



Fostering Sustainability through Innovative Pedagogies: Faculty Community Engagement at one University in the Eastern Cape

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Abstract: This paper examines the role of innovative pedagogies in promoting sustainability through community engagement initiatives in higher education. As global sustainability challenges intensify, universities are uniquely positioned to contribute solutions by integrating sustainability principles into their curricula. This study examined the practices employed by faculty members at Walter Sisulu University's former Faculty of Economics and Information Technology Systems (now the Faculty of Management and Public Administration Sciences) to address local sustainability issues through curriculum-linked community engagement. Using a qualitative research approach, data were generated from faculty activities, course outlines, and community projects to identify effective pedagogical strategies that enhanced student learning while benefiting local communities. Findings indicated that faculty members increasingly align their teaching methodologies with sustainability goals, promoting active student participation in community-oriented projects. These initiatives enrich the educational experience and empower students to become agents of change in their communities. This research underscores the importance of higher education institutions adopting innovative pedagogies that bridge academic knowledge with practical community needs, thereby fostering a sustainable future through education.

Keywords: *Education for Sustainable Development, Sustainable Development Goals, Sustainable development, Higher Education Institutions, Community Engagement.*

1. Introduction and background

Sustainable development has never been more urgent (UNESCO, 2017). Higher Education Institutions (HEIs) effectively address these challenges by equipping students with knowledge and skills for sustainable community practices (ibid). A sustainability practice refers to any activity aimed at promoting sustainable development. Sustainability practices are essential for higher education institutions (HEIs) because they significantly transfer knowledge to local communities (UNESCO, 2017). This type of support provides a mechanism for addressing society's direct needs. Hence, university curricula across the globe are experiencing significant pressure to transform their insular, distant form (Carvalho, 2021). The global community unites university leaders committed to integrating sustainable development into their institutions' curricula (Franco et al., 2019).

This commitment shows strong support for ESD in the curriculum (ibid). ESD is recognised worldwide by universities as one of the factors contributing to sustainability (Togo & Lotz-Sisitka, 2013).

Despite global progress in ESD, many HEIs in South Africa, such as Walter Sisulu University, still have curricula that are not aligned with local challenges, such as rural poverty and food insecurity. While faculty initiatives at the former FEITS show potential, they lack intentional alignment with the SDGs and comprehensive evaluation.

ESD has been a top priority on the global agenda since the 1992 Rio Conference (Agbedahin, 2019). A Global Higher Education for Sustainability Partnership Initiative was established to facilitate the integration of sustainability into higher education curricula worldwide (UNESCO, 2017). In 1995, UNESCO introduced the International Environmental Education Programme (IEEP) to the international community, intended to promote various educational activities to set a future EE blueprint. There are three identical and interchangeable terms in higher education for SD: education for sustainability, sustainable development and sustainability education. However, ESD is the term most used internationally, as reflected in United Nations documents (ibid).

Ninety universities across the globe adopted the Kyoto Declaration in 1993 to achieve an important objective in global sustainable development (UNESCO, 2017). The Kyoto Declaration emphasises a global perspective for higher education, focusing on universities' responsibility to students and the larger community (ibid). HEIs are progressively addressing sustainability challenges (Compagnucci & Spigarelli, 2020). Universities worldwide are partnering with stakeholders to address sustainability challenges across various communities (Höffken & Lazendic-Galloway, 2024).

In her analysis of international sustainability declarations and frameworks for higher education, Tilbury (2012) highlights the progress made by higher education institutions (HEIs) in transforming educational experiences toward sustainability. The journey of implementing sustainability practices starts within the institution itself, focusing on influencing the behaviours of both staff and students before engaging local communities in the process (ibid). Additionally, the United Nations Environmental Programme (UNEP) has played a pivotal role in assisting numerous universities in enhancing the quality of their education by integrating sustainability principles across all operational aspects of their institutions (Togo, 2009).

Higher education institutions (HEIs) are uniquely positioned to drive the global agenda for sustainable development, yet their potential remains largely untapped without deliberate strategic initiatives and collaborative efforts. The need for a concerted approach to embedding sustainability into the fabric of higher education curricula and community engagement cannot be overstated. While numerous institutions have begun to embrace this imperative, the effectiveness of these initiatives often hinges on establishing robust partnerships among diverse stakeholders.

In the United States, the foundation of a national network in 2003 exemplifies the potential of multi-stakeholder collaborations to advance sustainability education. This initiative, which united HEIs with businesses, communities, and other stakeholders to support the Decade of Education for Sustainable Development (DESD), catalysed the formation of sustainability committees across various institutions. However, to truly effect change, these committees need to transcend mere organisational structures and cultivate an active culture of sustainability that permeates campus life and extends into local communities. The challenge lies in ensuring that sustainability initiatives are not treated as ancillary but are integrated into HEIs' core missions, effectively transforming the educational landscape.

Australia's efforts indicate a promising trend towards this integration. Institutions such as Western Sydney University and the University of Sydney have established innovative partnerships to promote sustainability through diverse qualifications and projects.

Initiatives such as watershed management and smart solar benches demonstrate a commitment to environmental stewardship. Yet, recognition, such as the University of Sydney's 2020 AFR Higher Education Award for Sustainability, should serve as a call to action rather than a destination. It is imperative that these practices become the norm rather than exceptions.

Despite advancements, numerous HEIs still lack meaningful engagement with their surrounding communities, undermining the potential impact of their sustainability efforts. Collaborative models that integrate students, staff, and residents need to be widely adopted to foster a culture of sustainability. The University of Gloucestershire's edible garden in the UK is a valuable case study, illustrating how permaculture design can engage diverse stakeholders in practical sustainability learning. Such initiatives highlight the importance of local contexts in sustainable education and the need for HEIs to prioritise hands-on, community-based learning experiences.

While strides have been made in promoting sustainability within HEIs globally, a broader, more integrated approach is essential. Institutions must not only focus on advancing their internal sustainability goals but also engage meaningfully with their communities to create a lasting impact. The path forward involves cultivating dynamic partnerships, fostering participatory learning environments, and committing to ongoing evaluation and progress reporting. Only through these comprehensive measures can HEIs fulfil their potential as leaders in sustainable development.

1.1 Research questions

- How do innovative pedagogies in higher education promote sustainability through curriculum-linked community engagement?
- In what ways do faculty members at Walter Sisulu University integrate sustainability principles into teaching through community engagement initiatives?
- What pedagogical strategies do faculty employ to align teaching methodologies with local sustainability challenges while enhancing student learning?

2. Literature Review

The role of higher education in promoting equity and sustainability is more critical than ever. As we face pressing global challenges, it becomes essential for educational institutions to adapt their approaches to encourage innovative pedagogies that respond to local sustainability needs. By fostering collaboration across various disciplines and incorporating decolonial perspectives, we can empower students to become critical thinkers and proactive agents of change. This collective commitment to integrating sustainable development into higher education not only empowers students but also reflects a growing recognition of the critical role that universities play in achieving global sustainability goals.

Transforming the academic landscape requires our collective efforts to ensure that educational practices not only support the Sustainable Development Goals but also drive systemic change, especially in resource-constrained settings. By uniting our resources and expertise, we can create a more equitable and sustainable future through education. In academia, collaboration is essential for driving significant progress and fostering innovation. By pooling our knowledge and resources, we can tackle complex challenges and create lasting change in our fields.

Achieving all 17 Sustainable Development Goals is impossible without the vital contributions of higher education and research (Crespo et al., 2017). HEIs can encourage students' autonomous thinking by opening up possibilities rather than defining or

prescribing their future. It is essential to empower university students to determine their direction. HEIs worldwide have integrated strategies for sustainable development into their curricula and co-curricular activities (Togo & Lotz-Sisitka, 2013a). Mittelman (2017) resonates that university curricula worldwide are experiencing significant pressure to transform their insular, distant form. The global community is coming together as university leaders pledge to incorporate sustainable development into their institutions' curricula (Franco et al., 2019). Abo-Khalil (2024) stated that effective sustainability management practices are recognised at university campuses in the United States, Europe, Asia, and Africa.

Several international universities outside Africa, such as Stanford University in the United States, the University of Edinburgh in Scotland, and the University of Cape Town in South Africa, are leading the charge in integrating sustainability into their curricula and campus operations, showcasing innovative practices that not only enhance academic understanding but also inspire students and faculty alike to engage in environmental stewardship and social responsibility on a global scale.

2.1 International universities

In recent years, Australian universities have made significant strides in advancing sustainability initiatives, particularly since 2020. A notable example is the University of Newcastle's Environmental Sustainability Plan for 2019 to 2025. This ambitious plan aims to have the university achieve 100% renewable electricity by 2020 and carbon neutrality by 2025. It also sets a target for a 15% reduction in water usage per square meter. The plan emphasises stakeholder engagement and equity while supporting campus development, including the construction of bio-resource buildings. These efforts highlight the university's commitment to sustainable infrastructure and community involvement in environmental initiatives.

The University of Western Australia has outlined a comprehensive Environmental Sustainability Strategy for 2020-2025, aiming to achieve net-zero emissions by 2025. This strategy includes initiatives such as installing solar photovoltaic systems, implementing energy-efficiency retrofits, and reducing waste. Furthermore, it integrates sustainability principles into the institution's Vision 2030 priorities, which encompass clean energy initiatives and advancements in environmental science. This holistic approach reflects the university's commitment to environmental stewardship and sustainable development.

Griffith University in Australia has established a comprehensive Sustainability Strategy for 2023-2030, aiming to reach net-zero emissions by 2029. Key initiatives include a significant \$13.8 million investment in rooftop solar energy, a commitment to fleet electrification with a target of 50% hybrid or battery-electric vehicles by 2025, and a focus on climate-resilient planning exemplified by initiatives such as the Climate Action Beacon. This strategy underscores the university's proactive approach to addressing climate change and promoting sustainable practices within its operations.

The University of Hong Kong has developed a comprehensive system to conserve the natural environment. In parallel, the Universidad Autónoma de Madrid has created an innovative eco-campus that actively involves both students and staff in various sustainability practices.

In the Philippines, the Dark Green Schools (DGS) initiative within higher education institutions plays a significant role in promoting sustainability. This initiative aligns with the global framework for sustainable development and incorporates various governmental policies that emphasise environmental conservation, sustainable resource utilisation, and the promotion of environmental education. The DGS initiative has successfully fostered collaboration among students, faculty, local communities, and stakeholders.

These cases illustrate the strategies educational institutions in different regions employ to foster and advocate sustainable practices. The initiatives align with the SDGs, bolstering

community relationships, research, and operational frameworks while advancing the University of Sydney's mission to increase regional influence.

The integration of sustainability into higher education has advanced globally through various initiatives; however, the existing literature reveals a significant gap in the incorporation of innovative pedagogical methods that actively engage students in learning about and practising sustainable behaviours across different cultural contexts. This underscores a critical need for more comprehensive international research in this essential area of study, which can facilitate the exchange of best practices and foster a more global commitment to sustainability education.

2.2 African Initiatives

The integration of sustainability into higher education frameworks is increasingly recognized as vital for fostering strong connections between universities and their surrounding communities. This perspective is highlighted by Lotz-Sisitka (2012), who notes that African universities have begun to seize the strategic opportunity presented by sustainability initiatives. Prominent among these efforts is the Mainstreaming of Environmental and Sustainability in Africa (MESA) University Programme, which includes key institutions such as the University of Malawi, Uganda Martyrs University, and the University of Zambia Research (Lotz-Sisitka et al., 2015).

These universities have implemented transformative initiatives that have led to significant advancements across curriculum enhancement, policy formulation, community engagement, and research. Despite this notable progress, there remains a significant gap in the literature regarding the innovative pedagogical approaches these institutions employ to effectively educate and engage students in sustainability practices. This gap underscores the need for further research to understand and document the unique strategies that African universities are adopting to promote sustainability education.

2.3 South African Initiatives

In South Africa, Rhodes University exemplifies a comprehensive systems approach to sustainability by integrating environmentally responsible practices throughout its institutional framework, effectively linking its internal operations with the wider community (Togo & Lotz-Sisitka, 2013). This initiative encompasses collaboration among various departments and is bolstered by the Environmental Learning and Research Centre, which leads sustainability projects and engages with the community through research and educational programs.

Similarly, the George Campus of Nelson Mandela University, located near Walter Sisulu University, actively promotes sustainability through its unwavering commitment to teaching excellence, community involvement, and impactful research (Lotz-Sisitka et al., 2015). The Student Change Project, launched in 2011, showcases inspiring environmental initiatives driven by student-led efforts in partnership with diverse stakeholders, aiming to cultivate a sustainable campus and extend influence into the surrounding areas.

The University of Fort Hare has also implemented strategies to create a vibrant environment conducive to sustainability, engaging multiple stakeholders through a series of platforms that address various challenges. This creative ecosystem comprises technological, supply chain, and industry platforms designed to facilitate collaborative problem-solving regarding biophysical and institutional obstacles (Corazza & Saluto, 2020).

The collective approaches adopted by these universities illustrate a commitment to systematic engagement with sustainability challenges and embody the principles of systems thinking central to systems theory. These initiatives align with the United Nations Sustainable Development Goals (SDGs), enhancing community partnerships, research output, and operational practices while supporting broader regional sustainability efforts.

Despite the recognized advancements in integrating sustainability practices within South African universities, there is a notable gap in the literature regarding the specific contributions of innovative pedagogies to the development of environmental stewardship and sustainability awareness among students within this context.

3. Theoretical foundation

The application of systems theory to analyse innovative sustainability pedagogies in higher education institutions (HEIs) provides valuable insights into faculty roles in community engagement. By emphasizing the integration of subsystems, systems theory facilitates a comprehensive examination of the interconnected challenges associated with sustainability, both within educational frameworks and in broader societal contexts (Lai & Lin, 2017; Javanmard et al., 2023). Key characteristics of this approach include recognizing interrelated elements, establishing definable boundaries, maintaining hierarchical structures, and necessitating a holistic analysis of components considered as wholes (Schaveling & Bryan, 2018).

Systems theory emerged in the early to mid-20th century, primarily influenced by biologist Ludwig von Bertalanffy. He criticised the reductionist approaches prevalent in contemporary scientific methods, advocating for a perspective that considers systems as interconnected wholes. This holistic view emphasizes the relationships and interactions among components rather than analysing them in isolation (Von Bertalanffy, 1968).

The emergence of systems theory marked a significant shift in how we approach complexity in living and social systems. As noted by Rizzo (2018), this interdisciplinary paradigm arose in response to the limitations of reductionist approaches, which often failed to account for interactions within a whole system and the phenomenon of emergence. Its development was influenced by post-war challenges that called for a more holistic analysis across fields such as biology, cybernetics, and social sciences, paving the way for a more integrated understanding of complex systems.

The application of systems theory has evolved significantly over the years, gaining relevance across disciplines such as computer science, sociology, political science, and geography (Klishi, 2023). Notably, Buckley was the first to apply systems theory specifically to sociology; however, he critiqued von Bertalanffy's approach, arguing that it inadequately addresses the complexities of sociocultural systems (Buckley, 1967). In response to these limitations, Buckley proposed his framework of "sociocultural systems," designed to better accommodate the intricate and dynamic nature of social environments. The term "academic" refers to all aspects related to education, research, and scholarship within higher education institutions (HEIs). It encompasses a range of approaches, methodologies, and practices that facilitate learning and knowledge creation. In the context of Buckley's framework of "sociocultural systems," understanding academia as part of these systems of thought enhances comprehension of how academic practices function and interact within the broader educational environment.

The concept of academia is broad, encompassing education, research, and scholarship. Within the framework of higher education institutions (HEIs) operating under systems theory, "academic" typically refers to the approaches, methodologies, and practices that facilitate learning and knowledge creation. This includes innovative pedagogies—teaching methods designed to enhance student engagement and improve learning outcomes. At Rhodes University, for example, the integration of teaching, research, and community engagement reflects an academic environment that values collaboration across disciplines and with external stakeholders. Overall, the term "academic" encompasses not only the methods used in instruction and learning but also the values and responsibilities that institutions hold towards their students and the broader community.

The text also emphasizes the importance of feedback loops in educational environments, particularly in student-led projects such as feasibility studies for small and medium-sized enterprises (SMEs). These projects generate valuable data that can inform curriculum revisions while also having a broader impact on the community, which can further refine teaching methods. This approach aligns with Sustainable Development Goals (SDGs) 4, 9, and 11, which emphasise the importance of quality education and sustainable economic growth. Furthermore, integrating individual faculty innovations into broader institutional policies is vital. This aligns with Lotz-Sisitka's (2012) argument that HEIs should play a role in shaping economic and health systems beyond their immediate environments. By fostering a dynamic relationship between academic initiatives and community needs, HEIs can contribute significantly to societal resilience and sustainability.

Critiques of systems theory often highlight its potential for abstraction, suggesting that it may obscure practical applications. However, Schaveling and Bryan (2018) present a compelling counterargument, emphasizing that boundary-spanning analysis can reveal key leverage points for multi-level interventions. This makes systems theory particularly suitable for evaluating initiatives at Walter Sisulu University, especially within the context of the Faculty of Education's Information Technology Services (FEITS) programs. By contrasting these initiatives with global benchmarks, such as Education for Sustainable Development (ESD) frameworks, researchers can assess their effectiveness and adaptability within a broader educational landscape. Such an approach not only strengthens the evaluation process but also fosters a more nuanced understanding of the interplay between local initiatives and global standards.

The implications for research and practice are rooted in systems theory, which informs the study's interpretive methodology. This approach allows for the triangulation of various data sources, including interviews, documents, and observations, effectively mapping the interdependencies among subsystems. The findings support recommendations for clear alignment with the Sustainable Development Goals (SDGs) within HEI subsystems. This alignment promotes adaptive governance, which is crucial for anticipating and responding to potential disruptions, such as climate-related events or policy changes. By leveraging systems theory, the study offers a comprehensive framework for understanding the complexities of HEI operations and their broader societal impacts.

4. Research design and methods

4.1 Research methods

The research methodology described in the study employs a comprehensive qualitative approach rooted in interpretive paradigms. This method aims to provide an in-depth understanding of faculty practices related to sustainability education and community engagement (Pervin & Mokhtar, 2022). By concentrating on the perspectives and experiences of lecturers, the study seeks to uncover insights into the implementation and perception of these practices within academic environments (ibid).

4.2 Research design

The research employed a qualitative case study grounded in an interpretive paradigm to investigate faculty members' lived experiences, perceptions, and practices concerning sustainability education and community engagement (Pervin & Mokhtar, 2022). This methodological choice was deemed suitable as it facilitated an in-depth exploration of complex, context-specific teaching practices, moving beyond mere statistical assessments of variables.

Using a case study approach allows for a comprehensive examination of specific situations, events, or entities (Mohale, 2024). This strategy proved valuable for deepening understanding of the sustainability focus within the FMPAS curriculum. Abdallah (2025)

supports this, noting that case studies effectively reveal the realities of the context and provide rich descriptions of participants' experiences, thoughts, and feelings relevant to the topic.

Categorised as an intrinsic case study, this research aims to offer a detailed portrayal of the specific scenario (Hamilton, 2024). The focus of an intrinsic case study extends beyond the case itself to include the faculty or institution involved, as well as the various activities associated with that case.

This investigation centers on the FMPAS's activities during the 2019-2022 academic year, including teaching and learning, research, and community engagement, with particular attention to curriculum-linked community engagement efforts.

4.3 Population and sample

Participants were purposively selected based on criteria ensuring relevance to sustainability pedagogy and community engagement: (1) full-time faculty at Walter Sisulu University with at least 3 years' experience in relevant qualifications (e.g., Human Resource Management, Local Government Finance and Bachelor of Commerce); (2) active involvement in sustainability curricula or community initiatives; and (3) committee leadership roles. Seven participants (5 lecturers, 2 committee chairpersons; 4 female, 3 male; ages 35-55; all South Africans with postgraduate qualifications) were recruited via institutional email and snowball sampling, achieving data saturation. This sample represents diverse faculty but is limited to a single faculty member, thereby limiting generalizability.

4.4 Data Collection Instruments

The study employed three primary methods. First, semi-structured interviews were conducted with seven participants using open-ended questions to explore their teaching practices and engagement efforts. These interviews were held remotely via Zoom and telephone due to COVID-19 restrictions. Second, a document analysis was performed, reviewing 2019 course outlines, research committee reports, and community engagement reports for relevant sustainability themes. Third, observations of three online lectures conducted on Blackboard captured real-time teaching practices. Triangulating data across these methods ensured the validity of the findings.

4.5 Data Collection Procedure

The data collection process began with obtaining a letter of permission from Walter Sisulu University to ensure ethical compliance. Once approval was granted, participants received a consent letter to sign, confirming their willingness to participate in the study. This process ensured that all participants were fully informed and voluntarily consented to take part in the research. Five lecturers were interviewed using a semi-structured format to explore their experiences and perspectives. Additionally, interviews were held with the chairs of the research and community engagement committees to gain a broader understanding of the institutional dynamics. Due to COVID-19 restrictions, observations were conducted during online lessons facilitated by the interviewed lecturers, enabling a deeper examination of teaching practices in a virtual environment. Furthermore, document analysis was conducted on course outlines and reports from the faculty research committee and the community engagement committee, providing a comprehensive overview of the curriculum and institutional priorities. This multifaceted approach ensured robust data collection, thereby enriching the understanding of the context under study. This comprehensive and ethically sound research methodology has laid the groundwork for valuable insights into the educational practices and institutional dynamics at Walter Sisulu University.

4.6 Data analysis

Data were transcribed, anonymised, and analysed using Braun and Clarke's (2021) reflexive thematic analysis. This involved: (1) familiarisation through repeated reading; (2) inductive coding; (3) theme generation (e.g., "pedagogical integration," "community barriers"); (4) review and refinement to 5 core themes; and (5) interpretation within interpretive paradigms.

In conducting qualitative analysis, it is essential to organize data systematically and coherently for effective examination and interpretation. This careful structuring reduces the risk of miscoding and mislabeling, as Liu and Nesbit (2024) emphasise. Such an approach not only enhances the validity of the findings but also enables a deeper understanding of the underlying themes and patterns in the data. By following these organisational principles, researchers can ensure that their analysis is both rigorous and insightful.

The initial analytic phase focused on data gathered from semi-structured interviews with five lecturers, observations of five distinct lectures, and the assessment of lecturers' course outlines. This phase aimed to investigate the manifestation of sustainability within the course outlines, content, pedagogical approaches, and assessment methods across various qualifications. The analysis was conducted through Analytical Memos, which facilitated the researcher's exploration of relationships within the data and rendered ideas both observable and retrievable (Meyers et al., 2020).

The second analytical phase focused on synthesizing data from the interview with the chairperson of the Community Engagement and research committees. This analysis identified effective practices for tackling local sustainability challenges through curriculum and research-linked community engagement initiatives. Additionally, it revealed opportunities for faculty to enhance their involvement in these efforts. This tripartite approach not only highlights existing strategies but also promotes the integration of community engagement within academic frameworks, ultimately fostering a more sustainable and connected educational environment.

The final phase of the analysis involved a comprehensive review of interview data collected from the Research Committee chairpersons, along with quarterly community engagement reports. This stage of the analysis was instrumental in pinpointing key focus areas and research methodologies within the faculty's research projects that either address or have the potential to tackle local sustainability issues.

4.7 Ethical consideration

The study received ethical approval from the Research Ethics Committee at Walter Sisulu University. Participants provided informed consent through written forms that outlined the study's aims, their voluntary participation, and their rights to withdraw at any time. Confidentiality was rigorously maintained through the use of pseudonyms, secure Zoom recordings (which were deleted after transcription), and data stored in a password-protected Google Drive folder. To prevent any potential coercion, no incentives were offered to participants.

Data management involved systematic labelling of transcripts, documents, and notes, enabling the multi-method exploration of sustainability integration.

4.8 Trustworthiness of data

In conducting a qualitative intrinsic case study, the trustworthiness of findings is paramount. To achieve this, the research followed the criteria adapted by Lincoln and Guba (2019) for interpretive paradigms: credibility, transferability, dependability, and confirmability.

Lincoln and Guba's criteria provide a robust framework for assessing trustworthiness, consisting of four key elements: confidentiality, transferability, dependability, and confirmability.

Confidentiality was rigorously maintained throughout the study to protect participants' identities and privacy. All seven participants, including lecturers and committee chairs, were assigned pseudonyms during transcription and reporting to maintain confidentiality regarding their real names, roles, and identifiable details.

In academic research, safeguarding participants' anonymity is critical to fostering trust and encouraging open dialogue. This practice not only aligns with ethical standards but also enhances the credibility of the research findings (Tolich, 2023). By using pseudonyms, researchers can ensure that the insights gathered reflect the participants' perspectives without compromising their privacy. Moreover, this approach allows for a more honest and in-depth exploration of the topics under study, as participants may feel more comfortable sharing their thoughts and experiences when their identities are protected. Ultimately, maintaining confidentiality not only supports ethical research practices but also contributes to the richness and reliability of the data collected (ibid).

The concept of transferability in this research emphasised the importance of context and detailed descriptions to enable readers to assess the applicability of findings to other settings. In this study, thick descriptions were provided through participant demographics, highlighting a purposive selection of 7 faculty members from Walter Sisulu University, aged 35-55, each representing diverse roles within the institution. Additionally, the contextual backdrop of adaptations during the COVID-19 pandemic and the bounded timeframe of 2019 to 2022 were elaborated upon. These elements collectively enhance the transferability of the research outcomes to other South African higher education contexts, particularly to faculties aiming to incorporate sustainability into their curricula. This framework guides researchers and educators in drawing parallels and implementing similar strategies in their own environments (Mohale, 2024).

Dependability in qualitative research is crucial for ensuring the reliability and validity of findings. This was achieved through a comprehensive audit trail that thoroughly documented every stage of the research process. From purposive sampling to data collection procedures, each step was carefully recorded, including obtaining ethical permissions and conducting Zoom interviews.

The analytical process employed reflexive thematic analysis, which involved creating analytical memos to track the evolution of ideas and themes throughout the study (Liu & Nesbit, 2024). This systematic approach not only facilitated transparency but also reinforced the credibility of the findings. The inductive coding process, along with the refinement of themes into five core concepts, was also documented in a research journal. This level of detail reflects a commitment to reliability, enabling a clear understanding of how the research conclusions were derived.

By maintaining an organised and transparent research trail, the study invites scrutiny and fosters trust in the integrity of the qualitative analysis presented.

To enhance the research's credibility, confirmability was emphasised through reflexivity, in which the researcher acknowledged potential personal biases, such as familiarity with the institution, and documented them in reflective memos. A detailed audit trail was maintained, comprising raw data, transcripts, and decisions made throughout the research process to strengthen validity. Anonymisation protocols were implemented to protect participant identities, along with secure data storage methods. Additionally, a peer debriefing process involved a colleague reviewing coding consistency to ensure that the findings emerged from the data rather than being influenced by the researcher's prior assumptions. Collectively, these methodological safeguards reinforce the study's integrity, offering robust evidence of faculty experiences in sustainability pedagogy and community engagement.

5. Limitations

While triangulation enhanced validity, this study's findings are constrained by a small purposive sample of seven Walter Sisulu University faculty, a single-institution focus, and COVID-19 limitations on remote interviews and observations, potentially missing broader perspectives. Reliance on 2019 self-reported documents introduces institutional bias, while external factors, such as fluctuations in government funding, complicate attributing improvements in the matric pass rate solely to FEITS initiatives. These factors limit generalizability to other South African HEIs, suggesting the need for multi-site, longitudinal research.

6. Findings

6.1 Biographic data of participants

The demographics of the participants involved in the study are presented in Table 1.

Table 1: Demographics data for the respondents.

Demographic Factor	Category	Frequency	Percentage
Sex	Male	3	42.9%
	Female	4	57.1%
	Total	7	
Age	35-55	7	100%
	Total	7	100%
Subject taught	Public Economics	1	14.3%
	Development Economics	1	14.3%
	Supply Chain Management	1	14.3%
	Labour Relations 2	1	
	Entrepreneurship skills	1	14.3%
	Total	5	100%
Committee Chairperson	Faculty Community Engagement Committee	1	50%
	Faculty Research Committee	1	50%

	Total	2	100%
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Sources: Authors field data

Table 1 presents the demographic profile of seven faculty participants purposively selected from Walter Sisulu University's Faculty of Education and Training (FEITS) for a qualitative study on sustainability pedagogies. Most participants were male, with 5 out of 7 (71.4%) male and 2 (28.6%) female. All participants were within the mid-career age range of 35 to 55 years. Among the five lecturers, the teaching subjects were evenly distributed, with one lecturer each for Public Economics (14.3%), Development Economics (14.3%), Supply Chain Management (14.3%), Labour Relations (14.3%), and Entrepreneurship Skills (14.3%). The two committee chairpersons were equally split between the Faculty Community Engagement Committee (50%) and the Faculty Research Committee (50%). This small, yet experienced, sample reflects a diverse range of roles relevant to WSU's community-engaged sustainability initiatives, supporting data saturation in the interpretive case study.

6.2 Theme presentations

6.2.1. Theme 1: Innovative Pedagogies and Work-Integrated Learning for Sustainability

Innovative pedagogies for sustainability, as highlighted in community engagement reports and course outlines from the FEITS, underscore a commitment to developing inclusive and sustainable economic growth. Notably, the course outlines for the Entrepreneurship Skills and Development Economics modules exemplify this commitment. Through Work Integrated Learning (WIL), students actively engage with local small and medium-sized enterprises (SMEs) by conducting feasibility studies, thus bridging theoretical knowledge with practical application in real-world settings. This approach not only enhances students' learning experiences but also contributes to the economic vitality of their communities.

COVID-19 severely disrupted WIL through lockdowns and SME closures, limiting hands-on feasibility studies to virtual consultations and secondary data analysis.

FEITS is committed to tackling local sustainability challenges by actively engaging with stakeholders through the Community Engagement Committee. The initiatives implemented through these channels positively impacted the matric pass rate for the 2018-2019 academic year. As a result of WSU's additional efforts, the matric results in the Chris Hani District improved during this period. The proposal from the FEITS Community Engagement Committee advocates introducing short agribusiness courses at WSU. This initiative seeks to tackle critical challenges related to food security and poverty within Whittlesea and its neighbouring regions. With a focus on enhancing local farmers' skill sets, the agribusiness short course is designed to improve infrastructure and foster sustainable long-term growth. By equipping farmers with essential knowledge and practices, this program aims to create a more resilient agricultural sector in the community.

The findings from the FEITS data reveal a strong correlation between sustainability practices and several key areas, including green skills, green jobs, pedagogical approaches, and WIL. This alignment underscores the importance of integrating sustainability into educational frameworks and workforce development, highlighting the role of innovative teaching methods and experiential learning in fostering a more sustainable future. Furthermore, it emphasises the need for educational institutions to collaborate with industry stakeholders to ensure curricula align with emerging sustainability-related job markets.

6.2.2 Theme 2: Systems Alignment and Community Engagement

This pedagogical approach supports the Sustainable Development Goals (SDGs) of industry innovation (Goal 9), reduced inequalities (Goal 10), and sustainable cities and communities (Goal 11). The inclusive approach demonstrates a systems-thinking perspective that effectively addresses sustainability measures.

Systems thinking in entrepreneurship skills encompasses internal subsystems, including students, course content, module pedagogy, and the Community Engagement Committee, alongside external subsystems such as local SMEs and relevant government institutions. The illustrative scenario connecting the university with the community aligns with the model depicted in Figure 1 (Rhodes University system concerning its environment; Togo & Lotz-Sisitka, 2013). These initiatives address various Sustainable Development Goals (SDGs), specifically Goals 1 (No Poverty), 2 (Zero Hunger), 8 (Decent Work and Economic Growth), 9 (Industry, Innovation, and Infrastructure), and 11 (Sustainable Cities).

The findings highlight the critical importance of Higher Education Institutions (HEIs) in driving significant change within their communities. The FEITS initiatives exemplify feedback mechanisms in which students' WIL outputs have influenced committee proposals to enhance agribusiness training. This process not only improves local infrastructure (aligned with SDG 9) but also creates opportunities for decent employment (related to SDG 8). Moreover, increases in student matriculation rates demonstrate the positive effects tied to SDG 4.

These observations indicate that the integration of SDGs tends to occur incidentally rather than through deliberate planning, revealing some gaps in assessment practices. However, there is considerable potential for scaling these initiatives within South African HEIs.

6.2.3 Theme 3: Systems Alignment and Community Engagement through Sustainability Pedagogies

This theme directly addresses RQ2 on curriculum-linked practices. It illustrates how the FEITS at WSU incorporate sustainability principles into their teaching methodologies. This integration is achieved through Work Integrated Learning (WIL) feasibility studies, an emphasis on systems thinking that considers both internal and external subsystems, and initiatives driven by the Community Engagement Committee. These practices not only enhance the curriculum but also foster meaningful connections between students and the community, promoting a holistic understanding of sustainability in various contexts.

The Faculty Community Engagement Committee channels teaching into platforms that improve Chris Hani matriculation rates (SDG 4), with proposals such as agribusiness courses aimed at addressing poverty (SDG 1), hunger (SDG 2), and jobs (SDG 8).

6.2.4 Theme 4: Pedagogical Strategies for Local Sustainability Challenges

The FEITS faculty exemplifies innovative pedagogical strategies that effectively integrate sustainability into educational practices. This holistic approach connects WIL with pressing local challenges, notably rural poverty, and the viability of small and medium-sized enterprises (SMEs). By addressing these real-world issues, the program enriches student learning experiences through hands-on applications and fosters a system thinking perspective, promoting a deeper understanding of the intricate relationships among social, economic, and environmental factors.

In modules such as Entrepreneurship Skills and Development Economics, lecturers assign students the task of conducting feasibility studies for local SMEs. This initiative directly confronts inequalities in the Eastern Cape (aligned with SDG 10) and addresses innovation

gaps (as per SDG 9). By focusing on practical analysis rather than abstract theory, students develop critical skills applicable in real-world scenarios.

The onset of COVID-19 necessitated a swift shift to virtual simulations, Zoom mentorship, and the use of AI market tools, ensuring the continued relevance of community engagement while simultaneously fostering digital resilience essential for navigating future disruptions.

As the educational landscape transitions post-COVID, the hybrid WIL approach merges virtual SME simulations with micro-credentials and stakeholder platforms. This strategy guarantees that sustainability learning persists despite the constraints imposed by lockdowns. Additionally, faculty mentorship through case studies empowers students, helping them build agency to foster local resilience.

Ultimately, these strategies aim to transform traditionally insular curricula into responsive, community-anchored learning experiences. However, the incidental alignment with the SDGs exposes gaps within the intentional assessment frameworks that merit further attention.

7 Discussions

Innovative Pedagogies for Sustainability that have emerged from the FEITS are visible in community engagement reports and course outlines.

The course outlines for the Entrepreneurship Skills and Development Economics modules reflect a strong commitment to fostering inclusive and sustainable economic growth. Through Work Integrated Learning (WIL), students conduct feasibility studies for local small and medium-sized enterprises (SMEs), which directly support the Sustainable Development Goals (SDGs) of industry innovation (Goal 9), reduced inequalities (Goal 10), and sustainable cities and communities (Goal 11). This pedagogical approach is consistent with Togo and Lotz-Sisitka's (2013) systems-thinking framework, emphasising the interconnectedness of economic development and social equity. COVID-19 severely disrupted WIL through lockdowns and SME closures, limiting hands-on feasibility studies to virtual consultations and secondary data analysis. To overcome these challenges, FEITS could implement hybrid WIL models combining virtual SME simulations, digital platforms for remote stakeholder engagement, and micro-credential partnerships with local cooperatives. Faculty mentorship via Zoom case studies and AI-supported market analysis tools would maintain SDG alignment while building student resilience for future disruptions.

The inclusive approach outlined above demonstrates a systems-thinking perspective that effectively addresses sustainability measures. Systems thinking in entrepreneurship skills includes internal subsystems such as students, course content, module pedagogy, and the Community Engagement Committee, as well as external subsystems such as local SMEs and relevant government institutions. FEITS demonstrates its commitment to addressing local sustainability challenges by actively participating in stakeholder platforms, primarily through the Community Engagement Committee. The interventions in these platforms positively impacted the 2018-2019 matric pass rate, reflecting a response to Sustainable Development Goal 4 (quality education). The improvement in the matric results during this period, attributed to stakeholder partnerships, supports the notion expressed by Findler et al. (2018) that HEIs positively influence the achievement of regional developmental initiatives. In the 2018-2019 academic year, the matric results in the Chris Hani District improved due to the additional efforts made by WSU. This finding echoes McCowan's (2019) sentiment that none of the 17 Sustainable Development Goals can be achieved without contributions from higher education and research.

The FEITS Community Engagement Committee proposed that WSU offer short agribusiness courses. This proposal confidently endeavoured to address the pressing issues of food security and poverty in Whittlesea and its surrounding areas. The scenario illustrating the connection between the university and the community parallels the approach depicted in Figure 1, as referenced by Togo and Lotz-Sisitka (2013).

The agribusiness short course aimed to substantially enhance local farmers' skills, improve infrastructure, and stimulate long-term growth. These initiatives would address various Sustainable Development Goals (SDGs), specifically Goals 1 (No Poverty), 2 (Zero Hunger), 8 (Decent Work and Economic Growth), 9 (Industry, Innovation and Infrastructure), and 11 (Sustainable Cities).

The diagram in Figure 1 offers a comprehensive overview of Rhodes University's connections and interactions with its surrounding environment, as detailed by Togo and Lotz-Sisitka in their 2013 study. This representation highlights the intricate dynamics between the institution and its community, emphasising collaborative initiatives, educational outreach, and sustainability efforts. The interactions depicted reflect a commitment to fostering positive relationships that enhance both the university's mission and the well-being of the local populace.

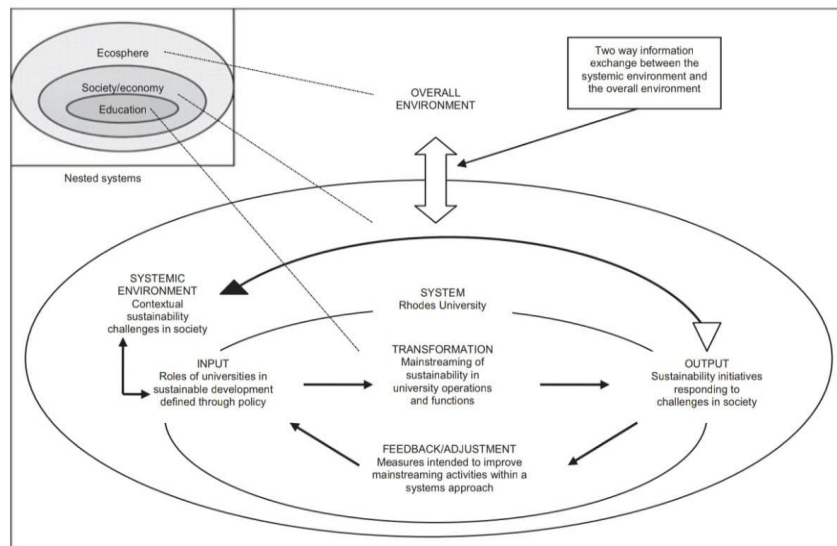


Figure 1: Rhodes University system about its environment (Togo & Lotz-Sisitka, 2013).

Data from the FEITS indicates that sustainability practices related to green skills, green jobs, pedagogical practices, and Work Integrated Learning (WIL) align with the views of Dlouhá et al. (2017), who argue that HEIs are increasingly taking active steps to contribute to sustainable development.

The findings emphasise the crucial role of Higher Education Institutions (HEIs) in driving transformative change, aligning with McCowan (2019), who asserts that the Sustainable Development Goals (SDGs) are unattainable without the active participation of higher education. The FEITS initiatives illustrate the presence of feedback loops, in which students' work-integrated learning (WIL) outputs have informed committee proposals for agribusiness training. This, in turn, enhances local infrastructure (SDG 9) and promotes decent work opportunities (SDG 8), while improvements in student matriculation rates reflect the impacts of SDG 4.

Furthermore, these observations resonate with Dlouhá et al. (2017), who noted the evolution of Central European HEIs through the adoption of green pedagogies. However, it is essential to recognise that this framework uniquely adapts to the South African context, which includes addressing challenges such as rural poverty. The adaptive strategies employed by HEIs in South Africa illustrate their potential to contribute to sustainable development within diverse socio-economic landscapes.

Stakeholder platforms, activated through the Community Engagement Committee, have facilitated multi-level interventions that align with the multistakeholder ecosystems conceptualised by Corazza and Saluto (2020) at the University of Fort Hare. Nevertheless, the incidental alignment with the Sustainable Development Goals (SDGs) rather than intentional integration highlights significant gaps, as indicated by the sustainability assessment indicators outlined by Findler et al. (2018) for higher education institutions (HEIs). Additionally, narratives from faculty emphasise various interpretive paradigms, illustrating how pedagogical approaches can empower students as agents of change. This empowerment addresses critiques of insular curricula, as discussed by Mittelman (2017). Innovative educational frameworks, such as FEITS, are being evaluated against global benchmarks, including the Philippines' Dark Green Schools initiative (Cuaresma, 2019) and the sustainable strategies employed by institutions like the University of Sydney through its solar initiatives. These comparisons reveal FEITS as both contextually innovative and scalable within its framework. However, the challenges posed by the COVID-19 pandemic have notably emphasized the need for adaptability, particularly in the realm of remote Work-Integrated Learning (WIL), highlighting the critical requirement for effective digital tools to support this transition.

The findings emphasize the importance of integrating Sustainable Development Goals (SDGs) into various subsystems of Higher Education Institutions (HEIs), thereby fostering enhanced synergies between research initiatives and community needs, as highlighted by Franco et al. (2019). However, there are limitations to consider, including a small sample size of just seven participants and reliance on data collected during the COVID-19 pandemic. This suggests the need for longitudinal studies to validate outcomes in a post-pandemic context. Future research could also focus on quantifying the impacts of these integrations using SDG indicator tools, thereby providing a more robust framework for assessing effectiveness.

8. Recommendations

The following recommendations provide a strategic roadmap for higher education institutions (HEIs) to integrate Sustainable Development Goals (SDGs) into their curriculum, pedagogy, funding, and accreditation processes. The recommendations for the study are as follows:

- **Embed SDG Mapping in Course Design:** Require all course outlines (e.g., Entrepreneurship Skills and Development Economics) to explicitly include linkages to relevant SDGs. Use tools such as the sustainability indicators from Findler et al. (2018) and conduct annual audits to ensure alignment with Goals 4, 8, 9, 10, and 11.
- **Foster Systems-Thinking Workshops:** Organise quarterly faculty workshops that apply the framework developed by Togo & Lotz-Sisitka (2013). These workshops should connect internal subsystems (e.g., pedagogy, students) with external subsystems (e.g., small and medium-sized enterprises, cooperatives) and co-design micro-credentials, such as short agribusiness courses.
- **Prioritise HEI Funding for SDG-Aligned Work-Integrated Learning (WIL):** Advocate for amendments to the National Development Plan to allocate specific grants (e.g., R5 million annually per institution) for hybrid models and community

projects, based on the successes seen in the Chris Hani District with SDG 4 impacts.

- Mandate Sustainability Benchmarks: Update the Department of Higher Education and Training (DHET) guidelines to require the integration of SDGs in the accreditation process. This should be informed by global benchmarks, such as the Philippines' Dark Green Schools (Cuaresma, 2019), and include incentives for multistakeholder platforms (Corazza & Saluto, 2020). By implementing these strategic recommendations, higher education institutions can play a pivotal role in advancing sustainable development and fostering a generation of learners equipped to tackle global challenges.

9. Conclusion

This study uniquely contributes to the literature by providing empirical evidence from FEITS on how WIL and innovative pedagogies can effectively embed sustainability into higher education curricula. These findings position universities as pivotal agents of change, offering a replicable model for integrating sustainability across teaching, research, and community engagement.

For policy, they underscore the need for targeted funding and incentives, such as those aligned with South Africa's National Development Plan, to scale these initiatives nationwide and foster equitable, sustainable development. In practice, institutions can adopt FEITS-inspired frameworks to enhance graduate employability, community partnerships, and curriculum reform, equipping students to lead just transitions.

As global and local sustainability crises escalate, higher education must urgently accept this responsibility. By prioritising collaborative and context-responsive education, universities can promote systemic change towards a more equitable and resilient future.

References

- Abo-Khalil, A. G. (2024). Integrating Sustainability into Higher Education: Challenges and Opportunities for Universities Worldwide *Heliyon*, 10(9).
<https://www.cell.com/action/showPdf?pii=S2405-8440%2824%2905977-2>.
- Abdallah, M. M. (2025). Scientific Research Methodology and Experimental Design in Education and Language Learning Studies: Basics and Guidelines. *Online Submission*.
- Agbedahin, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence, and future. *Sustainable development*, 27(4), 669-680.
<https://doi.org/10.1002/sd.1031>.
- Alexander, A. P. (2019). Lincoln and Guba's quality criteria for trustworthiness. *IDC International Journal*, 6(4), 1-6.
- Bangani, S. (2024). Leveraging Community Engagement to Contribute to Sustainable Development Goals 8 and 11. *International Federation of Library Associations and Institutions*, 50(3), 451-462. DOI:10.1177/03400352241263533.
- Barresi, P., Reiter, M., & Smardon, R. (2022). The Sustainable Human and Environmental Systems Approach to Sustainability Education: Foundational Principles, Pedagogical Strategies, and Administrative Considerations. *OIDA International Journal of Sustainable Development*, 15(01), 11-22.
<https://ssrn.com/abstract=4351271>.
- Buckley, W. (1967). Sociology and modern systems theory.
- Braun, V., & Clarke, V. (2021). Reflecting on reflexive thematic analysis. *Qualitative Research in Psychology*, 18(3), 328-352.
<https://doi.org/10.1080/14780887.2021.1899563>

- Carvalho, T. (2021). The Transformation of Universities in Response to the Imperatives of a Knowledge Society. *Universities in the Knowledge Society: The Nexus of National Systems of Innovation and Higher Education*, 15-31. DOI: https://doi.org/10.1007/978-3-030-76579-8_2.
- Corazza, L., & Saluto, P. (2021). Universities and Multistakeholder Engagement for Sustainable Development: A Research and Technology Perspective. *IEEE Transactions on Engineering Management*, 68(4), pp.1173-1178. DOI: [10.1109/TEM.2020.3020736](https://doi.org/10.1109/TEM.2020.3020736)
- Cuaresma, J. C. (2019). How green can you go? Initiatives of Dark Green Universities in the Philippines. *Sustainability on University Campuses: Learning, Skills Building and Best Practices*, 165-189. Cham: Springer International. <https://link.springer.com/book/10.1007/978-3-030-15864-4>
- Crespo, B., Míguez-Álvarez, C., Arce, M. E., Cuevas, M., & Míguez, J. L. (2017). The Sustainable Development Goals: An Experience in Higher Education. *Sustainability*, 9(8), 1353. <https://doi.org/10.3390/su9081353>.
- Compagnucci, L., & Spigarelli, F. (2020). The Third Mission of the University: A Systematic Literature Review on Potentials and Constraints. *Technological Forecasting and Social Change*, 161, 120284. <https://doi.org/10.1016/j.techfore.2020.120284>
- Dlouhá, J., Glavič, P., & Barton, A. (2017). Higher Education in Central European Countries—Critical Factors for Sustainability Transition. *Journal of Cleaner Production*, 151, 670-684. <https://doi.org/10.1016/j.jclepro.2016.08.022>
- Findler, F., Schönherr, N., Lozano, R., & Stacherl, B. (2018). Assessing the Impacts of Higher Education Institutions on Sustainable Development—an Analysis of Tools and Indicators. *Sustainability*, 11(1), 59. <https://doi.org/10.3390/su11010059>.
- Franco, I., Saito, O., Vaughter, P., Whereat, J., Kanie, N., & Takemoto, K. (2019). Higher Education for Sustainable Development: Actioning the Global Goals in Policy, Curriculum, and Practice. *Sustainability Science*, 14(6), 1621-1642. <https://doi.org/10.1007/s11625-018-0628-4>.
- Garira, E. (2024). A Systemic Perspective to Realizing and Improving the Quality of Education in Schools. *International Journal of Educational Reform*, 10567879231222862. <https://doi.org/10.1177/10567879231222862>.
- Higgins, K., & Calvert, A. (2025). *Education for Sustainable Development Curriculum Design Toolkit*. Advance HE & York University. Retrieved from Education for Sustainable Development Curriculum Design Toolkit. <https://pure.ulster.ac.uk/en/publications/18ba7311-9013-46db-8b5c-96721ae5ad4f>
- Hamilton, L. (2024). Case study research in education: Considering possible paradoxes and concerns. In *Handbook of case study research in the social sciences* (pp. 194-214). Edward Elgar Publishing.
- Höffken, J., & Lazendic-Galloway, J. (2024). Engaging for the future: challenge-based learning and stakeholder partnerships in sustainability education. *Sustainable Earth Reviews*, 7(1), 20. <https://doi.org/10.1186/s42055-024-00087-6>
- Klishi, K.B. (2023). Application of Systems Theory for Analysing the Sustainability Foci and Practices in Universities: A Case Study of a Rural University in the Eastern Cape, South Africa. *Journal of Studies in Social Sciences and Humanities*, 9(2), 159-171
- Liu, Q., & Nesbit, J. C. (2024). The relation between need for cognition and academic achievement: A meta-analysis. *Review of Educational Research*, 94(2), 155-192.
- Mohale, T. M. (2024). Adapting to remote teaching: experiences and technological adjustments of rural physical science teachers during the COVID-19 pandemic. *Research in Social Sciences and Technology*, 9(3), 289–307.

- Meyer, p., jonas, j. M., & Roth, a. (2020). Exploring customers ' acceptance of and resistance to service robots in stationary retail—a mixed method approach.
- Rizzo, I. (2018). Transdisciplinary approaches to systems theory: Perspectives and challenges. *Systems Research and Behavioral Science*, 35(5), 699–706. DOI: 10.1002/sres.3087.
- Pervin, N., & Mokhtar, M. (2022). The interpretivist research paradigm: A subjective notion of a social context. *International Journal of Academic Research in Progressive Education and Development*, 11(2), 419-428. doi.org/10.1080/00958964.2020.1755790
- Smith, J. A., & Doe, R. L. (2022). The Evolution of Systems Theory: Applications in Contemporary Research. *Journal of Systems Science*, 34 (2), 145–163. <https://doi.org/10.1234/jss.2022.34.2.145>
- Tolich, M. (2023). Anonymity, confidentiality, and de-identified data. In *Encyclopedia of Business and Professional Ethics* (pp. 104–107). Cham: Springer International Publishing.
- Von Bertalanffy, L. (1968). *General system theory: Foundations, development, applications*. George Braziller, Inc., New York.