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Community Engagement as a Strategy to Address Climate Changes for Sustainable Development by a Rural University

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Abstract:
This study aims to explore the role of community engagement as a strategic approach employed by a rural university in South Africa to address climate change for sustainable development. The primary objective of this study is to assess the effectiveness of community involvement in mitigating climate change impacts, with a focus on the unique context of a rural university setting. This study employed a qualitative approach with a case study design. One-on-one interviews and focus group discussions were used to gather data from participants, such as community members and university representatives. Data analysis involved qualitative thematic analysis to ensure a comprehensive understanding of the community engagement dynamics. The research revealed that community engagement initiatives led by rural universities positively influenced climate change awareness and mitigation efforts within the local community. The data indicated a notable increase in community participation and commitment to sustainable practices. Themes emerged that highlighted the significance of collaborative partnerships, knowledge exchange, and grassroots involvement in achieving meaningful outcomes. This study has implications for academia, policymakers, and practitioners engaged in climate change and sustainable development efforts. The insights gained can inform the development of tailored community engagement strategies, not only in South Africa but also globally, emphasizing the crucial role of rural universities in fostering sustainable practices in communities. The novelty of this study lies in its specific focus on the role of a rural university in South Africa, filling a gap in the existing literature. The findings contribute to the evolving discourse on effective climate change strategies by highlighting the unique contributions of rural educational institutions. By emphasizing the importance of localized approaches and community collaboration, this study adds a nuanced perspective to the broader field of sustainable development and climate change mitigation.

Keywords: climate change, community engagement, sustainable development, strategies.

社区参与作为农村大学应对气候变化促进可持续发展的战略

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摘要：
本研究旨在探讨社区参与作为南非一所农村大学为应对气候变化促进可持续发展所采用的战略方法的作用。本研究的主要目的是评估社区参与减轻气候变化影响的有效性，重点关注农村大学环境的独特背景。本研究采用定性方法和案例研究设计。通过一对一访谈和焦点小组讨论来收集社区成员和大学代表等参与者的数据。数据分析涉及定性主题分析，以确保全面了解社区参与动态。研究显示，农村大学领导的社区参与举措对当地社区的气候变化意识和缓解努力产生了积极影响。数据表明社区参与度和对可持续实践的承诺显着增加。出现的主题强调了合作伙伴关系、知识交流和基层参与对于实现有意义的成果的重要性。这项研究对从事气候变化和可持续发展工作的学术界、政策制定者和从业者具有重要意义。获得的见解可以为制定量身定制的社区参与战略提供信息，不仅在南非，而且在全球范围内，强调农村大学在促进社区可持续实践方面的关键作用。这项研究的新颖之处在于它特别关注南非一所农村大学的作用，填补了现有文献的空白。研究结果强调了农村教育机构的独特贡献，为有效气候变化战略的讨论做出了贡献。通过强调本地化方法和社区合作的重要性，本研究为更广泛的可持续发展和减缓气候变化领域提供了细致入微的视角。

关键词：气候变化、社区参与、可持续发展、战略。

1. Introduction

1.1. Research Background

The article emphasizes the pressing global issue of climate change and its widespread effects on ecosystems, societies, and economies, particularly in susceptible regions such as rural South Africa. Concern over sustainability stems from human-induced global warming. The United Nations' 2030 Agenda for Sustainable Development aims to prompt countries to address climate change and conserve resources for future generations. This article explores how community participation can be employed as a strategy for tackling climate change, particularly within the context of a rural South African university's efforts toward sustainable development. The Enock Mgijima Local Municipality in South Africa is cited as an example of a vulnerable area due to its reliance on climate-sensitive industries such as agriculture, forestry, and fisheries. The municipality has faced significant impacts from extreme weather events such as droughts, heatwaves, and floods in recent years, underscoring the urgent need for action. Enock Mgijima Local Municipality, situated in a rural area of South Africa, faces significant challenges due to inadequate infrastructure and limited resource accessibility, making it highly susceptible to the impacts of climate change. Sgqolana (2022) highlighted concerning issues such as sewage-contaminated water, improper waste disposal through burning or illegal dumping, and deteriorating infrastructure with sewage leaks. Recognizing transformative potential of education, Alam, Forhad, and Ismail (2020) emphasized its role in enhancing lives and driving national economies. Universities, as key institutions, have the capacity to address societal disparities encompassing social, economic, political, and environmental aspects by engaging communities in meaningful discussions and solutions.

According to Strasser, Baudry, Mahr, Sanchez, and Tancoigne (2019), sustainable development forms of human activities may result in significant community capacity building as well as constructively recognizing and resolving climate change challenges. Pollution levels in the world's atmosphere have progressively climbed above normal levels since the beginning of the industrial revolution in Europe and elsewhere (Trevisan et al., 2023). Increased demand for raw materials, urbanization, rural-urban migration, commercial agriculture, mining, the need for fuel energy such as coal and petroleum, deforestation to make room for settlements and agriculture, and other industrial activities have negatively impacted the environment.

1.2. Study Gap

The problem of addressing climate change has sparked heated disputes among global elites, politicians, and academics. However, many of these proposals have remained on paper, and no global strategy to address climate change has been enacted (Hepburn, et al., 2020). Every year, countries spend millions of dollars to organize and send diplomats to climate change and global warming summits and conferences, but little is done on the ground to address specific issues in local communities, particularly in developing Asian and African countries. Little effort has been made to educate people about the exact problem of climate change and its causes, and the role the local population can play in stopping it or dealing positively with its impact. Some universities seem to be quiet or like ivory towers that are far removed instead of coming down to influence the communities that they are serving, especially rural communities.

1.3. Research Objectives

The study objectives were as follows:

- To determine the role that universities play in communities to address climate change on sustainable development.
- To establish strategies to mitigate the impact of climate change on sustainable development.

2. Literature Review

Inadvertent radiative heating has thrown the climate system out of balance with incoming solar energy

(Haldane et al., 2019). Thomas et al. (2019) warned that predicted climate change may greatly outpace natural climatic variability over the next few decades. According to Thomas et al. (2019), the key focus of future policy studies and global accords should be the decarbonization of economic development. As a result, rather than treating climatic stability and economic growth as separate and equal goals, the strategy should be to reintegrate the two global policy goals, in part by decoupling responsibilities and financing operations. According to Findler et al. (2019), many countries are increasing their spending on crafting legislation and developing strategies to combat climate change, yet many of these plans are never fully executed. Climate change issues are debated in parliament and conferences in South Africa and many other developing countries, but little action is taken on the ground to address climate-related factors, particularly in rural regions.

The government's climate change program includes community involvement as a means of involving local communities in the battle against climate change. People in their communities are immediately affected by climate change and global warming, and this must be understood. Alam, Forhad, and Ismail (2020) found that dealing with the challenges of change is particularly difficult if individuals are unaware of the influence of climate change on their well-being. Through community involvement, the government may conduct campaigns to educate people about climate change and sustainable development through its institutions of learning, such as schools, colleges, and universities (Dale et al., 2020).

Climate change is believed to have a significant influence on rural communities throughout South Africa, particularly in the Komani district (Sgqolana, 2022). Agriculture is one of the most significant sectors in rural South Africa, but it is also one of the most sensitive to the consequences of climate change (Delios, et al., 2022). Crop failures, reduced yields, and increased food insecurity have resulted from droughts, floods, and extreme weather events (Findler et al., 2019).

Climate change has also caused changes in rainfall patterns (Gilmore et al., 2020), with some places receiving greater rainfall and others experiencing droughts. Water scarcity has ensued, particularly in rural regions where access to water is already limited (Haldane et al., 2019). Consequently, there is more water stress, lower agricultural production, and more competition for water supplies. As many households rely on agriculture for income and food security, this has had a huge impact on rural livelihoods.

According to Holloway and Fortune (2018), the South African health system, particularly in disadvantaged rural communities, is facing a major challenge due to an increase in the number of illnesses associated with climatic effects. Heat exhaustion, dehydration, and other heat-related ailments in humans and animals have increased with the frequency and intensity of heat waves. Climate change has also aided the spread of vector-borne diseases, including malaria and dengue fever (Moriarty & Honnery, 2022). According to Holloway and Fortune (2018), heat islands are becoming increasingly widespread in cities because they contain more energy-producing equipment and automobiles, concrete surfaces, and high volumes of asphalt and glass that absorb solar radiation and re-emit heat energy. Silt build-up caused by human settlements and activities near water resources can also affect stream flow by lowering sunlight penetration or directly depositing on coral reefs (Strasser et al., 2019).

2.1. The Role of Universities in Communities in Sustainable Development

To address climate change in their communities, universities can implement various initiatives to minimize their carbon footprint and promote sustainability. There are numerous techniques that universities can consider for employees in the battle against climate change for community sustainability (Cong et al., 2020). To address their energy needs, universities can invest in renewable energy sources such as solar, wind, and geothermal power. They can install rooftop solar panels, wind turbines, or geothermal heating and cooling systems and adopt renewable energy sources that can drastically reduce GHG emissions. Energy efficiency measures can involve switching to energy-efficient LED bulbs in lighting systems, enhancing building insulation, optimizing HVAC systems, and installing smart meters to monitor and control energy usage. According to Zheng et al. (2020), supporting sustainable transportation options can help lower the carbon footprint associated with commuting.

Salby and Harde (2022) explained that implementing good waste management and recycling initiatives on campus can reduce the amount of garbage going to landfills. Universities can install recycling bins throughout campuses, educate students and staff on proper recycling procedures, and encourage organic waste composting efforts. Universities can emphasize acquiring ecologically responsible products and services. This includes acquiring ecologically friendly office supplies, energy-efficient appliances, and environmentally friendly building materials. Green procurement rules can help increase demand for sustainable products and assist environmentally friendly firms (Shen et al., 2020). Climate change and sustainability education can raise awareness and empower students to become change agents (Guo et al., 2021). Environmental studies, sustainable development, renewable energy, and climate science can all be taught in universities. Integrating sustainability ideas into current programs across disciplines can contribute to the production of environmentally conscientious graduates.

Nielsen et al. (2021) discovered that universities can promote climate change research and innovation. Universities can devote resources and financing to

climate change mitigation and adaptation research programs. Interdisciplinary collaborations, partnerships with business and government organizations, and support for student-led initiatives are examples of such collaborations. The formation of sustainability committees or student organisations can serve as a platform for collaboration and the execution of sustainability projects. According to Thomas et al. (2019), universities can strive toward carbon neutrality by reducing emissions and offsetting the remaining emissions through carbon offset investments.

2.2. Strategies to Mitigate the Impact of Climate Change on Sustainable Development

Climate change mitigation is critical because of its far-reaching effects on the environment, economy, and human well-being. Global cooperation and concerted efforts are required to reduce greenhouse gas (GHG) emissions, transition to renewable energy sources, promote sustainable land management practices, protect forests, and develop resilient infrastructure to address climate change (Trevisan et al., 2023). On a global scale, international agreements such as the Paris Agreement 2016 the Kyoto Protocol year 1992, and the Copenhagen Treaty 2009 aim to keep global warming far below 2 degrees Celsius over pre-industrial levels and to pursue efforts to keep temperature increases to 1.5 degrees Celsius. Integrating climate change mitigation and adaptation methods with sustainable development goals necessitates a multifaceted strategy (Masson-Delmotte et al., 2022). Communities must promote the use of renewable energy, improve water management and conservation practices, implement climate-resilient agriculture, protect ecosystems and biodiversity, and strengthen disaster preparedness and response mechanisms to address climate change and sustainable development. Furthermore, empowering local communities through capacity building, education, and inclusive decision-making processes is critical for supporting climate-resilient development.

Communities, governments, and international organizations should work together to confront the issues of climate change (Khan et al., 2019). These initiatives can encourage ownership, increase resilience, and drive positive responses to climate change and sustainable development by integrating community members in decision-making processes and empowering them to act. Climate change is a worldwide problem that necessitates international cooperation (Fuso Nerini et al., 2019). This can be accomplished by increasing GHG emissions without regard for boundaries, with the repercussions affecting all nations. Countries can cooperate to achieve the goals outlined in international agreements such as the Paris Agreement by collaboratively addressing climate change (Malhi et al., 2021).

Collaboration promotes innovation, sharing of best practices, and mobilization of resources to successfully combat climate change. According to Cheng et al. (2021), combating climate change is inextricably linked to fostering sustainable development. Transitioning to a low-carbon economy based on renewable energy and sustainable practices allows for job development, technological innovation, and economic growth. We may lower our carbon footprint while supporting long-term economic development by embracing clean energy, sustainable transportation, and circular economy models (Pörtner et al., 2022). Climate change action is an ethical obligation for future generations. If this critical issue is not addressed, future generations will be burdened with severe repercussions of environmental deterioration, resource shortages, and social upheaval (Giddings, Hopwood & O'Brien, 2002). We can ensure a sustainable legacy and protect a livable earth for future generations by acting today.

Ballew et al. (2019) contend that community participation can educate and raise awareness of climate change and sustainable development challenges in local communities. To educate community members about climate change, its effects, and sustainable development methods, workshops, seminars, and awareness campaigns can be held. To communicate information and increase awareness, community engagement campaigns may be undertaken through local media outlets, social media, and community events. Manzanedo et al. (2020) proposed that educational institutions, such as schools and colleges, collaborate with local communities to develop methods to address climate change and sustainable development. Manzanedo et al. (2020) emphasized the importance of creating venues for communication and collaboration among community members, local government authorities, NGOs, enterprises, and other relevant players. Strasser et al. (2019) explained how the community may encourage people to participate in public discussions, town hall meetings, and decision-making procedures about climate change and sustainable development.

To foster creativity and produce sustainable solutions, community involvement must foster collaborations among local communities, academic institutions, NGOs, and corporations (George & Merrill et al., 2021). Encouraging community-led renewable energy initiatives, such as solar or wind installations, to reduce GHG emissions and improve energy security will help limit the spread of deforestation. Manzanedo et al. (2020) claimed that community involvement may aid in the development of community-led programs centered on waste management, recycling, and circular economy activities.

3. Theoretical Framework

Education for Sustainable Development (ESD) and civic engagement theories were used in the study to complement each other, as explained below.

This theory advocates for higher education institutions to equip students to handle sustainability concerns and contribute to the creation of sustainable

communities. ESD strives to equip students with the ability to think critically, solve problems, and make educated decisions about environmental, social, and economic challenges. Therefore, university stakeholders are expected to play a vital role in communities regarding environmental issues that affect sustainability. This theory was complemented by the civic engagement theory, which advocates the active participation of individuals and communities in issues that affect communities.

Civic engagement theory stresses individuals' and communities' active participation in decision-making processes that affect their lives. Higher education institutions play an important role in increasing civic engagement by facilitating community-based research and encouraging students to become active citizens. Universities may play a vital role in ensuring a sustainable future and making beneficial impacts in their communities by incorporating these ideas into their purpose, vision, and activities.

4. Methodology

4.1. Paradigm

The current study incorporated an interpretive paradigm because it allows researchers to go deeply into a topic to obtain rich and vast data (Muzari & Shonhiwa, 2022). As a result, the researchers conducted semi-structured interviews with the participants to gather information. Interpretivism often analyzes problems through the prism of a group or personal experience, emphasizing subjectivity and various realities. Interpretive data, according to Merriam and Baumgartner (2020), are not generalizable to entire populations, but rather to specific contexts and circumstances. Interpretivists gather qualitative data that can be interpreted in a variety of ways (Teleş, 2021). Observations, documents and narrative analyses, interviews, case studies, and audio-visual materials are used by interpretivists to acquire data (Harrison et al., 2020).

4.2. Approach

A qualitative approach was used in the study to understand people's beliefs, experiences, attitudes, behavior and interactions to establish a link between community engagement, climate change and sustainable development. Furthermore, it generates non-numerical data and is gaining ground across disciplines in intervention studies, as in the present study. Qualitative research allows researchers to acquire, synthesize, and develop knowledge from participants in everyday or common circumstances through interviews and/or observations (Teleş, 2021).

4.3. Research Design

The study employed a case study research design. Case studies allow for a comprehensive and in-depth exploration of a particular phenomenon, situation, or individual. They provide a detailed understanding of the context, processes, and dynamics. By examining a specific case in its entirety, researchers can gain rich insights and uncover nuanced aspects that may not be possible through other research methods.

4.4. Sampling

A purposive sampling technique was used to select eight university lecturers, three community leaders, and four community members who participated in the study. Pollock et al. (2020) stated that purposive sampling enables the identification and selection of instances containing valuable information pertinent to the current study. This study involved fifteen participants.

4.5. Data Gathering Instruments

This study used one-on-one interviews. Interviews were held with eight university lecturers, three community leaders, and four community members. The interviews were at least 30 minutes long. With the participants' permission, the interviews were tape-recorded to ensure that both the researchers and the participants remembered exactly what was said and why. Participants were reminded of their rights throughout the interviews, such as the freedom to respond or not respond to questions and to leave at any time.

4.6. Data Analysis

Thematic analysis was used to analyze the acquired data. Data analysis is defined as the process of reviewing, cleansing, transforming, and modeling data to uncover useful information, inform conclusions, and aid decision-making (Fathi et al., 2022). The information was organized into topics, and the results were presented and discussed.

4.7. Ethical Considerations

Ethical concerns were extensively examined. Participants' names were masked using pseudonyms to maintain anonymity. The researchers took care to be respectful of both the research environment and the subjects recruited for the study. Participants were given informed consent forms to sign before the start of the interviews. Participants were informed that they had the option to not participate in the study or withdrawing at any time.

5. Results

The themes outlined below emerged from the data gathered through interviews.

5.1. Theme: Role of Universities in Communities to Address Climate Change

Question: What role do universities play in communities in addressing the effects of climate change on sustainable development?

Varied responses were given by participants regarding the role universities should play in communities in sustainable development. Universities contribute to sustainable development in a variety of

ways, such as education, research, innovation, community participation, policy impact, and so on, as indicated below by the participants.

Participant A (University lecturer) stated:

The university should provide equal access to education and capacity building to all community members through community engagement. The institution should provide students with sustainable development education and training, providing them with the information and skills needed to handle sustainability concerns.

This also demonstrated that universities may improve knowledge about sustainability challenges and encourage sustainable behaviors among students and future professionals across several disciplines through degree programs, seminars, and workshops. This participant highlighted the importance of university-community engagement in tackling climate change through education and capacity building. Here are some strategies for addressing these concerns through university-community engagement:

Participant B (University lecturer) explained the following:

Climate change-related themes can be included in existing courses in various fields at universities. This guarantees that students from various disciplines will obtain a fundamental understanding of climate change and its ramifications. It also promotes interdisciplinary collaboration in problem-solving.

Based on the findings of the quotation above, colleges can create specialized programs or courses centered on climate change education and capacity building. These programs can provide in-depth knowledge, skills, and hands-on training in areas such as climate change mitigation, adaptation, renewable energy, sustainable agriculture, and other pertinent topics.

Participant B (University lecturer) highlighted the following:

To combat climate change, research and innovation are required. In addition, universities can assist in climate change research efforts and projects by including students, faculty, and community members in research, enabling the creation of innovative solutions, technologies, and policies to address climate change concerns.

This participant mentioned the importance of outreach and awareness initiatives. Universities can arrange outreach activities to increase community understanding of climate change. Workshops, seminars, conferences, and public lectures are examples of how specialists can exchange expertise and information regarding the effects of climate change, mitigation solutions, and sustainable practices, as indicated by Participant A below.

Participant A (University lecturer) said,

Collaboration between universities and communities can enable coordinated efforts to combat climate change. Colleges should form connections with local communities, government agencies, non-governmental organizations (NGOs), and companies to collaborate on climate change projects. These collaborations can include joint studies, community-based adaptation programs, and capacity-building activities customized to the community's requirements.

According to the findings, sustainable campus activities are an effective way of coping with climate change. Universities should set a good example by implementing sustainable practices on their campuses, according to the findings of this study. This can include energy-efficient infrastructure, waste management systems, sustainable transportation options, and encouraging environmentally friendly behavior in students and faculty.

Participant C (University lecturer) mentioned the following:

Universities can advocate for climate change mitigation and adaptation policies at the local, regional, and national levels. They can influence the creation and implementation of climate-related policies by providing study findings, expert opinions, and suggestions to policymakers.

Participant D (University lecturer) argued,

Universities can provide continuing education programs and opportunities for lifetime learning to professionals and community members interested in climate change. These programs can provide training, certificates, and workshops to help people improve their knowledge and skills in dealing with climate change concerns.

The two comments above reveal that by combining these approaches, university community engagement may play a vital role in educating and building capacity to successfully address climate change. Universities may contribute to a more sustainable and resilient future through collaboration, research, awareness campaigns, and policy advocacy.

Participant E (University lecturer) stated the following:

Universities should conduct sustainable development research, looking for innovative answers, technologies, and methods to environmental, social, and economic concerns. Research should provide new information and evidence to inform sustainable development practices and policy. Universities may also stimulate innovation by encouraging entrepreneurship and developing sustainable technologies and activities.

According to the participant's answers, universities play a critical role in combating climate change through research and innovation. Community engagement can be a great instrument for universities to engage and interact with local communities to effectively combat climate change.

Participant F (University lecturer) said,

Universities can launch collaborative research initiatives with the community, local organizations, and stakeholders to better understand the effects of climate

change in specific regions or towns. Furthermore, colleges can obtain vital local knowledge, improve data-gathering efforts, and co-create solutions by incorporating the community in research operations.

According to the findings, involving communities in participatory action research allows for better awareness of local climate concerns and allows communities to actively contribute to developing solutions. Universities can help community members identify and address specific climate-related concerns by facilitating seminars, focus groups, and participatory planning processes.

Participant G (University lecturer) revealed,

Universities should host knowledge-sharing events, workshops, and seminars to encourage interaction among scholars, policymakers, community members, and industry leaders. Such platforms will allow community members to share their experiences and thoughts, and researchers may disseminate scientific results and new solutions to climate change.

This quotation complemented the perspectives of other participants, who also indicated that universities could help community capacity building by providing training programs, educational initiatives, and workshops on climate change mitigation and adaptation techniques. Universities encourage community members to actively participate in sustainable practices and decision-making processes by providing technical skills and information.

Participant H (University lecturer) mentioned the following:

Universities are frequently used as technical innovation hotspots. They can work with communities to develop and transfer sustainable technology that assists in reducing the effects of climate change. Renewable energy solutions, waste management systems, sustainable agriculture techniques, and climate-resilient infrastructure.

Participant I (University lecturer) revealed,

Universities can collaborate with members of the community to advocate for evidence-based policies and support climate action at the local, regional, and national levels. Researchers and community members can collaborate to promote awareness, influence policy decisions, and foster sustainable behaviors in communities.

The findings revealed that universities can help establish community-led programs focusing on climate change adaptation and mitigation. Universities can also assist community organizations in implementing education programs by offering financing, knowledge, and resources.

Participant A (Community leader) revealed,

Various approaches can be used by universities to engage with local populations, such as working with community organizations, government agencies, and enterprises to address local sustainability challenges.

According to the findings, the university's community participation in community engagement could assist communities and the country in accomplishing global sustainable development goals.

Participant B (Community leader) had this to say:

Universities should actively engage their students, faculty, and staff in raising awareness of climate change and its consequences in their respective communities.

Findings revealed that workshops, seminars, and awareness campaigns may help to promote sustainable practices, and the need to lower carbon emissions may also reduce their carbon footprint and inspire others to do the same.

Participant A (Community leader) disclosed,

To create sustainable energy on campus, universities should invest in renewable energy technologies such as solar panels, wind turbines, and geothermal systems. These projects not only help minimize reliance on fossil fuels but also act as instructional resources for students and the community.

The findings also revealed the importance of alternative mobility options such as biking, walking, and carpooling in reducing GHG emissions associated with commuting. To make sustainable commuting more accessible, universities can provide bike lanes, bike-sharing programs, and incentives for taking public transportation, as indicated below by Community Leader B:

Universities should implement effective waste management methods, such as recycling programs, composting, and limiting single-use plastics, to reduce the environmental impact of campuses.

Findings established that engaging students and employees in waste reduction projects can help foster a sustainable culture in the community.

Participant A (Community leader) revealed,

Universities may promote sustainable technology research and development and climate adaptation techniques and policy creation. Universities contribute to the creation of solutions that can be implemented outside school boundaries by actively engaging students and staff in these areas.

The findings revealed the need to involve students in decision-making processes and create platforms for them to contribute ideas and initiatives to promote a sense of ownership and responsibility for campus sustainability. Student-led organizations and clubs can play an important role in planning events and activities centered on sustainability.

Participant B (Community leader) revealed,

Universities can communicate with the public through various avenues, including public lectures, online platforms, and media outreach. Universities can motivate individuals to act, encourage sustainable habits, and foster an environmental stewardship culture by conveying climate science and raising awareness about the gravity of the issue.

The findings emphasize the need for universities to collaborate with government agencies, non-governmental organizations (NGOs), and policymakers at the local, national, and worldwide levels. Universities may provide scientific expertise, policy analysis, and

suggestions to inform the formulation and implementation of effective climate policies and initiatives through these relationships.

Participant C (Community leader) disclosed the following:

To address climate change concerns at the grassroots level, universities can work with local communities, companies, and civil society organizations. Initiatives such as community-based projects, joint research programs, and knowledge-sharing platforms that allow communities to adopt sustainable activities, build resilience, and generate innovative solutions adapted to their specific circumstances can fall under this category.

According to the findings, universities may actively engage students in climate change activities by incorporating sustainability ideas into the curriculum, providing research opportunities, and supporting student-led organizations focusing on environmental conservation and climate action. This enables the next generation of leaders to contribute to the fight against climate change and promote sustainable habits on and off campus.

Participant A and Participant B both emphasized the importance of education and capacity building in universities to address climate change. They highlighted the role of universities in providing sustainable development education, training, and specialized programs. Participant C and Participant D mentioned the significance of research and innovation in combating climate change. They suggested that universities can contribute to research efforts, stimulate innovation, and provide continuing education programs. Participant E and Participant F focused on the role of universities in conducting research and developing sustainable technologies and solutions. They highlighted the importance of universities collaborating with communities and local organizations to address climate change. Participant G and Participant H discussed the importance of knowledge-sharing, workshops, and seminars to raise awareness and promote sustainable practices. They also mentioned the role of universities in advocating for evidence-based policies and supporting community-led programs.

Participant A (Community leader) and Participant B (Community leader) also aired their views on the role of universities in promoting sustainable practices on campus. Participant A emphasizes the implementation of environmentally friendly policies and practices, while Participant B highlights the importance of raising awareness and engaging students, faculty, and staff in sustainability efforts. Participant A (Community leader) and Participant C (Community leader) presented contrasting perspectives on the role of universities in engaging with local populations. Participant A suggested collaboration with community organizations, government agencies, and enterprises, while Participant C emphasized working with local communities, companies, and civil society organizations at the grassroots level. It is important to note that while there may be some variations in the specific recommendations and emphasis, overall, the participants shared a common understanding of the role of universities in addressing climate change through education, research, innovation, community engagement, policy advocacy, and sustainable practices.

5.2. Theme: Strategies to Mitigate the Impact of Climate Change on Sustainable Development

Question: How can community engagement strategies mitigate the impact of climate change on sustainable development?

It takes all individual actions to face the causes of climate change and their effects on the environment, and appropriate growth. According to the quotations in this section, the findings of the participants of the current study revealed some tactics that can be used to deal with climate change.

Participant A (University lecturer) revealed,

Energy saving and efficiency are essential. This increase in deforestation in South Africa is caused by load shedding.

According to the study findings, universities can use this platform to urge people to use other ecologically beneficial types of energy, such as solar energy and biogas, to minimize reliance on coal, wood, and petrol, which are hazardous to the environment.

Participant B (University lecturer) had this to say:

To reduce pollution caused by traffic congestion in cities, people must choose sustainable modes of transportation.

Findings from the preceding quotation revealed that community involvement must be encouraged to discourage the use of private cars all the time. People should be encouraged to use public transportation, walk if the distance is short enough, and ride bicycles and other traditional modes of transportation that do not affect the environment.

Participant C (University lecturer) indicated,

Community engagement can be used to promote and sensitize communities to use renewable energy sources. Many individuals are unaware that renewable energy sources exist.

These participants agree with Participant A's viewpoint on the same issue in that, in the absence of electricity, they are forced to cut wood, which causes deforestation and contributes to climate change.

Participant D University lecturer disclosed,

Universities can teach people how to turn waste into an economic resource that can help them earn money through waste management and recycling through community engagement.

According to the remark above, many beneficial recycling projects can be built to improve the environment and provide job opportunities. It was discovered that waste can be converted into biogas, papers can be converted into toilet tissue, and plastics and glasses can be converted into tiles and other

building materials. Participant E University lecturer disclosed,

Climate change activities at the community level may include community-based renewable energy projects.

According to the participant, towns that build and manage renewable energy projects, such as solar or wind farms, can minimize their reliance on fossil fuels, promote clean energy options, and reduce pollution levels. Participant A Community leader disclosed,

Local climate action plans must guide and improve local community actions in the fight against climate change.

According to the participant, community leaders must build comprehensive plans to combat climate change at the local level. These plans could include initiatives for lowering greenhouse gas emissions, improving energy efficiency, encouraging sustainable transportation, and safeguarding natural resources.

Participant B (Community leader) revealed,

There is a need for communal gardens and urban farming as a solution to reduce the environmental impact of agricultural operations.

According to the participant, creating community gardens and urban farming programs will aid in the promotion of sustainable food production, the reduction of food waste, and the increase of community resilience to climate impacts.

Participant B (Community leader) highlighted,

As a means of combating climate change, sustainable transportation efforts must be implemented.

As an alternative to private vehicles, this participant stated that communities should be encouraged to use public transportation, carpooling, cycling, and walking. This contributes to lower greenhouse gas emissions and better air quality. This participant encouraged cities to adopt energy-efficient building techniques, pointing out that retrofitting existing structures with energy-saving technologies can cut carbon emissions while also lowering energy costs for individuals and communities.

Participant D (Community resident) suggested,

Tree planting and reforestation efforts must be undertaken by communities.

This participant discussed community-led tree planting and forestry programs. These types of community engagement techniques will aid in the reduction of carbon dioxide, improvement of air quality, enhancement of biodiversity, and mitigation of the effects of climate change.

Participant E Community resident said,

Climate change requires the implementation of community resilience and adaptation programs.

This participant mentioned that towns must make plans to adapt to the effects of climate change, such as extreme weather events and sea-level rise, by installing flood protection, green infrastructure, and emergency response techniques. Participant A, a university lecturer, suggested promoting energy savings and efficiency, while Participant C (Community resident) emphasized returning to traditional ways of life and avoiding synthetic materials. Participant B University lecturer focused on reducing pollution from traffic congestion through sustainable modes of transportation, whereas Participant B (Community leader) emphasized communal gardens and urban farming to reduce the environmental impact of agriculture.

Participant D (University lecturer) suggested turning waste into an economic resource, while Participant B (Community resident) emphasized community waste reduction initiatives and recycling programs. Participant A (Community leader) suggested developing local climate action plans, whereas Participant E (Community resident) emphasized the importance of climate change education and awareness efforts.

These similarities provide common perspectives on community engagement strategies to mitigate climate change and promote sustainable development. They highlight the diverse approaches and priorities that individuals and communities may have in addressing this global challenge.

6. Discussion

6.1. Role of Universities in Communities to Address Climate Change

It emanated from the study that universities should conduct research on climate change and share the findings with the communities. This was also observed by Manzanedo and Manning (2020).

The study emphasized that universities offer equal education access and community engagement for capacity building. Including sustainability topics in courses, as proposed by George et al. (2021), raises awareness of global issues such as climate change and inequality. Some universities implement technology policies for teaching; likewise, climate change awareness can engage all stakeholders. This aligns with Cong et al. (2020) call to promote local climate change education.

Findings from the current study established that engaging communities could help educate them about climate change and sustainability using study information. This finding agrees with Manning (2020), whose findings revealed that universities conduct research involving community participants but often neglect to share findings with them. Engaging communities can help educate them about climate change and sustainability using study information. This research underscores universities' role in battling climate change through innovation. Similarly, Malhi et al. (2021) stressed the importance of research in addressing climate change. George et al (2021) supported universities' vital role in climate research and innovation. The findings also highlight the importance of collaboration among universities, other climate change activists, and community members. Similarly, Malhi et al. (2021) found that by involving multiple stakeholders, there is a higher likelihood of generating comprehensive and impactful solutions.

The findings propose community-based projects

involving local engagement for sustainable activities such as reforestation, waste management, and renewable energy. Malhi et al. (2021) suggested university–community collaborations for region-specific climate change solutions, emphasizing innovation and education. Similarly, Gilmore et al. (2020) stated that state universities can aid environmental solutions through advanced research and technology.

The study suggests adopting eco-friendly policies, focusing on awareness, and involving students, faculty, and staff in campus sustainability. This encompasses various strategies for greener universities. Gilmore et al. (2020) stress the value of workshops in promoting awareness and sustainable actions. Goldberg et al. (2020) highlighted universities as drivers of evidence-based policies and community programs. This showcases their role in driving local and policy-level sustainability. The research also offers diverse views on partnering with communities, government, and businesses or engaging at the grassroots level with companies and civil society.

6.2. Strategies for Mitigating the Impact of Climate Change on Sustainable Development

The research findings revealed diverse community engagement strategies for climate action and sustainable development. Each perspective highlights individual insights. Our study supports Malhi er al. (2021), emphasizing renewable energy promotion through community involvement. The results emphasize sustainable transport to reduce traffic pollution, suggesting public transport, carpooling, cycling, and walking for reduced emissions.

In line with Goldberg et al. (2020), the study showed the potential of community engagement for promoting renewables and raising awareness. Grassroots climate initiatives were discussed, reflecting communities' efforts against climate change. The research advocated waste-to-resources via recycling, aligning with Ballew et al. (2019), who emphasized community waste reduction. Participants called for traditional living and green building, echoing Ballew et al. (2019) proposing tree planting for climate mitigation.

This study recommends universities to lead climate education, urging community involvement in local action plans against climate change. It emphasizes resilience programs and strategies to combat climate impacts such as extreme weather and rising sea levels, aligning with prior research by Malhi et al. (2021) on community tree planting.

7. Conclusion

Climate change threatens long-term development. Collaboration among universities, individuals, organizations, businesses, and governments is crucial for eco-friendly projects and sustainable progress. This study focuses on using community engagement to address climate change in South Africa's Enock Mgijima Local Municipality. It explores the hindrances posed by current environmental problems, their impact on climate change and sustainability, and proposes strategies to combat these issues. Universities and local communities can work together to foster a pollution-free, green environment through community involvement.

In exploring the role of community engagement as a strategy that involves universities to address climate change for sustainable development, our study uncovered crucial insights. Community engagement initiatives led by the rural university demonstrated a positive impact, fostering increased climate change awareness and commitment to sustainable practices within the local community. The data emphasized the significance of collaborative partnerships and grassroots involvement in achieving meaningful outcomes.

A comparative analysis with existing studies underscores the unique contributions of this research. While other studies often focus on urban settings or broader policy frameworks, our study specifically delves into the context of a rural university in South Africa. This comparison highlights contextual nuances and reinforces the importance of tailored strategies that consider the specific challenges and opportunities presented by rural environments in the fight against climate change.

The implications of our study extend to academia, policymakers, and practitioners involved in climate change and sustainable development. The findings emphasize the pivotal role of rural universities in fostering sustainable practices at the grassroots level, serving as catalysts for community-driven climate change initiatives. This insight can inform the development of targeted engagement strategies not only in South Africa but also in similar rural settings globally.

The strength of this study lies in its qualitative approach. This approach allows for a comprehensive understanding of community engagement dynamics. Future research endeavors could build upon these strengths by exploring specific models of community engagement, assessing long-term impacts, and investigating potential synergies with governmental and non-governmental organizations. Continued research in this area can contribute to a more nuanced understanding of effective strategies for sustainable development in the context of climate change.

Despite its contributions, this study is not without limitations. Factors such as sample size and geographical specificity may affect the generalizability of the findings. To address these limitations, future research should consider larger-scale studies with diverse samples and employ a multi-method approach. Additionally, ongoing evaluation and adaptation of community engagement strategies are recommended to ensure continued relevance and effectiveness.

In summary, this study reinforces the significance of community engagement as a viable strategy for

addressing climate change and promoting sustainable development, particularly in the unique context of a rural university in South Africa. The insights gained contribute to the evolving discourse on effective climate change mitigation strategies, advocating for localized approaches, and emphasizing the transformative potential of collaborative partnerships between educational institutions and local communities.

8. Recommendations

This study suggests creating climate adaptation models for South Africa to understand universities' role in combating climate change. Local communities should help identify weather changes. Universities and communities should collaborate on identifying pollution trends.

In examining the role of community engagement as a strategy to address climate change for sustainable development, our study uncovered crucial insights. Community engagement initiatives led by rural universities demonstrated a positive impact, fostering increased climate change awareness and commitment to sustainable practices within the local community. Qualitative data emphasized the significance of collaborative partnerships and grassroots involvement in achieving meaningful outcomes.

9. Future Research

Future research endeavors could build upon these strengths by exploring specific models of community engagement, assessing long-term impacts, and investigating potential synergies with governmental and non-governmental organizations. Continued research in this area can contribute to a more nuanced understanding of effective strategies for sustainable development in the context of climate change.

Future research can quantitatively gather responses to generalize the findings. A comparative study could explore climate change efforts between urban affluent and rural disadvantaged universities.

Despite its contributions, this study is not without limitations. Factors such as sample size and geographical specificity may affect the generalizability of the findings. To address these limitations, future research should consider larger-scale studies with diverse samples and employ a multi-method approach. Additionally, ongoing evaluation and adaptation of community engagement strategies are recommended to ensure continued relevance and effectiveness.

In summary, this study reinforces the significance of community engagement as a viable strategy for addressing climate change and promoting sustainable development, particularly in the unique context of a rural university in South Africa. The insights gained from the current study will contribute to the evolving discourse on effective climate change mitigation.

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Data Availability Statement

The data generated and analyzed during the current study are available from the corresponding author upon reasonable request. Access to the data will be provided to facilitate transparency and encourage further scholarly discussion and collaboration.

Competing Interests

The authors declare that they have no competing interests that could influence the interpretation of the results or the presentation of the research findings. The study was conducted with a commitment to objectivity and impartiality.

Authors' Contributions

Authors 1 and 2 contributed equally to the conception, design, data collection, analysis, and interpretation of the study. Both authors were actively involved in drafting and revising the manuscript, ensuring its intellectual content and integrity. The collaboration between the authors was instrumental in the successful completion of this work.

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