2008): familiarisation; coding; generating themes; reviewing themes; defining and naming themes; and writing up. The researchers reviewed the interview notes and relevant literature multiple times to become comfortable with the data. Subsequently, large parts of the data were classified and organised into broader themes based on recurring ideas and meanings. The themes were then assessed to verify they were a good fit for the data obtained before being explicitly defined and titled. Finally, the findings were written and presented in the results section, while the conclusion summarised the major themes and their relevance to the study.

3.7 Ethical Considerations

Key ethical issues include voluntary participation, where participants are informed that they may withdraw at any time; informed consent, where participants receive full information about the study before agreeing to take part; anonymity, where identifying personal details are not collected or disclosed; and confidentiality, where participants' identities are protected by using pseudonyms for schools and teachers in the final report. Ensuring that the participants do not have to answer uncomfortable questions, are able to withdraw from any part of the study, and reducing the likelihood of potential harm (psychological, social, physical or legal); and ensuring accurate and responsible communication of results (Dudovskiy, 2022). Ethical approval for this study was acquired from the University of South Africa ethics committee, approval was received from school administrators, and informed consent was gained from participating teachers. The researchers secured individual learners' data in strict confidence and ensured ethical standards were adhered to throughout the research process.

3.8 Credibility and Trustworthiness

Norman and King (2020) describe core concepts of qualitative rigour that were applied in this study to achieve credibility and trustworthiness. Use of rigorous data collection processes (interviews and observations) and careful arrangement, classification and thematic analysis of data increased credibility and helped guarantee conclusions represented participants' responses. The transferability of the study was strengthened by providing rich explanations of the research context and processes, allowing readers to transfer the findings to similar educational contexts. Confirmability was achieved by creating an audit trail of all data collection and processing phases and by anchoring the findings in participants' responses rather than in the researcher's bias. Dependability was achieved by following a clear, consistent research strategy that involved regularly assessing data analysis techniques to confirm the stability and accuracy of findings over time. Additionally, authenticity was preserved by accurately

reflecting participants' viewpoints and experiences, ensuring the final report mirrored the teachers' voices.

4 Limitations and Delimitations

Limitations and delimitations of this study are distinguished by the level of control the researcher has over them, although both refer to boundaries that influence the research process (Simon & Goes, 2020). Limitations are uncontrollable factors that may affect the study's outcomes, such as time constraints, participant responses, and the unpredictability of both human behaviour and environmental conditions (Miles, 2019). Limitations of this study included the use of questionnaires and checklists, which would have limited participants' ability to give thorough explanations and the risk of incomplete or inconsistent responses. The findings were further limited in their generalisability by the unpredictable nature of climate and weather, the different ways in which observations were interpreted, and the fact that the study was conducted in schools in one town. The limitation of the study was the sole focus on Grade 3 learners. Delimitations, however, were deliberately established by the researchers to define the study's scope in accordance with its objectives and research questions. These included selecting only Grade 3 learners, limiting the number of teachers to one per school, and restricting the study to a limited geographic area to enable depth of analysis and manageable data collection.

4. Data Presentation, Findings, and Discussion

Theme	Focus of Theme	Key Issues Identified Across Cases	Overall Interpretation
Theme 1: Teachers' perceptions of learner behaviour during weather changes	Examines how different weather conditions influence learner behaviour and academic performance	Extreme heat, cold, wind and humidity caused drowsiness, restlessness, anger, talkativeness and poor focus. Boys were more likely to be disruptive. The moderate temperatures helped with concentration and behaviour.	Learner behaviour is quite responsive to weather fluctuation, and attention, engagement and classroom performance are all directly impacted.
Theme 2: Strategies implemented by teachers during adverse weather conditions	Explores how teachers adapt teaching when learners cannot go outside or are affected by weather conditions	Use of indoor brain breaks, exercise activities, interactive classes and adaptable teaching approaches and behaviour management. Teachers differed in the way they used methods (supporting, structured or reflective).	The tactics used by teachers to keep learners engaged are adaptive and flexible but depend on the situation and the teacher's experience.
Theme 3: Challenges faced by teachers in the classroom	Identifies key barriers affecting teaching and learning effectiveness	Disruptive behaviour, bullying (particularly amongst the guys), overcrowded classes, absenteeism, time difficulties, load shedding and water shortages.	Behavioural, environmental and infrastructural issues are inter-related and impede teaching and learning, hence reducing instructional time and learner achievement.

Source: Author

4.1 Theme 1: Teachers' perceptions of learner behaviour during weather changes

4.1.1 Case 1: Mrs. Ready (pseudonym)

The seasonal and weather changes had a huge impact on the behaviour and academic performance of learners, said Mrs Ready. Extreme heat and humidity led to lethargy, restlessness, poor concentration and an increase in aggression, particularly among boys, while girls were more talkative but coped a little better. These findings were substantiated by Lala and Hagishima (2023), who found that heat waves negatively affect learner health and learning, and by Swanson and Witte (2022), who found that 23–24°C was the ideal temperature for learner performance, which aligned with Mrs. Ready's observation that learners were calmer and more focused within this range. She further noted that autumn conditions were more stable and conducive to learning, while winter and windy conditions increased absenteeism, disruption, illness, and behavioural challenges, with boys generally showing higher levels of aggression and girls becoming slower or more talkative.

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 can cause them to get sick, become dehydrated, experience heat exhaustion, become more irritable, and lose focus much more quickly than on 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, were 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 as researchers we can see how the heat influenced her class's behaviour and their motivation to stay focused on their work. Hence, as researchers, we are certain that this slowed down the learning process, and we believe the learners would not absorb all the information, which means the teacher must reteach the material at a later stage, thereby leaving learners further behind in terms of the curriculum and expectations. Overall, fluctuating spring conditions created inconsistent concentration and behaviour, confirming that weather variability significantly disrupts classroom stability and learner engagement.

4.1.2 Case 2: Mrs. Book (pseudonym)

When investigating another teacher in Case 2, it was found that extreme weather conditions had a negative impact on learners' behavior and concentration, especially heat above 32°C, said Mrs. Book, as boys tended to become aggressive and all learners lethargic, with poor concentration and less engagement with academic work under such conditions. Girls were found to be slower and more talkative under humid conditions. These findings were reinforced by Mahlokwane (2023), who stated that learners from low-income, resource-constrained families are more exposed to climate change impacts, and by Aizenman (2023), who suggested that extreme heat increases hostility and lowers learners' concentration. She further observed that water shortages and drought conditions significantly

disrupted learning through absenteeism and dehydration, while load shedding and reduced daylight in autumn mornings also contributed to learner restlessness and loss of routine. The learners' school journey will continue to be affected by 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 In winter, cold and rainy conditions increased absenteeism due to illness, lack of proper clothing, and safety concerns, while wind and fluctuating spring weather further intensified behavioural instability, especially among boys, although Jarrett (2022) questioned the direct academic impact of wind on learners.

4.1.3 Case 3: Mrs. Warm (pseudonym)

Regarding the teacher in Case 3, she indicated that students from a rural, high-poverty community were greatly affected by harsh temperatures, water shortages, and seasonal changes. Mrs. Warm noted that the students were lethargic, chatty, and aggressive, and had poor concentration, especially in hot, humid summer settings. Janse Van Vuuren (2022) corroborated her observations by linking the protracted drought and water problems experienced in Graaff-Reinet to climate change, which explained the contextual challenges that affected learner attendance and well-being. She also found that changes in autumn temperature, load shedding, and cloudy conditions disturbed classroom procedures. Rainy days reduced attention as pupils were distracted by the weather. Cold winter extremes led to increased illness absences, limited access to clean clothes, and restricted movement, while Wong (2023) confirmed the assumption that rainy conditions have a detrimental impact on learner mood, motivation, and involvement. Additionally, windy conditions increased boys' aggression and reduced concentration among girls, while spring remained the most challenging period due to constant weather variability, although Cimons (2023) noted that learners often struggle to regulate behaviour and adaptation during fluctuating environmental conditions.

The weather in autumn changed regularly. 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 the temperature is 21 degrees Celsius or slightly below, learners tend to be calm and their concentration levels are more settled, but if the temperature gets too cold, learners

will start to feel 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 3 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°.

4.1.4 Similarities and differences amongst the cases

For Theme 1, across all three cases (Mrs. Ready, Mrs. Book, and Mrs. Warm), a key similarity is that extreme weather conditions significantly influenced learner behaviour and academic performance. All teachers observed that high temperatures and humidity led to lethargy, restlessness, and talkativeness, and to poor concentration, while colder conditions often led to increased talkativeness, a slower work pace, or disengagement. It was also shown that boys were more frequently reported to be affected in terms of hostility and disruptive behavior, especially during high heat, cold or changeable weather conditions. Also, all teachers said that variations in weather significantly influenced learners' capacity to concentrate, complete work and maintain consistent conduct, often resulting in worse academic achievement in different seasons.

However, despite these commonalities, there were also notable variances in the experience of learner behaviour across the situations. Mrs. Ready was more emphatic about the seasonal variation and temperature cut-offs, especially emphasising the best learning conditions at about 22–25°C and the variations between boys' and girls' reactions. Other contextual and infrastructural factors, such as water shortages, load shedding and socio-economic issues that exacerbated the behavioural disruptions, were brought to the fore in the case of Mrs. Book, apart from weather circumstances. But Mrs. Warm said that the combined effect of climate fluctuation and rural poverty-related issues, such as overcrowding, absenteeism, and a dearth of resources at the community level, aggravated behavioural challenges. All teachers reported weather-related behavioural disruptions, although their experiences varied in focus, from the effects of temperature to the combination of environmental and infrastructure stressors to wider socio-economic vulnerability.

4.2 Theme 2: Strategies Implemented by Teachers during Adverse Weather Conditions

4.2.1 Case 1: Mrs. Ready

Adverse weather circumstances, such as heavy rain, intense heat, strong winds and frigid temperatures, often meant learners were unable to walk outside for break time, which significantly affected their ability to release energy and restore attention during classes, said Mrs. Ready. According to Kroeker (2022), she realised the value of outdoor breaks for learners' physical, social, and cognitive development and

therefore incorporated alternate brain-break tactics within the classroom to assist in maintaining learner attention and engagement. She also emphasised the need for inclusive teaching approaches and effective communication with learners and parents. This aligns with Chakraborty (2023), who stresses the value of teacher–learner relationships and emotional support. In addition, she recognised that break time was equally important for teachers, allowing them to rest, reflect, and engage with colleagues.

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 trickier, 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 to interact with others, and develop empathy, skills also associated with academic achievement.

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 floods, 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 that classroom movement is very important for a child's body, and that 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 improve learners' academic performance.

4.2.2 Case 2: Mrs Book

Mrs. Book reflected that keeping learners inside during break time as a disciplinary measure negatively affected their behaviour and academic performance, which made her realise the importance of structured brain breaks, especially during adverse weather conditions when learners could not go outside. Without consistent breaks, she found that learners tend to be less attentive and more disruptive, particularly in hot, cold, or wet conditions, necessitating that she modify her teaching approach to include more movement-based, engaging class activities, as supported by Youngman (2023). She also noted that learners struggled to concentrate in excessive heat, cold and rain and became restless and distracted. She had to adapt her classes to keep learners engaged and avoid wasted learning time. She

admitted that teachers need to change their approach to support learners' re-focusing and manage concentration issues related to weather-related disturbances, following Brookman-Byrne (2023).

Teachers will have to go back and reteach the concept, which takes more time. They should focus on ensuring that what has been taught, even if only a small amount, is fully understood. Mrs. Book 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, learners' brains focus more on their body temperature than on what is happening around them, which means their 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 increasingly and need to make sure that the learners are focusing on what is being expected of them.
Brain breaks are beneficial in cold or stormy weather, as they are in extreme heat. 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, helping learners stay warmer than 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.

When observing the class on a given day, the approach should be to achieve the best outcome. If learners struggle to concentrate for long periods and there is a lot of work to get through, it may be useful to divide it into smaller tasks, with regular breaks to refresh the brain. Assessing the ability to concentrate on a topic later and merging it with another can be a strategic decision. The goal is to ensure learners' success.

4.2.3 Case 3: Mrs. Warm

Mrs. Warm noted that harsh weather conditions had a huge impact on student behaviour and academic engagement, and teachers were required to use flexible and inventive techniques to support learners when they were unable to walk outside during break time. Referring to Lala and Hagishima (2023), she stated that elementary school learners are particularly vulnerable to the impacts of climate and weather changes, and therefore, teachers must adapt their classroom activities to meet their needs. She further

emphasized the necessity of emotional regulation and classroom management, as discussed by Gildharry (2023) and Ali et al. (2022). They stressed the importance of setting limits, upholding norms, and imposing fair penalties. In order to address the reduced focus as proposed by Bell (2023), she included alternate brain-break activities, including movement exercises, music, drawing, and games, so that learners may be in a state of engagement and emotional balance in spite of the unfavourable weather conditions.

4.2.4 Similarities and differences amongst cases

In Theme 2, across all three cases (Mrs. Ready, Mrs. Book, and Mrs. Warm), a key similarity is that all teachers had to adapt their teaching strategies when learners could not go outside for a break due to adverse weather conditions such as extreme heat, cold, wind, and rain. In all cases, teachers recognised the importance of brain breaks and learner movement and therefore implemented alternative indoor strategies to help learners regain focus and reduce restlessness. Another shared strategy was the use of interactive and engaging classroom activities (e.g., movement-based tasks, discussions, or informal learning breaks) to manage learners' concentration difficulties when outdoor play was not possible. All teachers also demonstrated an awareness that learners' behaviour during these periods was often beyond their control, requiring flexibility and responsive teaching approaches to maintain classroom engagement.

Despite these similarities, there were substantial variances in how teachers implemented their ideas. Mrs. Ready highlighted the importance of building a caring and inclusive classroom where learners' well-being is a priority, as well as of communicating with parents; however, she also agreed that break time is crucial for learners and teachers. Mrs. Book nevertheless learned solutions through trial and error, first by cutting break time as a punishment and then understanding the detrimental impact of this, eventually introducing structured brain breaks and adapting teachings to keep participation. Mrs. Warm's teaching became more thoughtful and adaptive, emphasising emotional management, classroom control, and a broader array of structured alternatives, including games, music, sketching, and movement exercises. All teachers used brain breaks and adaptive tactics. The use of these ranged from supportive communication to experiential adjustment to regimented, emotionally regulated classroom management.

4.3 Theme 3: Classroom management challenges

4.3.1 Case 1: Mrs. Ready

Major problems reported by Mrs. Ready included classroom issues such as disruptive conduct, bullying, and frequent fighting (particularly with boys), which cut into teaching time and required regular punishment and classroom management. The findings are consistent with Kroeker (2022), who observes that bullying and physical fights have increased among younger pupils, and Hussaini (2023), who argues that harsh weather conditions can exacerbate disruptive behaviour and impact academic achievement. She also struggled with large class sizes, time constraints, learner absenteeism due to weather-related

issues, and disruptions from load shedding and school events that reduced teaching time and made it harder to provide personalized support to learners.

These learners are affected by climate change because, on days when it suddenly gets hot, they cannot concentrate as well, which leads them to stop listening and fall further 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).

Additionally, winter absenteeism linked to cold weather and poor living conditions contributed to learners falling behind academically, reflecting broader patterns of climate vulnerability in education (Kearney et al., 2022).

4.3.2 Case 2: Mrs. Book

Mrs Book reported on the continuing disciplinary challenges, including more frequent bullying, shouting, and fighting, particularly among boys, which reduced teaching time and disturbed the delivery of lessons. Herman et al. (2022) reinforce these challenges by arguing that disruptive behaviour negatively affects classroom surroundings and learning time. She also experienced student absence due to excessive heat, water shortages, lack of clean uniforms, and load shedding, which hindered learner attention and academic achievement. Zali (2023) reinforces these observations by indicating that excessive heat negatively affects the health, behaviour and concentration of learners, particularly when coupled with environmental stressors such as water scarcity. When extreme weather events occur, these learners are directly affected, as they may not be able to access their school due to bridges being washed away or roads being destroyed. Children may stay at home to help support the household, but they also face the added burden of disease 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, some learners are absent the next day because 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 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.

4.3.3 Case 3: Mrs. Warm

Mrs. Warm identified disruptive conduct, bullying, and fighting – especially among boys as major challenges that cut down on teaching time and impeded curriculum coverage. Similar results are obtained by Wangdi and Namgyel (2022), who argue that disruptive behaviour negatively impacts student achievement and instructional time. She also struggled with overcrowded classrooms as learners became more talkative and less focused, making it hard to support high- and low-performing learners effectively. This aligns with Siyoba (2023), who states that overcrowding reduces the quality of teaching and learners' performance. Absenteeism due to extreme weather, illness, and home situations further hindered learning. This is consistent with Hussaini (2023), who cites various climate-related factors influencing school attendance. Overall, these combined challenges resulted in significant learning losses and increased pressure on the teacher to manage behaviour, attendance, and curriculum demand simultaneously.

Chersich and Rees (2019) reported in a study involving 18 schools that learners were in overcrowded classrooms where the temperature exceeded 30° Celsius every day. These learners' test scores were 20% lower than those of learners in a classroom where the temperature was 20 Celsius, and the 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 when teaching a specific concept, leading learners to miss 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 must relocate due to the impacts of climate change.

4.3.4 Similarities and Differences Amongst Cases

In Theme 3, across these three situations, we see a few striking commonalities in the classroom issues they face. Firstly, all three teachers mentioned disruptive behaviour as a key difficulty, and this resulted in a lack of focus, numerous disruptions to sessions, and yelling out, and hence a great reduction in teaching time and learner engagement. Secondly, bullying and fighting were constantly reported in all cases, especially among guys, and teachers had to invest a lot of time in managing conduct instead of teaching. Thirdly, all the teachers faced time limits and lost instructional time since they had to deal with discipline problems, give repeated explanations and manage the classroom rather than finishing their planned lessons.

Another major similarity was the problem of learner absence. This was linked to external factors, such as extreme weather conditions, illness, and family situations, which led learners to fall behind academically across all three schools. Moreover, all teachers also mentioned challenges associated with overcrowded classes and varied ability levels, which made it challenging to provide individual attention and support to all learners. Disruptions to the environment and infrastructure, such as load shedding, water shortages, and harsh weather, were prevalent issues that further decreased the effectiveness of instruction and contributed to learner disengagement. Overall, although teachers came from different schools, they faced closely linked difficulties that combined to impact on teaching time, learner behaviour and academic performance.

5. Summary of Major Findings

The first theme shows that the study discovered that weather conditions significantly affect learner behaviour and academic achievement. In all three cases, teachers consistently reported that excessive heat, cold, wind, and humidity had a detrimental impact on learners' focus, conduct, and engagement. Depending on the weather conditions, learners were lethargic, restless, talkative, or violent, and boys generally showed higher levels of disruptive and aggressive behaviour. By contrast, moderate temperatures (about 22–25 degrees Celsius) were related to improved focus, better conduct, and increased academic engagement. These results show that student conduct is quite responsive to environmental changes that directly affect classroom performance.

In Theme 2, the study also found that teachers had to employ adaptive strategies to cope with teaching in severe weather circumstances. Since learners typically could not walk outside for break time, teachers used indoor brain breaks, movement-based activities, interactive teaching, and creative engagement tactics to refocus learners. All teachers agreed they needed to change their teaching strategies to maintain attention and manage disturbances caused by weather issues. But there were variations in the application of tactics from supportive and inclusive to rigid behavioural interventions and reflective classroom management practices.

Finally, the data showed that teachers face several interconnected classroom obstacles, exacerbated by environmental and contextual factors, as indicated in Theme 3. Some of the key issues were disruptive behaviour, bullying and fighting (particularly among boys), overcrowded classrooms, learner absenteeism, and time constraints limiting curriculum coverage. These issues were further worsened by external circumstances such as load shedding, water shortages, and extreme weather, which reduced teaching time and negatively impacted learner participation. The study demonstrates that these problems are interconnected and cumulatively result in decreased teaching effectiveness and learner underperformance in all instances.

6. Implications for Education

The study's findings have substantial implications for education, especially in connection to teaching practice, school management and policy formation. They emphasise the necessity for climate-responsive education systems that consider that weather conditions have immediate effects on learner behaviour, focus, attendance and academic performance. Teachers need continual professional development to enable them to adopt adaptive classroom practices, such as brain breaks, flexible delivery of lessons and behaviour control techniques that respond to environmental disruptions. Schools also need to develop support mechanisms to manage difficulties such as load shedding, water shortages, overcrowding, and learner absence, as these variables compound the effects of severe weather on learning. Furthermore, education stakeholders and policymakers may explore incorporating climate awareness and resilience measures into school planning and curriculum design to ensure continuity of learning under changing climatic conditions.

7. Recommendations

7.1 Suggested teaching strategies during adverse weather

Teachers should adjust their teaching practices to be flexible and adaptive to the learners' lower attentiveness and behavioural shift under extreme weather conditions. This includes brain breaks, movement-oriented activities, interactive learning assignments, group discussions, and imaginative ways to engage learners when they cannot go outside. Lessons should also be shortened or broken up in extreme heat, cold, or rain to retain focus. Teachers should keep their pacing to their needs and employ learner-centered strategies that make learners active participants, even in unfavourable weather conditions.

7.2 School support mechanisms

Schools need to create formal support structures to help teachers manage weather-related disruptions. This involves having contingency plans for load shedding, water shortages and adverse weather conditions in place, and offering resources such as alternative learning materials and indoor activity kits. Schools can also consider flexible timetabling during periods of extreme weather and professional development for teachers on climate-responsive classroom management. Furthermore, schools should enhance support for the wellness of learners by assuring access to fundamental necessities during crises (e.g. availability of water and secure learning spaces).

7.3 Parent and stakeholder involvement

Support for learners affected by climate-related challenges should involve parents and stakeholders. Schools should improve communication with parents about absenteeism, weather disruption, and learner assistance needs. Parents should be motivated to make sure learners attend school as much as possible and are sufficiently equipped for the weather conditions (e.g. correct clothing, hygiene needs). Schools should work with community stakeholders, such as local education authorities and service

providers, to address concerns related to water shortages, infrastructure disruptions, and transit difficulties that contribute to absenteeism and poor student performance.

7.4 Climate-responsive classroom practices

Teachers should adapt classroom procedures according to changing weather conditions and their impact on student conduct. This includes providing controlled yet flexible learning environments, embedding environmental awareness into classes, and offering indoor, safe physical and cognitive activities during inclement weather. Teachers should also keep a careful eye on learner behaviour and employ proactive classroom management tactics that discourage disruption. Lessons should be planned to accommodate varying attention spans, ensuring that high- and low-performing learners remain engaged regardless of environmental conditions.

8. Conclusion

In conclusion, this study showed that weather conditions are a major factor influencing how learners behave, engage, and perform academically in the primary school classrooms. All three reported sensitivity to environmental changes, with excessive heat, cold, wind, and humidity contributing to increased restlessness, anger, talkativeness, and decreased attention. In contrast, moderate and steady temperatures were observed to improve behaviour and boost academic focus. These findings support the notion that external environmental factors, in addition to teaching techniques, can enable or impede successful teaching and learning and thereby impact classroom learning.

This study also found that teachers need to continually adapt their teaching methods to offset the impact of severe weather and address broader issues such as overcrowding, absenteeism, load shedding, and water shortages. Teachers used several coping tactics, such as classroom brain breaks and interactive activities, but the persistent nature of these issues indicates a need for greater institutional and systemic support. This study highlights the need to develop climate-responsive educational methods and to increase school and stakeholder engagement to enable effective teaching and learning despite environmental disruption. Climate change has significant psychosocial, physical, and pedagogical repercussions for learners in primary school settings. Psychosocially, it affects learners' emotional wellbeing, behaviour, motivation, and social interactions, often resulting in anxiety, irritability, and reduced engagement in learning activities (Burke et al., 2018; Vergunst & Berry, 2021). Physically, extreme weather conditions such as heatwaves, cold spells, and rainfall negatively affect learners' comfort, concentration, attendance, and overall health, thereby disrupting their ability to participate fully in classroom activities (Santos & Bakhshoodeh, 2021; United Nations, 2022). Pedagogically, these challenges place additional pressure on teachers to adapt instructional strategies, manage classroom behaviour, and maintain academic continuity despite environmental disruptions, thereby affecting the quality and effectiveness of teaching and learning (Phillips, 2022; Ngcoya, 2022).

Declarations

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Clinical Trial Number: Not Applicable

Ethics, Consent to Participate, and Consent to Publish declarations: The study received ethics approval from the University of South Africa Ethics Committee, and participant consent was obtained

Data Availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request

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Figures



Figure 1

A road that has been destroyed in KwaZulu-Natal due to the floods in 2022

Source: Author

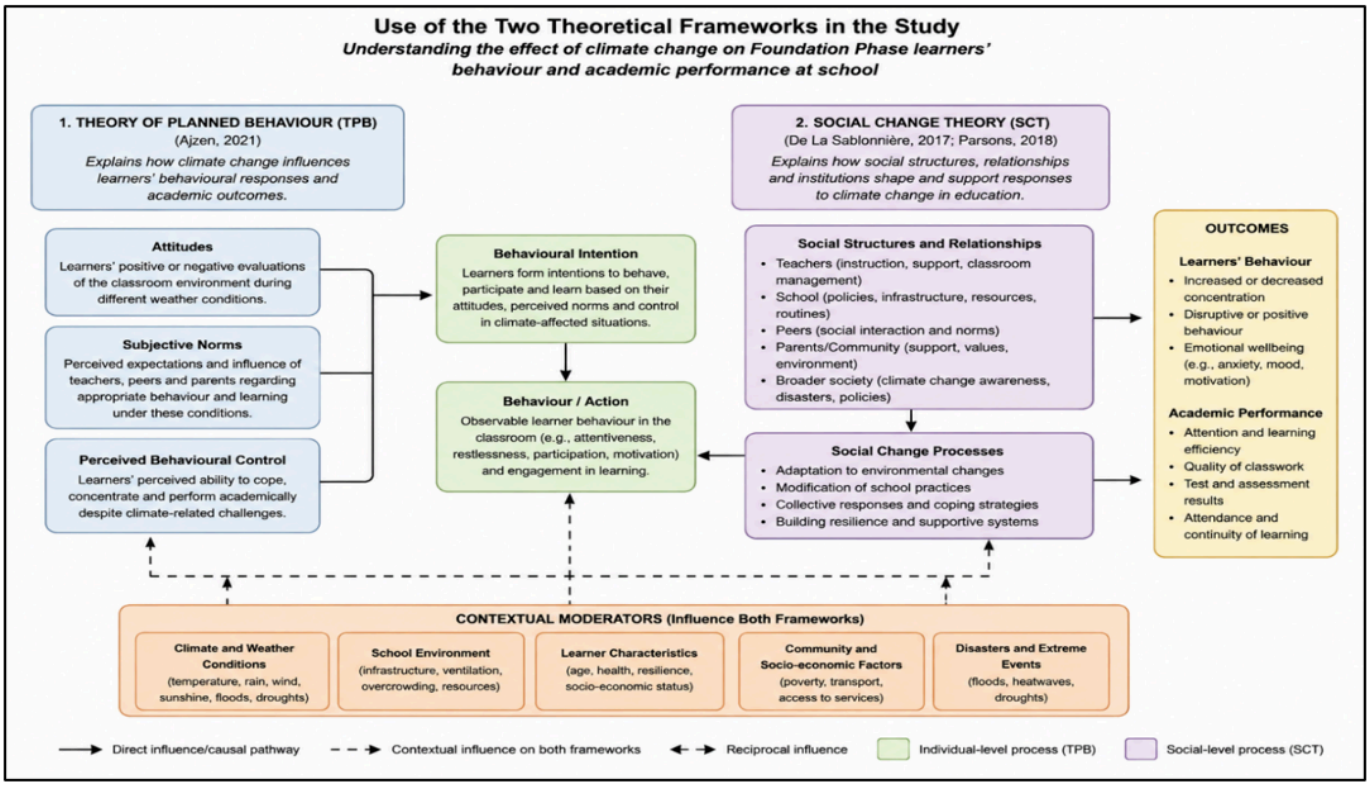


Figure 2

Diagram showing the integration of the two theories used

Source: Author

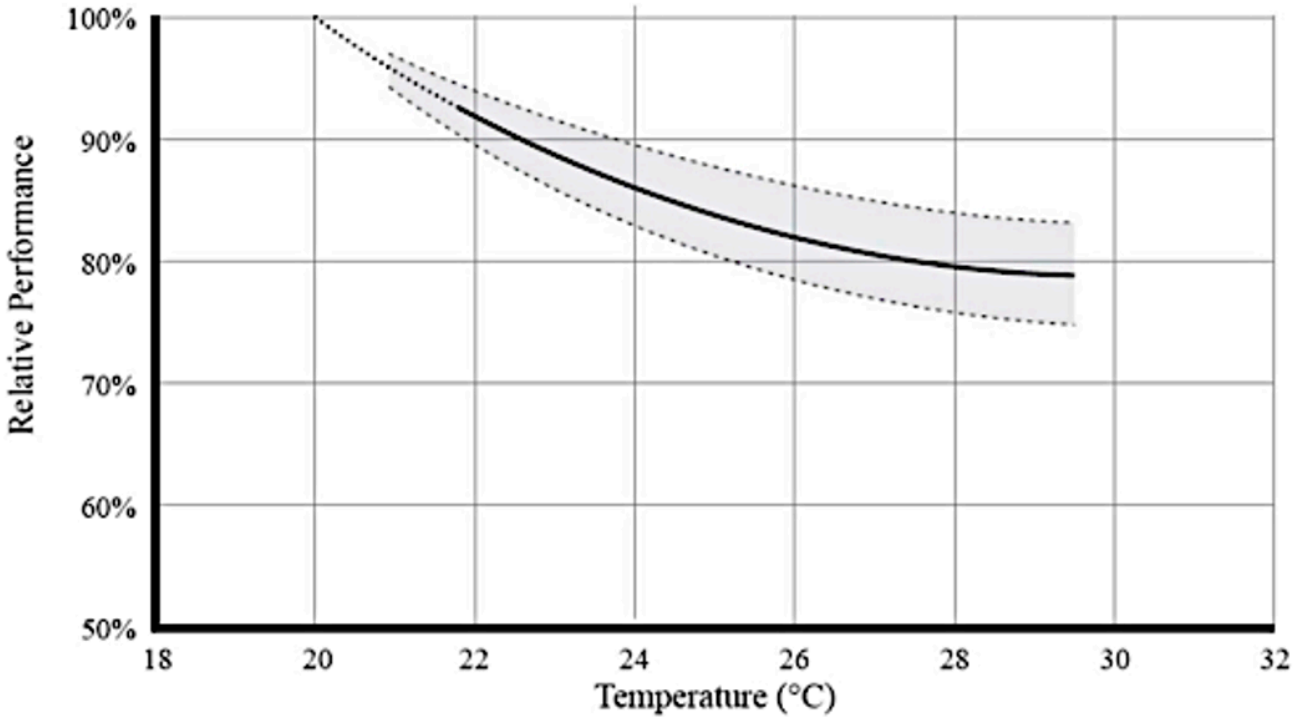


Figure 3

The performance, more specifically, the speed at which schoolwork was completed in relation to the classroom temperature

Source: Wargocki et al. (2019)

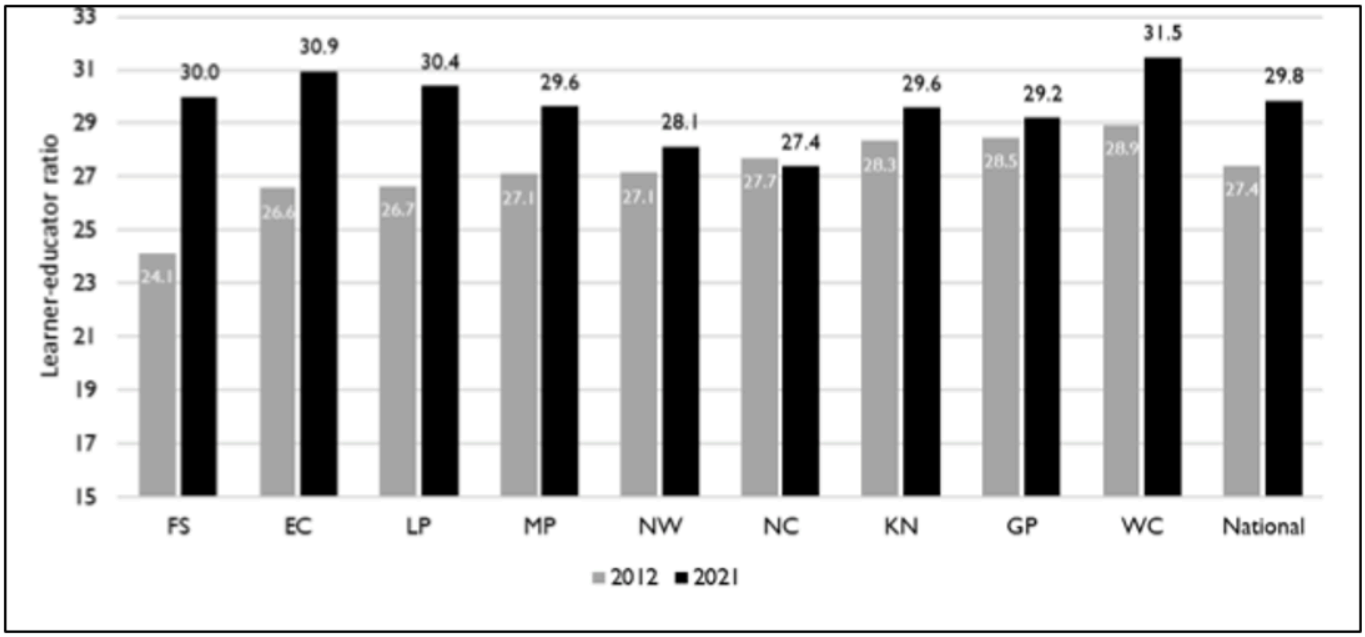


Figure 4

The difference in the learner-to-public-educator ratios in South Africa from Grade 1 to 12 in public schools from 2012 to 2021