Antecedents that Restrain or Drive Female Students' Activeness in Climate Change Mitigation – A South African Baseline Case Study

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Abstract

Climate change is one of the major challenges to sustainable development which negatively affects humanity. Universities, both distance learning and contact, need to review and reconfigure approaches to blend critical knowledge and action for climate change mitigation. A starting point is to understand the views and practices of enrolled students to identify driving and restraining antecedents on climate change and mitigation. The inclusive role of women and empowerment in climate mitigation is increasingly being acknowledged. The United Nations SDGs 13 (take urgent action to combat climate change and its impacts) and 5 (achieve gender equality and empower all women and girls) provide reference for this study. This study explored the views of female students at a South African university on climate change to identify antecedents likely to restrain or drive women activeness in climate change mitigation. The embedded mixed-method baseline case design used an electronic questionnaire with open and closed questions. A total of 58% (24) of the 41 respondents were female students. The driving antecedents included a basic understanding of climate change and awareness of the SDGS (75%). The restraining antecedents included a realisation to do more to mitigate climate change (54.3%) and a level of excellence in research, innovation and problem-solving skills (< 30%). The findings confirm that there is much to be addressed in women empowerment with a focus on mitigation measures and skills. Higher education stakeholders should be cognisant of these antecedents in curriculum design and implementation and crafting specific projects for identified antecedents.

UNISA university of south africa PRESS
Progressio
Volume 46 | 2025 | #17477 | 15 pages
https://doi.org/10.25159/2663-5895/17477
ISSN 2663-5895 (Online), ISSN 0256-8853 (Print)

Keywords: women empowerment; climate change; sustainable development

Introduction

The global environment is plagued by a plethora of impacts emanating from a range of sources, with devastating consequences for humanity. Climate change contributes to this complexity of environmental issues, and it has become a focal point of managing our environment due to the uncertainty associated with it, posing challenges to human well-being and ecosystems (IPCC 2022). Human activity and natural processes lead to exacerbated barriers to achieving sustainability. Shaping the next generation is instrumental in implementation of the Sustainable Development Goals (SDGs). Higher education institutions (HEIs) play a critical role in addressing these barriers through creating an awareness, empowerment and capacity building in their students towards achieving the SDGs. SDG 13, target 13.3 "Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning" (UN 2024) highlights the importance of HEIs in climate change education. In particular, women have the potential to contribute to climate change mitigation as it has been proven that their role as primary caregivers, results in prioritising their families' well-being, through "pro-environmental practices" (Nosheen et al. 2023). Preparing women for an active role in climate change mitigation starts through their education but there may be drivers and restraints to this.

There is significant literature on the role of women in climate change adaptation and mitigation, in particular economic empowerment (Ajani et al. 2013; Edmunds et al. 2013; Kovaleva et al. 2022; Nosheen et al. 2023). However, an area of limited exploration relates to the drivers and restraints to women activeness in climate change mitigation. This study responds to the research question: what are the possible antecedents that restrain or drive women activeness in climate change mitigation? The findings of this study have the potential to inform university curricular for improvements to incorporate gender-related climate change mitigation content.

Because of the impacts of climate change, African countries are likely to continue facing increased social and economic inequalities and water insecurities among other challenges (Kovaleva et al. 2022). In African countries, gender-related imbalances exacerbate the vulnerabilities among women and children (Kovaleva et al. 2022). Gender equality approaches enhance participation of women-positive, educational empowerment, and progress towards the fruition of sustainable development outcomes, with potential to reduce poverty (Li et al. 2024; Maitre et al. 2018). It is clearly elucidated in the literature that climate justice and gender justice share an unquestionable synergy (Rainard et al. 2023). Sustainable Development Agenda 2030 advocates that girls or women and boys or men are equally empowered through education (Husein et al. 2021). Puleo (2017) asserts that it is possible to build a world with an ecological culture of social equality, gender included. Higher education has a valuable role to play in developing and advancing the ecological culture of social equality. However, it should be acknowledged that not all universities are adequately

prepared for addressing climate change in their curricula; reinvention or improvements are therefore critical (Filho et al. 2021).

Critical ecofeminism underpinned this study. Critical ecofeminism surpasses women's relation to nature; it is interdisciplinary interconnecting women with environmental issues within a holistic agenda of transformation (Gaard 2015; Öztürk 2020; Rainard et al. 2023). There is need for a shift in focus from women to gender issues, from women as victims to women with agency and from just the science to socio-ecological equality (Gaard 2015; Rainard et al. 2023). This shift from women to gender is critical to advancing urgency to feminist responses, human induced climate change and the rethinking of environmental feminism (Gough et al. 2024). Siegel (2024) avers that the entanglement of ecofeminism beyond gender and environmentalism means constructing innovative pathways for education.

People, in their circumstances, can influence their contexts; a person who is able to shape their world is said to have agency (Crowhurst and Cornish 2020). Crowhurst and Cornish (2020) in citing Bandura (2006) identify three modes of agency, namely, individual (individually enact transformation), social agency (synergy of skills, resources, values and knowledge to enact change) and proxy agency (change is enacted by individuals or groups on others to achieve objectives). The different agency modes can be developed in students in HEIs, for example through the curriculum (knowledge and skills). This study explored the knowledge and skills of female students in the context of climate change mitigation.

There is much to identify, understand and respond to in relation to gender inequality. An antecedent is a thing that exists and that can influence outcomes; the identification of which helps to inform future efforts (Sun et al. 2017). In this baseline case study, driving and restraining antecedents to women activeness in climate change mitigation were identified.

Methodology

A mixed-method single case study design was adopted in this study. Case studies involve an in-depth investigation to understand an issue of an individual, group, unit or system and may use both qualitative and quantitative methods to source data (Arya 2020; Coombs 2022). This case study involved a baseline assessment to identify driving or restraining antecedents to women activeness in climate change mitigation. Baseline assessments, among other values, can be used to describe, investigate and understand an educational context, contribute to curriculum design and identify the skills and needs of students (Sterk et al. 2022).

Students from year levels three and four in a department (Faculty of Natural Sciences) at a university in South Africa were the respondents. The department was selected based on convenience. All female students from the department were invited to participate in

the study. A total of 58% (24) of the 41 respondents were female students and form the case study unit for this paper. A descriptive design was applied to the research to get a deeper understanding of the female students' voices and of the antecedents. A mixed-method approach was used to collect simultaneous quantitative and qualitative data to get a more in-depth understanding of the antecedents that are likely to restrain or drive female students' activeness in climate change mitigation. An electronically administered questionnaire with open-ended (qualitative) and closed questions (quantitative) was used to elicit student responses. The open-ended questions were analysed qualitatively through coding of antecedents and the closed questions using descriptive statistical analyses.

Ethical Considerations

The study was conducted under a registered university research project.

Results

Antecedents Which Are Likely to Drive Women Activeness in Climate Change Mitigation

The following four antecedents were identified as drivers of women activeness in climate change mitigation: (1) awareness of Sustainable Development Goals; (2) understanding climate change; (3) skills; and (4) positive attitudes towards developing early awareness of climate change.

Awareness of Sustainable Development Goals

To participate in local, national and global contexts and to enact appropriate behavioural or intellectual environmental solutions, knowledge and awareness of critical international agreements are necessary, one being the SDGs. Figure 1 shows the female student responses to their awareness of the SDGs.

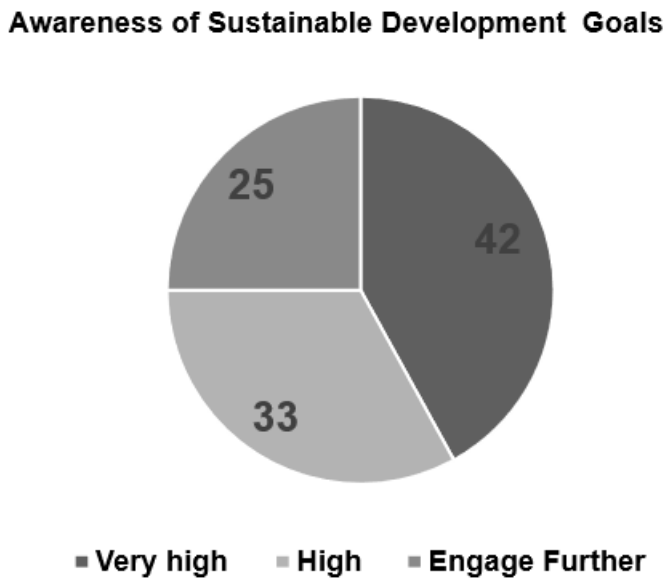

Figure 1: Awareness of the Sustainable Development Goals

Overall, 75% of the students indicated that they seem to have a high/very high awareness of the SDGs. A total of 25% indicated that they still need to engage further with the SDGs.

Understanding Climate Change

For the study, the researchers adopted the United Nations Framework Convention on Climate Change (UNFCCC) definition of climate change as a unit of analysis, namely, "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UNFCCC 1992).

The UNFCCC definition of climate change makes reference to human activities, natural change and change over a period of time. Although most students did not articulate an understanding inclusive of all three aspects of the definition, they did show an understanding of the phenomenon (such as Students 4 and 8) (table 1). However, Student 7 presented an understanding inclusive of all three aspects referred to in the UNFCCC definition.

Table 1: Students' understanding of climate change

The UNFCCC (1992) makes reference to: • Human activities • Natural change • Change over a period of time	
Student 4	"Anthropogenic driven alteration in weather patterns and environmental phenomenon."
Student 8	"Climate change refers to long-term shifts in temperatures and weather patterns."
Student 7	"It is a long-term shift or changes in temperature and weather conditions, either natural or by human activities."

Skills

Social agency requires the pooling of skills to achieve a desired outcome (Crowhurst and Cornish 2020). Team or group work skills (figure 2) showed the highest rating of excellence (60%) from the list of the skills presented. Team or group work skills can be considered a driving antecedent for women activeness within the context of this study.

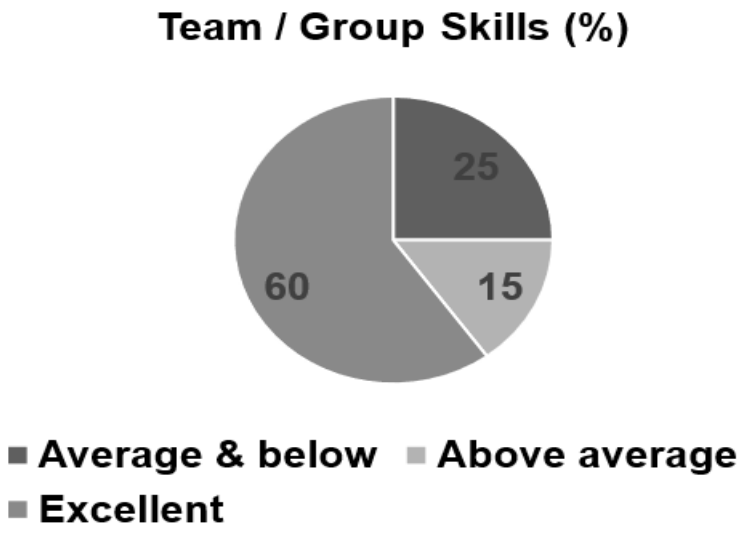

Figure 2: Rating of team/group skills

Positive Attitude Towards Developing Early Awareness of Climate Change

The students were asked to make any other comments on environmental awareness. In the nine responses to this question, the development of awareness from a young age was noted (Students 2 and 9) (table 2). This is an important comment as women in many

parts of the world, for reasons which may be country or culturally specific, are excluded or have not been given equal opportunities and access to education.

Table 2: Support for early awareness of climate change issues

Respondent	Response
Student 2	"Teaching the community from a young age can have long-term effects on environmental awareness, because elders would not entirely understand or rather agree or better yet change their ways of doing things easily, so the best thing is to target young people who are still willing to try things in different ways."
Student 7	"More education is needed."
Student 9	"Environmental education must be taught in school so children would know from a young age to take care of the environment."

Antecedents Which Are Likely to Restrain Women Activeness in Climate Change Mitigation

The following three antecedents were identified as restraining women activeness in climate change mitigation: (1) inadequate effort; (2) the lack of use of bicycles; and (3) specific skills.

Do You Think You Are Doing Enough in the Way You Live to Address Climate Change?

Individual agency is required to enact change within contexts. A reasonable deduction from just under 50% of the responses is that more can be done to mitigate climate change (figure 3).

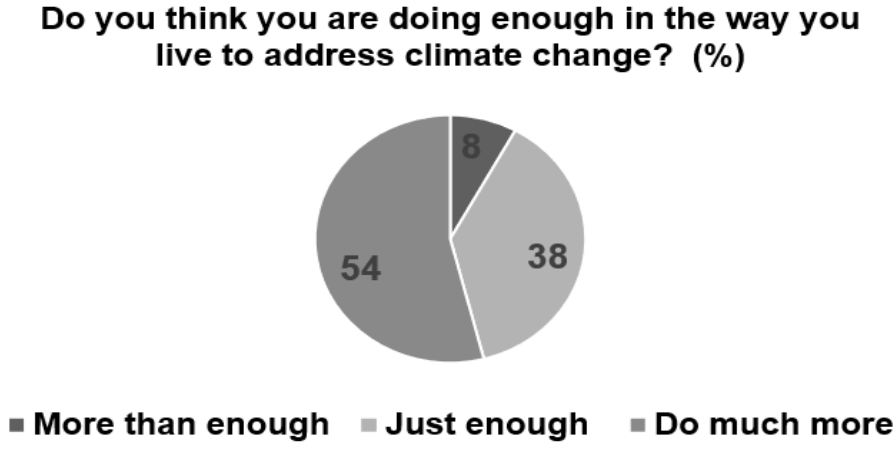

Figure 3: Student responses to their efforts to address climate change

Further to the choices above students were asked: What do you think you can still do in your life to address climate change? There were varied suggestions which can be largely categorised as behavioural mitigation (use of energy, recycling and halting burning of waste), awareness and education, and research and synergy (table 3).

Table 3: Student responses to further efforts to address climate change

Respondent	Suggestion	Category
Student 3	"Using energy saving light bulbs, using renewable energy such as maybe using solar energy for up water etc."	Behavioural
Student 9	"By recycling more."	Behavioural
Student 10	"I need to get out of the habit of burning things that can't be easily disposed of in waste bins."	Behavioural
Student 4	"Raise awareness and try to minimise product that cause greenhouse gases."	Awareness and education
Student 6	"Create more awareness in my community."	Awareness and education
Student 11	"I will conduct research on climate change for my postgraduate diploma to try to find new solutions."	Research
Student 2	"Work with organisations that can create more awareness to the community and schools especially primary schools."	Synergy

Transport – The Use of Bicycles

The increased use of bicycles as a mode of transport is a useful mitigator to climate change. Figure 4 shows the responses to the questions related to bicycles (ownership and ability to ride). Most students indicated no ownership of a bicycle (96%) and affordability was a reason for not owning one (58.3%). A high percentage (70.4%) indicated that they have never ridden a bicycle, with two responses (9%) indicating health problems.

Most students (96%) responded that they do not own a bicycle. A total of 70% of the students responded that they have not ridden a bicycle. However, over 50% of students indicated that they could drive. It is reasonable to assume in this context that less emphasis is placed on the skill of riding a bicycle. There were students who have a driver's licence (30.4%) but had never ridden a bicycle before. There were varied responses to the question: when was the last time you had ridden a bicycle? The responses ranged from 2 months (1 response), 1 year (1 response), 2 years (3 response), at five years old (1). The ownership of bicycles and the frequency of riding (uncorrelated) can be identified as restraining antecedents to bicycles as a climate change friendly mitigator.

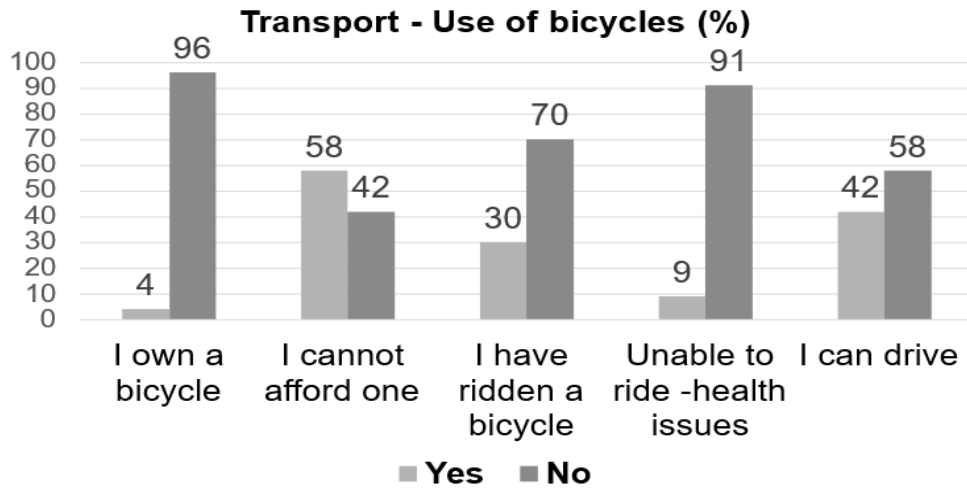

Figure 4: Student responses relating to the use of bicycles

Skills

Women activeness in climate change mitigation related to research, awareness and education demands excellence, like in many other aspects of life. Skills are essential to enact individual, social and proxy agency. Research has highlighted inequalities to access and opportunities to develop skills in women.

The responses indicate that less than a third of the students are deemed to have excellence in skills of research and innovation (19%), problem-solving (28%) and environment auditing skills (24%) (figure 5). These can be regarded as restraining antecedents to effective climate change mitigation.

Skills as a broad category were identified both as drivers and restraints. However, a specific skill, namely, group, was a driver, while lower collective excellence in research and innovation, problem-solving and environment audit skills were identified as restraints to women activeness.

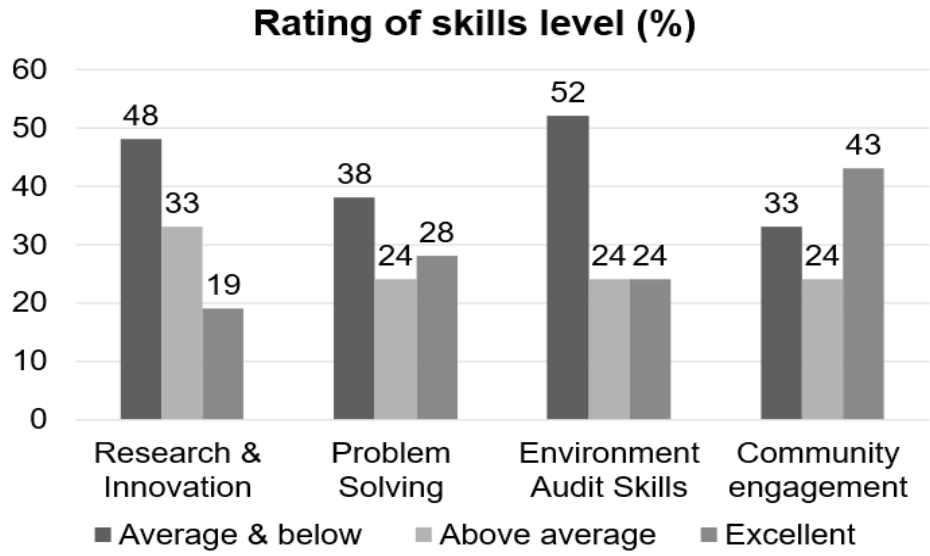

Figure 5: Student rating of skills related to climate change mitigation

Discussion

Climate change is more than a scientific problem (Gaard 2015). Issues of inequality relate to climate change mitigation. The manner in which men and women experience climate change and its challenges are different. Understanding what these differences are, where they occur, what causes them and how to address them is critical to successful implementation of climate change mitigation and adaptation (Edmunds et al. 2013). Women vulnerability to climate change is one of these concerns (Asongu et al. 2021). However, the perception needs to go beyond women as being victims of environmental degradation (Gaard 2015). There is a need for a shift from perceiving women as "victims" to the development of agency (Huyer et al. 2021), ie to act, to participate and to make decisions. Central to critical ecofeminism is also the agenda of transformation. Realising gender equality and the empowerment of women and girls will make a crucial contribution to progress across all the SDGs and targets (UN 2015). Baseline studies within specific contexts provide valuable information to understand the areas for development of agency and the drivers which can be supported or sustained.

Driving Antecedents

Critical knowledge is valuable for participation (Filho et al. 2021). For example, given the inequalities, the development of knowledge and awareness is important for women to participate at a political level. Political empowerment is likely to significantly reduce vulnerability (Asongu et al. 2021). In this study, awareness of the SDGs and understanding climate change were identified as driving antecedents. As indicated in the results section, overall, 75% of the students indicated that they seem to have a

high/very high awareness of the SDGs. In addition to those presented in the results sections, other student responses were:

> Change in weather conditions and patterns that lead to modified ecological communities. (Student 6)

> It makes weather to be catastrophic and lead to severe disasters. (Student 12)

> It is the extreme irregular weather patterns due to global warming. (Student 13)

However, as pointed out by Gaard (2015), there is a need to go beyond conceptions of climate change and to delve into the deeper issues of society such as inequalities, vulnerability and lack of agency in women. Climate change mitigation requires team work skills at various levels of socio-ecological and economic collaboration. Hence, women need skills for participation and innovation not just inclusion for representativity. Higher education, distance and contact education, can provide these skills through group work activities by ensuring that female learners are given equal opportunities to be group leaders.

Restraining Antecedents

Inadequate efforts to implement mitigation strategies (doing just enough – 38%; do much more – 8%), the lack of use of bicycles (70% indicated that they had not ridden a bicycle before) and the lower number indicating excellence in specific skills, namely, research and innovation (19%), problem-solving (28%) and environmental auditing skills (24%) for climate mitigation, were identified as restraining antecedents in the context of this study.

From a curriculum perspective, for example, to increase awareness and participate in addressing social issues of women, students can be given a task of developing a realistic project to support women education and empowerment in a local community. In addition, higher education could amplify efforts to give female students greater access to research through affirmative responses for postgraduate research. This is likely to greatly contribute to women agency in climate change mitigation. Student 11 expressed a desire to do research in postgraduate studies:

> I will conduct research on climate change for my postgraduate diploma to try to find new solutions.

Bicycles are considered one of the strategies for climate change mitigation. However, there is a need for cultural dialogue on the use of bicycles especially in African communities. The Ugandan government committed itself to an approach of consultation to understand practices and attitudes relating to bicycles and gender (UNEP 2022). Higher education requires not only a similar commitment, but also authentic action. Many HEIs provide student support to secure a driving licence but do not provide support for the skill of riding a bicycle or providing such on campus, especially to

encourage female students to ride. However, these interventions need dialogue beyond university management committees. Bicycle projects in HEIs need to implement inclusivity, active participation, voices and inputs of female students, which are central to ecofeminism.

Research and innovation skills are necessary in a world faced with multiple related issues which include climate change. While the development of these skills may be included in both undergraduate and postgraduate research, there is a need for analysis of the level of these skills in female students within different contexts. This study indicated a low level of excellence (19%) of these skills among the female respondents.

Case studies by their nature are context specific and cannot draw on generalisations. The north–south divide, economic context, and social and cultural norms of the population sampled are therefore important with regard to the recommendations below, as there are various factors to be considered in determining the role of women in climate change mitigation. However, gender mainstreaming in university climate change curricular is pivotal in changing the way forward (Rainard et al. 2023).

Conclusion

Climate change mitigation is complex, but the social inequalities should not be downgraded. One of the ways of understanding social inequalities such as women activeness in climate change mitigation is through identification and response to the driving and restraining antecedents through research and consultation. In agreement with the literature that not all universities are adequately prepared to address climate change, it is necessary to reposition the formal and informal curricula in higher education. It is recommended that lecturers in distance and contact learning undertake professional development in gender issues that have an impact on climate change mitigation. The application of socio-ecological case studies that delve into the deeper issues of gender inequalities and women activeness, action research and scholarship of teaching and learning, as demonstrated in this baseline study, has considerable potential to inform university curricular. However, the agency factors of critical knowledge and behavioural outcomes require a synergetic balance rather than isolation in pedagogical strategies for climate change mitigation.

Recommendations

Higher education stakeholders, in distance and face-to-face education, need to be cognisant of these antecedents in curriculum design and implementation. These antecedents can be explored further in the direction of future research suggested below. Specific programmes and/or projects can be crafted to address specific antecedents identified in this study such as a bicycle project (being taught how to ride or subsidising or providing bicycles to female students from disadvantaged financial backgrounds). These projects need to actively include female students in the dialogue from inception.

Direction for Future Research

Further research is required to provide a more comprehensive overview of the factors influencing women activeness in climate change mitigation. All universities in South Africa and around the world should consider departmental and institutional research studies to further explore and understand contexts and respond appropriately to their findings. Future research should categorically include active "voices" of female students in the design and reporting of such studies.

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