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Barriers and opportunities in implementing climate change education in the FET Phase Geography curriculum in South Africa

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ABSTRACT

Climate change has disrupted economies and continues to affect lives in several communities and countries. The United Nations Sustainable Development Goal 13.3 urges all nations to take urgent action to combat climate change. Therefore, education is crucial in promoting climate change action because it helps people reduce their impacts and empowers them to mitigate and adapt to climate change. Currently, literature on the barriers and opportunities in implementing climate change education in South African secondary schools is limited. This study is based on the teacher training conducted by Fundisa for Change using the Teaching Climate Change manual. Archer's (1995) morphogenesis theory was used to understand the barriers and opportunities in implementing climate change education in secondary schools in South Africa. Data were gathered through document analysis and semi-structured interviews with Fundisa for Change teacher participants and with Department of Basic Education officials in Gauteng Province, South Africa, and analysed using a thematic analysis approach. The study found the following opportunities in implementing climate change education: (1) climate change topics are included in the South African national geography curriculum in the Further Education and Training phase, (2) the participating teachers exhibited adequate knowledge of environmental sustainability education, and (3) common research tasks administered require learners to apply knowledge of climate change. However, schools are supplied with lesson plans,



tests, and examinations that act as barriers to implementing climate change education, hindering teachers' agency.

Keywords: Climate change, Climate change education, Fundisa for Change programme, Geography education, Morphogenesis theory

INTRODUCTION

As a result of the global climate change crisis becoming a compelling issue, the need for climate change education has never been more significant. The United Framework Convention on Climate Change (UNFCCC) (2006) reported that climate change is a concern for humankind because climate is essential for the sustainability of life on Earth. According to the Intergovernmental Panel on Climate Change (IPCC), global temperatures have increased by approximately 1.2°C since pre-industrial times due to an increase in greenhouse gas emissions caused by anthropogenic activities (Masson-Delmotte et al., 2021). Global climate is warming due to human activities, which has a significant impact on people and ecosystems around the world. As temperatures rise, the frequency and severity of natural disasters such as droughts and water shortages, heat-related illnesses, infrastructure damage, and biodiversity loss also increase (Hauois, 2024). Climate change aggravates social and economic inequality, particularly in developing countries (Masson-Delmotte et al., 2021). For this reason, addressing climate change is crucial to ensure a sustainable future for all inhabitants of Earth.

Sustainable Development Goal (SDG) 13 urges nations of the world to 'take urgent action to combat climate change and its impacts' (United Nations, 2015). SDG 13, target 13.3, indicates a need to improve education, raise awareness and capacitate humans on climate change mitigation, impact reduction, and adaptation (United Nations, 2015). Kioupi & Voulvoulis (2019) contend that education is the most effective tool for empowering individuals, creating resilient communities and promoting positive change. Therefore, integrating climate change education is crucial to transform people's thinking and worldviews concerning their actions on the environment. The provision of quality education at school level through teacher education and training is one of the objectives of climate change education as stipulated in the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2010), and recommends Geography as one of the subjects that can be utilised to integrate climate change education into the curriculum. This is because geography is an interdisciplinary discipline that connects physical, political, economic, societal, and environmental knowledge (Schwanen, 2018). The interdisciplinary nature of geography can provide a framework for teaching climate change education allowing learners to understand the cause, impacts and potential for human actions to address climate change.

This paper emerges from a wider study which focussed on the influence of the teacher development programme on education for sustainable development, where teachers'

environmental content knowledge and teaching practices were investigated (Thenga, 2020). The study was informed by the Fundisa for Change teacher training programme in South Africa which aims to enhance transformative environmental learning through teacher education (Fundisa for Change, 2013). In 2016, some in-service teachers in South Africa were trained on environmental sustainability content, teaching and assessment practices using the Teaching Climate Change manual (Vogel et al., 2013). This study focuses on the implementation of climate change education following the training offered to teachers by Fundisa for Change. The research question that guides this study is: What are the barriers and opportunities in implementing climate change education in the Geography Further Education and Training (FET) curriculum in secondary schools in South Africa?

This paper will first discuss climate change education, barriers and opportunities for implementing climate change education by reviewing different research studies. Secondly, Archer's (1995) morphogenesis theory is presented as a theoretical framework that underpins the study, where the influence of structure and culture on teachers' agency is investigated. Thirdly, the research methodology utilised to carry out the study is provided. Lastly, the paper presents the findings, discussion and conclusions.

CLIMATE CHANGE EDUCATION

Climate change education can be defined as the 'processes aimed at improving the degree to which the education system is prepared for and responsive to the challenges of climate change' (Mochizuki & Bryan, 2015, p.5). To respond to climate change challenges, teachers should equip learners with the necessary knowledge and skills to respond to climate issues effectively. Stevenson et al. (2017) argue that climate change education aims to prepare and build learners' capacities to deal with uncertain futures associated with climate change, and adapt to the impacts of climate change to encourage behaviours necessary for sustainability (UNESCO, 2010). Reid (2019) argues that climate change education can help reduce threatening conditions of climate change, respond to climate change needs locally and globally, and deal with the implications of climate change uncertainty.

Chang & Kidman (2020) assert that geography education is crucial in deepening knowledge on environmental issues such as climate change, food security, water management and energy choices. Chang & Kidman (2020) further argue that geography overlaps with environmental education because it equips learners with relevant knowledge, skills, and values that enable them to act on environmental issues. This is best addressed through curriculum and pedagogies that allow learners to explore, discuss and debate ways of dealing with such a problem, using inquiry-based, creative, participatory learning (Stevenson et al., 2017). This requires teachers to have clear guidance from the curriculum and the necessary climate change knowledge to facilitate and guide learners.

Barriers and opportunities of climate change education

Evans et al.'s (2012) study on barriers, successes, and enabling practices of education for sustainability in primary schools in far North Queensland, Australia, found that teachers lack a conceptual understanding of climate change due to a lack of professional development, staff resistance to curriculum changes and unacceptability of being perceived as individuals who care about the environment. According to a study by Huoponen (2023) on teachers' perceptions of environmental literacy and teaching environmental issues in 40 countries, the curriculum places little or no emphasis on environmental education. Naidoo & Heath (2024) suggested that the South African Geography FET Curriculum and Assessment Policy Statement (CAPS) should be updated to better include climate change education and align it with national and international best practice. Teachers will find it easier to integrate climate change education if the curriculum is revised to make the themes more evident.

Some studies conducted mainly in the global north also reported barriers to implementing climate change education in the schooling system (Taylor et al., 2019; Howard-Jones et al., 2021; Greer et al., 2023; Gandolfi, 2023; Rushton et al., 2024). Taylor et al. (2019) noted that teachers in New Zealand often avoid integrating climate change into the curriculum because of a lack of support from senior management and assessment demands. In England, climate change education in schools is hindered by under-resourcing and lack of support (Howard-Jones et al., 2021; Rushton et al., 2024). In South Africa, support from senior management from the Department of Basic Education (DBE) can encourage teachers to implement sustainability education or climate change education.

According to Greer et al. (2023), lack of policy on climate change issues and absence of pro-environmental behaviour limits climate change education at the expense of emphasising economic values in exploiting resources. Education policies should thus encourage schools to acquire high learner attainment against the curriculum, examination specifications, and inspections (Huoponen, 2023). Gandolfi (2023) noted that in England the focus is on teaching about the environment, and not for the environment or in the environment. Teaching about the environment provides a theoretical understanding of environmental issues, whereas teaching for or in the environment promotes experiential and active engagement with the environment. Teachers have reported that climate change and sustainability are not prioritised in the British curriculum and that there is insufficient time to teach such topics (Rushton et al., 2024).

Very few studies reported opportunities that promote the implementation of climate change education. Evans et al. (2012) stated that the principal's trust in teachers can enable the implementation of climate change education. Hebe (2021) studied the factors that support the implementation of environmental and sustainability education in early childhood education in South Africa. This is linked to the ability of individual teachers to demonstrate conceptual understanding based on their professional development and teaching experience. Support from various stakeholders and the use of appropriate

learning and teaching support materials is needed to enable the implementation of climate change education in early childhood development programmes.

Theoretical framework

Archer's (1995) morphogenetic theory is used in this paper to understand barriers and opportunities in implementing climate change education after teachers were trained through the Fundisa for Change teacher development course in environmental literacy. This theory explores how structure, culture, and agency interact and influence each other. Structure refers to the social institutions and frameworks that shape individuals' agency. Culture encompasses the shared beliefs, values and customs that shape social behaviours (Archer, 2000). In this study, structure refers to the rules and policies of the DBE that guide teachers' actions, whilst culture refers to the institutional relationship which includes DBE expectations and teachers' responsibilities. Archer (2020) further contends that agency focuses on the capacity of individuals to act independently and make decisions. Even though the participating teachers had been trained in environmental literacy, their practices in implementing climate change education are influenced by the structural or cultural circumstances of the DBE and the situations within individual schools.

The realist social theory of morphogenesis stipulates that change depends on the interaction between individuals and the structural conditions of the social context which guide their practice (Porpora, 2013). The social context referred to in this study is teaching Geography in secondary schools, where the effects of the structural and cultural conditions of the DBE are investigated to understand the barriers and opportunities for the implementation of climate change education. Newman (2019, p.108) states that 'structure and culture exert a causal influence on agents (conditioning), agents interact (interaction), and this interaction changes or maintains the structure (elaboration)'. Archer (1995) argues that structure, culture and agency have powers whose interplay elaborates action. Notably, the participating teachers can change these structures through their actions, but the current school environment also has an impact on them. Teachers' agencies may either be constrained or enabled by educational policies that emphasise testing and efficiency in teaching practices (Leijen et al., 2020). Teachers operate within the rules, policies and institutional practices of the DBE, which they may maintain or transform through their actions. Either morphostasis (the preservation of pre-existing structures) or morphogenesis (the emergence of new structures) can result from the morphogenetic cycle (Archer, 2020). This means that the participating teachers' agency may either sustain or transform the structure and culture of the DBE in implementing climate change education.

RESEARCH METHODOLOGY

The interpretive research paradigm was conducted to explain barriers and opportunities for implementing climate change education. The interpretive research paradigm lies in the

idea that meaning is socially constructed by individuals in contact with the world (Merriam, 2009). Pervin & Mokhtar (2022) indicate that the interpretive research paradigm aims to better understand how people construct, modify and interpret social reality. This study seeks to understand how participating teachers implement climate change education following the Fundisa for Change teacher training programme they attended.

Sampling techniques

The study used purposive sampling to select the participants who were all teachers enrolled in the Fundisa for Change programme. The list of teachers was acquired from the Delta Environmental Centre in Johannesburg, where they were trained. The teachers trained were from one education district in Gauteng Province. Five of the 16 teachers in the programme voluntarily agreed to participate in the study. The participating teachers sampled are qualified Geography teachers with more than five years of teaching experience. The participating teachers were assigned pseudonyms A, B, C, D and E. Teacher E is from a fee-paying school, Teachers A, B, C and D are from non-fee-paying schools. Teachers A, C and E were teaching grade 11, while Teachers B and D were teaching grade 12. The sample size is small because the purpose of the study is to provide an in-depth explanation and not generalisation (Denscombe, 2007) of the implementation of climate change education in South African schools.

Data generation methods

Data were generated through document analysis and semi-structured interviews. The FET Geography Curriculum Assessment Policy Statement (DBE, 2011) and Teaching Climate Change manual (Vogel et al., 2013) were compared to identify climate change content knowledge from grades 10 to 12. Semi-structured interviews were conducted with the participating teachers to determine the implementation of climate change education in their teaching practice. The research tasks and lesson plans for grades 11 and 12 were analysed to identify the integration of climate change content knowledge. Three DBE officials (one from the education district, one from the Gauteng Provincial Education Department, and one from the national office) were interviewed to understand how lesson plans, tests and examinations influence the implementation of climate change education in schools.

Data analysis

Thematic data analysis was conducted to identify, analyse and report patterns within data to provide rich and detailed explanations (Braun & Clarke, 2006). The study adopted inductive and deductive approaches to analyse the data (Merriam, 2009). An inductive approach was utilised to extract themes from the data (Braun & Clarke, 2006). A deductive approach was applied using codes from the theory to analyse the data (Braun & Clarke,

2006). Archer's (1995) morphogenetic theory provided themes such as structure, culture and agency which were utilised in deductive analysis to understand the implementation of climate change education as a social practice. The study used these deductive themes to show the impact of the DBE's structure and culture in shaping teachers' agency in implementing climate change education.

Ethical considerations

This paper emerges from a PhD study which complied with ethics regulations and was approved by the University's Ethics Committee (Protocol number: 2017ECE018D). The participants gave written consent for the information provided and participated voluntarily in the study. To protect the privacy of the participants, pseudonyms are used. Permission to conduct the study in the five public secondary schools was obtained from the Gauteng Department of Education (GDE).

RESULTS

Five categories were used to present the results of this study. First, the South African Geography Curriculum and Assessment Policy Statement (CAPS) and the Teaching Climate Change Manual are compared to show climate change and environmental sustainability content knowledge. Second, semi-structured interviews were used to show the teacher participants' ability to identify climate change and environmental sustainability content knowledge from the Geography curriculum. Third, the grade 11 and 12 research assignments were analysed to assess climate change and environmental sustainability content knowledge. Fourth, responses to semi-structured interviews with participating teachers and DBE officials on employing standard lesson plans to teach geography. Finally, the standard tests and examinations are used to determine the implementation of climate change education. This data was used to determine how the structural and cultural conditions of the DBE affected the implementation of climate change education.

Comparison between the Teaching Climate Change manual and the FET Geography CAPS to determine climate change units

During the Fundisa for Change training, the participating teachers were exposed to the connections between the climate change units in the Teaching Climate Change manual and the national FET Geography CAPS (Table 1). The units that cover climate change concepts in the Teaching Climate Change manual connect very well with topics in the Geography curriculum. Table 1 suggests that the grades 10 to 12 curricula already include some topics related to climate change. This provides an opportunity for teachers to build on existing concepts without significant restructuring of the curriculum. Learners can gain an understanding of climate change through topics such as poor usage of resources, water mismanagement, and natural disasters including droughts, desertification and floods.

Table 1. Climate change units in the Teaching Climate Change manual and their relationship to topics in the CAPS.

Climate change units	Topics in the Teaching Climate Change manual	Topics in the CAPS
Energy exchange	Grade 10 – How energy is supplied and added to the system, and how energy is transformed through various processes	Term 1 – The atmosphere <ul style="list-style-type: none"> • The heating of the atmosphere • Moisture in the atmosphere
	Grade 11 – How energy is transferred across the system	Term 1 – The atmosphere <ul style="list-style-type: none"> • The Earth's energy balance • Global air circulation • Pressure belts
	Grade 12 – Energy transfer (e.g. pressure belts, cold and warm front, high and low pressure)	Term 1 – Climate and weather <ul style="list-style-type: none"> • Pressure belts, cold and warm fronts, high and low pressures • Midlatitude cyclones • Tropical cyclones • Subtropical anticyclones • Valley and urban climates
Energy resource use and change	Grade 10 – The role of people in climate systems	Term 1 – The atmosphere <ul style="list-style-type: none"> • The impact of climate and climate change on Africa's environment – deserts, droughts, floods and rising sea levels
	Grade 10 – Change through time and how people respond to climate change	Term 2 – Geomorphology Term 3 – Population <ul style="list-style-type: none"> • Population movements Term 4 – Water resources <ul style="list-style-type: none"> • Water management Floods
	Grade 11 – How people respond to changes in energy flows Why some people use more of the global energy bundle and the impacts	Term 1 – The atmosphere <ul style="list-style-type: none"> • Droughts and desertification Term 4 – Resources and Sustainability
Responses to energy exchanges and climate change	Grade 11 – How do people respond to climate change	Term 2 – Geomorphology <ul style="list-style-type: none"> • Mass movement and human response
	Grade 12 – How humans interact with climate change. Responses and interventions; population and movements; settlements; governance; and climate policy	Term 1 – Climate and weather <ul style="list-style-type: none"> • Responses to climate and climate change Term 2 – Settlement Term 3 – Economic geography (agriculture) <ul style="list-style-type: none"> • Farming • Food security

The integration of such topics helps learners understand these issues in a local and global context. On that account, the DBE structural conditions through the FET Geography curriculum created an opportunity for implementing climate change education. To this end, the Geography curriculum offers a foundation for implementing climate change education, but this requires teachers to know how to teach climate change effectively so that they can empower learners to act and resolve climate crises.

Teacher participants’ ability to identify climate change and environmental sustainability content knowledge from the Geography curriculum

During the semi-structured interviews, participating teachers were asked if they could identify sections in the curriculum with climate change and environmental sustainability content knowledge. The question asked during interviews was *‘Can you identify sections in the curriculum with climate change and environmental sustainability content knowledge?’* All the participating teachers indicated that they could identify climate change and environmental sustainability content knowledge in the Geography curriculum. Teachers A and B did not specify the climate change and environmental sustainability concepts that enable the implementation of climate change education. Teacher C’s response was *‘Climate change and environmental sustainability is found in all geography topics. It is mainly found in climatology, development and sustainability, and energy and resources in grade 11.’* Teacher E stated that those topics are taught in terms 3 and 4 as per the curriculum specifications. Teacher D who was teaching grade 12 said *‘Climate change, environment and sustainability content is clear in topics such as climate and weather. There are small aspects that deal with environmental sustainability in economic geography, where the focus is on improving the economy and trade relationships.’* The fact that they could identify climate change and environmental sustainability content is seen as an opportunity that can enable them to implement climate change education in their teaching practice. Participating teachers’ knowledge of climate change and environmental sustainability shows the influence of their agency in implementing climate change education.

Research assignments revealing climate change and environmental sustainability concepts

The integration of climate change and environmental sustainability concepts in grades 11 and 12 research tasks for school-based assessments as shown in Table 2 indicates the commitment of DBE to promote climate change education through assessment practices. The research tasks for grades 11 and 12 require learners to investigate environmental problems and suggest possible solutions which foster meaningful understanding and critical thinking. These tasks prepare learners to become informed citizens and encourage them to think of solutions relevant to solving environmental challenges such as climate change. Therefore, this shows that some of the cultural conditions of the DBE create

opportunities for the implementation of climate change education.

Table 2. Examples of the grade 11 and 12 research assignment (Thenga, 2020).

Grade 11 research task	Grade 12 research task
<p><u>Research:</u> Choose a topic from the two options provided</p> <p>1. Globalization Globalization has a positive influence on South Africa's economy and population. Investigate this hypothesis from any corporation of your choice.</p> <p>Learners were expected to provide the following:</p> <ul style="list-style-type: none"> • History of the corporation • Where and why the corporation was established in South Africa • Impacts on the economy and people • Challenges • South Africa. companies that have gone global and where they are in the world • Positive impacts <p>2. Non-conventional energy resources Hypothesis: South Africa will rely more on non-conventional energy sources for the provision of power in the future.</p> <p>Learners were expected to address the following</p> <ul style="list-style-type: none"> • History and development of the energy source • Map of distribution of the energy source in South Africa • Description of the application of the energy source • The importance of the energy source • Problems encountered when using the source • Acceptance or rejection of the hypothesis 	<p><u>Research task:</u> Investigate a problem or issue that is experienced in learners' communities. The problem/issue must have been reported in a local/provincial/national newspaper. Learners are expected to investigate the problem and write a report discussing their findings. Below is a list of examples that learners can investigate.</p> <ul style="list-style-type: none"> • Non-delivery of Reconstruction and Development Programme (RDP) houses • Flooding in the area • Poor service delivery • Job creation programmes • Industrial areas issues, e.g. pollution • Transport problems • Mining issues, e.g. pollution / environmental damage • Damage due to old and outdated infrastructure

Use of the standard lesson plans

Although research tasks set by the DBE act as an opportunity for implementing climate change education, some of the DBE's culture may act as a barrier to implementing climate change education. The provision of standardised lesson plans to guide teachers in planning lessons is one of the institutional practices that seem to be hindering the implementation of climate change education. The DBE officials were asked for their views concerning utilising standardised lesson plans to teach Geography, and if they are used as expected. According to the provincial official '*Lesson plans are supposed to be adapted. We are sitting with a challenge of teachers who do not prepare lessons. They just take the*

generic lesson plans as they are and file them.'

The district official stated that '*Generic lesson plans are not working as expected. They create lazy teachers. Teachers are expected to adapt the lesson plans to their situations, but they use them without any additions.*' The provincial and district officials' responses revealed that teachers use the standard lesson plans as they are without altering them, and this results in lesson plans that would not have climate change and environmental sustainability included. This practice sustains the culture of DBE which hinders the implementation of climate change education because participating teachers do not incorporate what they have learnt from the Fundisa for Change teacher development programme. Teachers may need flexibility in planning lessons to overcome the barrier to implementing climate change education effectively.

The views of the DBE officials on the impact of standardised tests and examinations in the implementing climate change education

Semi-structured interviews were used to investigate the DBE officials' views regarding using standardised tests and examinations to evaluate their effects on implementing climate change education. The question asked was '*What are the views of the DBE on standardised tests and examinations for assessing climate change and environmental sustainability knowledge in Geography?*' The responses from the interviews with the DBE officials revealed that teachers are encouraged to use standardised tests and examinations. The Gauteng provincial official mentioned that standardised tests and examinations improve learner pass rates. The provincial official further indicated that the DBE focuses on high pass rates. This response shows that the official was not concerned with climate change, but with all the Geography content a learner is expected to know to achieve a pass in the subject. The district official indicated that teachers do not want to set their tests and examinations. One-on-one interviews with participating teachers corroborated this idea stating that they do not set examination papers because moderation by district officials is time-consuming. The participating teachers were asked '*How they assess learners before the Fundisa for Change course?*' An additional question asked was '*Are there any changes in the way you assess learners after the course?*' Teacher C said

'Yes, I now incorporate a little information from recent newspapers and handouts provided in the course and I also download information from the internet for daily and informal assessments. We use Departmental common tests for all school based assessments and examinations set at district level. We are not forced to use them, but if we decide to set our own, they have to be sent to the district for moderation. I have not used anything I have set on my own after the course.'

All the other teachers in the study also emphasised the use of tests and examinations from the district as opposed to setting their own. This cultural practice is sustained by participating teachers even though it hinders the opportunities to implement assessment practices learnt from the course. For the participating teachers to make use of the climate

change concepts learned from the Fundisa for Change programme, the DBE should encourage teachers' autonomy in designing tests and examinations.

DISCUSSION

The purpose of this study was to investigate the barriers and opportunities to implementing climate change education in grade 10 to 12 Geography education in the Gauteng Province, South Africa. The findings of this study show that barriers and opportunities for implementing climate change are connected to the impact of DBE's structure and culture on teachers' agency. The FET Geography CAPS offers a potential for implementing climate change education. This is evident from the climate change units in the Teaching Climate Change manual and the FET Geography CAPS for grades 10 to 12. However, the identification of climate change units from the curriculum would not be easy for a teacher who is not trained. While the participating teachers can identify climate change in the FET Geography curriculum, the grade 11 and 12 research tasks integrate the knowledge of climate change content knowledge, which is seen as an opportunity for implementing climate change education. However, this implementation is hampered by standard lesson plans, tests and exams. It is possible to ascribe the limited integration of climate change education to DBE's cultural conditions that do not prioritise climate change and environmental issues. This suggests that part of DBE's culture is regarded as a barrier to the global urgency for climate change education.

The potential opportunities for implementing climate change education align with Hebe's (2021) findings that the South African early childhood curriculum enables the implementation of environmental sustainability education. Notably, the participating teachers demonstrated an understanding of climate change education through their ability to identify the content knowledge on climate change and environmental sustainability content knowledge associated with the professional development course they attended. This concurs with Hebe's (2021) findings where early childhood teachers demonstrated an understanding of the environmental sustainability education concepts based on professional training and experience. The research tasks set at DBE for grades 11 and 12 learners required them to show an understanding of climate change and environmental sustainability knowledge which enables the implementation of climate change education. As Rushton et al. (2024) argued, there is a need to increase the visibility of climate change units in the curriculum to increase opportunities for its implementation. Naidoo & Heath (2024) recommended that the FET Geography CAPs should be revised to align with climate change education to ensure national and international practices for representations of climate change adaptations. This calls for the DBE to clarify climate change topics in the FET national Geography curriculum so that climate change education is implemented effectively.

The culture of DBE created barriers to implementing climate change education. The standardised lesson plans, common tests and examinations act as barriers to the implementation of climate change education. The DBE encourages schools to use

standardised lesson plans, standardised tests and examination papers with an emphasis on pass rates. This corresponds with Greer et al.'s (2023) findings that schools have the pressure to achieve high student attainment against the curriculum, which limits teachers' freedom to teach climate change education, and that focus on examinations and improving student grades rather than teaching climate change education (Huoponen, 2023). The finding of this study corroborates this view. This reliance on standardised assessments and lesson plans limits teachers' ability to integrate climate change content into their teaching practices. The DBE officials do not provide support for the implementation of climate change education, as they place efforts on improving pass rates in schools. This supports the view that a lack of senior management hinders the implantation of climate change education (Taylor et al., 2019; Howard-Jones et al., 2021).

CONCLUSIONS

The integration of climate change topics in the national FET Geography CAPS, and the participating teachers' ability to identify climate change and environmental sustainability and research assignments supplied by DBE, offer opportunities to implement climate change education. However, some of the DBE's cultural conditions such as standardised lesson plans, tests and examinations hinder the effective execution of climate change education. Because of the limited sample size used in the case study approach, the findings cannot necessarily be applied to a larger group of teachers. Furthermore, concentrating on one education district in the Gauteng Province may not capture diverse barriers and opportunities for climate change education in other contexts. Consequently, a need for ongoing professional development in climate change education to support the implementation of climate change education is important. The FET Geography CAPS should also be revised so that it becomes easy for all teachers to identify climate change in the curriculum. Future research could explore learners' understanding of climate change at the school and university levels. Notably, integrating climate change education into the curriculum is essential for learners as well as preparing the future generation for environmental challenges.

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