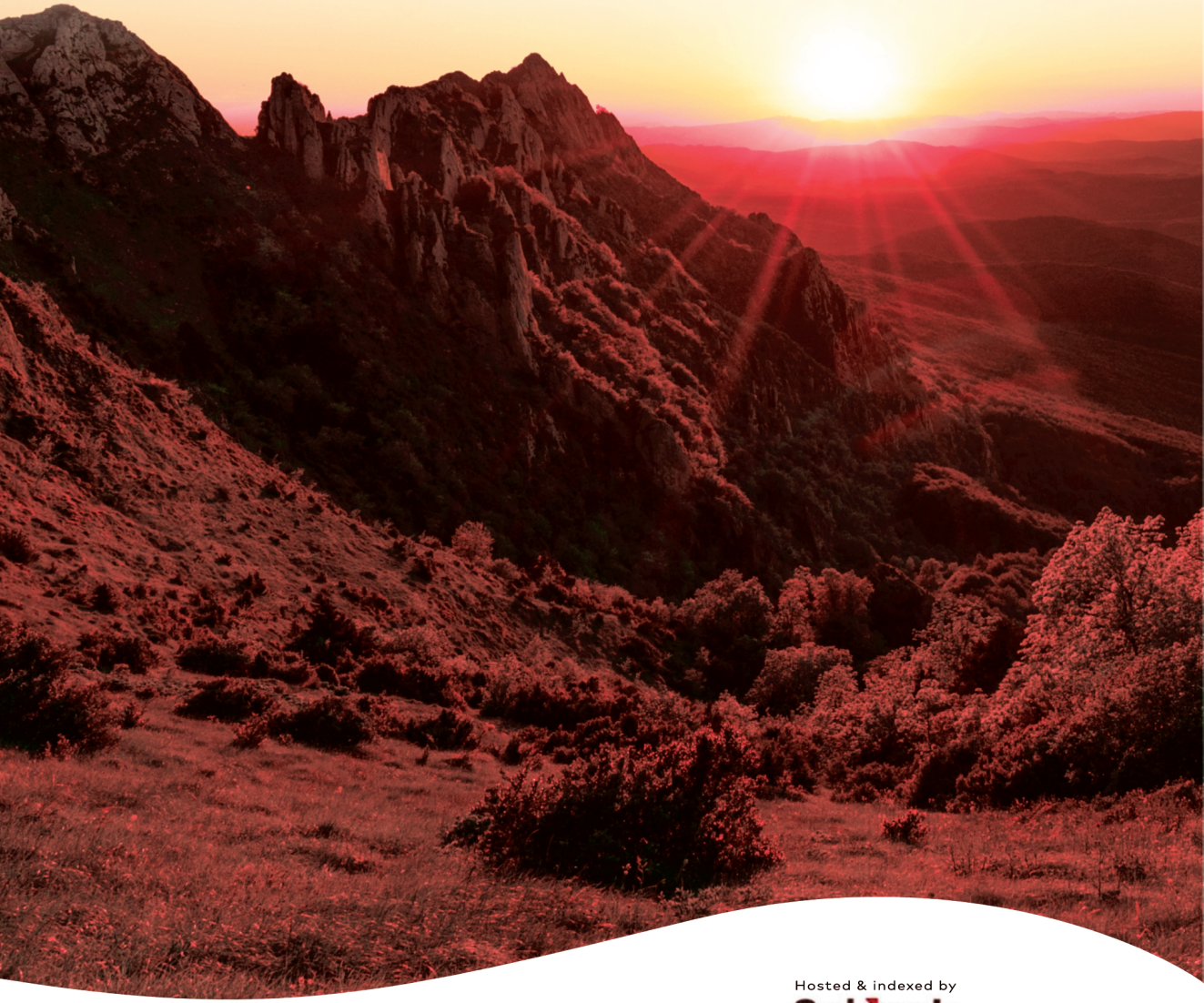
The Dyke

Volume 18 No.1



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ISSN 1815-9036 (Print)
ISSN 2790-0940 (Online)

Epistemic (in)justice in Science Teacher Education: A gaze through the Zimbabwe's Heritage-Based Education 5.0

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Abstract

Epistemic (in)justice has been described as 'the crisis of African higher education'. Regardless of the state of awareness of this crisis, several African nations have implemented policies and curriculum frameworks to revolutionize their higher education. This transformation stems from the recognition that the future (re) production, distribution, and consumption of knowledge will be heavily influenced by the training of the current generation of knowledge (re)producers. In Zimbabwe, the development of science teachers is framed within the context of heritage-based Education 5.0. This philosophy emphasises that science teacher training be grounded in five pillars of the nation's heritage: teaching, research, community service, innovation, and industrialisation. The potential of this heritage-based philosophy is to address predominantly Western-oriented entrenched epistemic injustices within higher education institutions. This study investigates the capabilities of heritage-based Education 5.0 to mitigate the epistemic injustices in science teacher education. An interpretive research approach was employed, involving the analysis of key policy documents related to heritage-based Education 5.0. The generated data was subjected to content analysis, with codes aligned to predetermined themes to report findings. The results indicate that the heritage-based Education 5.0 framework effectively addresses historical epistemic injustices in earlier science teacher education curricula. The findings further reveal that the policy promotes inclusive science education, gender-responsive methodologies, respect for student diversity, and the integration of heritage and multicultural practices. These strategies are identified as instrumental in mitigating the impacts of testimonial and hermeneutical injustices. The study recommends robust implementation measures, including increased funding for epistemic resources and tools in science teacher education, as well as ongoing professional development to encourage the adoption of transformative pedagogical practices.

Keywords: Epistemic injustice Heritage philosophy Knowledge (re) production Science Teacher Education

The Dyke
www.thedyke.msu.ac.zw

18(1):1-23
ISSN 1815-9036 (Print)
ISSN 2790-0940 (Online)

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Introduction

Globally, universities have long been recognised as centres for knowledge production and dissemination. These institutions serve as hubs for learning, teaching, research, community service, and innovation. Through these epistemic activities, universities engage students and communities in the co-creation of knowledge. The literature (Glass & Newman, 2015; Khoo et al., 2020; Maistry & Lortan, 2017) underscores this profound social responsibility attributed to institutions of higher learning. According to Maistry and Lortan (2017), universities' core mission of producing and disseminating knowledge positions research-related community engagements as vital platforms for the democratisation of knowledge. Khoo et al. (2020) argue that teaching and innovation, which constitute central activities of university work, play a critical role in the (re)production of academic knowledge.

Aligned with these arguments is the epistemic social responsibility of universities prompts probing questions such as What counts as knowledge? Whose knowledge is valued and should be (re)produced? For whom is the knowledge produced? What is the social relevance of the knowledge produced? Whose knowledge gets disseminated and how? These questions reveal the inherently value-laden and hegemonic nature of epistemology, a process many scholars (Glass & Newman, 2015; Maistry & Lortan, 2017; Ndofirepi & Gwaravanda, 2019) trace to the historical, political, and economic power dynamics between the global North and South.

The global North, primarily composed of mainly Western countries, exerts considerable control over the (re)production of knowledge, while the global South, encompassing much of South America and Africa, often plays a subordinate role (Glass & Newman, 2015). This geopolitical imbalance manifests as a hegemonic relationship favouring Western countries in the epistemic power structure. African universities, in particular, endure the most of this disparity. For the past 500 years, Western perspectives, concepts, and governance models have dominated these institutions, marginalising Afrocentric knowledge systems. This dominance is evident in the content taught, research agendas, publishing standards, and global university rankings, which overwhelmingly favour Eurocentric paradigms.

This paper does not seek to undermine the contributions of Western knowledge systems. Indeed, the advancements in science and technology driven by these systems are acknowledged. However, the dominance of Western epistemology

over African knowledge systems has been exacerbated by subjugative political systems, such as colonialism in most African nations, including Zimbabwe, and apartheid in South Africa. Despite some curriculum reform efforts, universities in these regions remain influenced by their colonial legacies, contributing to what scholars (Ndofirepi & Gwaravanda, 2019; Shizha, 2007) describe as 'the crisis of African higher education.' This crisis stems from a scenario where African universities, conscious of the dominance of Western traditions and ideals, witness the marginalisation, displacement, or silencing of Afrocentric viewpoints and knowledge systems. Efforts to counter this situation are often impeded by the dual forces of lingering colonial legacies and globalisation (Ndofirepi & Gwaravanda, 2019; Shizha, 2013). Citing Nyanchoga (2014), Ndofirepi and Gwaravanda (2019) outline the key manifestations of this crisis: the adoption of corporate-driven models prioritising economic interests over societal needs, academic capitalism hindering epistemic shifts, a lack of sensitivity to the social contexts of these institutions, challenges in balancing cultural diversity with nation-building, and the failure to integrate Indigenous knowledge systems into curricula.

The crisis of African higher education gives rise to significant social and structural inequalities, as well as epistemic injustices (Bacevic, 2021; Koskinen & Rolin, 2019; Lohkivi et al., 2012). Gender bias is one such inequality, with Lohkivi et al. (2012) noting that certain power structures, including gender, influence communication practices, leading to epistemic injustices and a neglect of objectivity criteria. Tanswell and Rittberg (2021) define epistemic injustice as the injustices that negatively impact individuals' or groups' ability to engage in epistemological activities. Citing Fricker (2009), Stroupe et al. (2019) describe it as the denial of opportunities for knowledge production to certain individuals or communities, alongside the marginalisation of their voices, resulting in diminished intellectual courage, esteem, and self-respect.

Epistemic injustice, thus, arises when the capacity of certain actors, defined by factors such as race, gender, economic status, or geographical location to participate in or contribute to knowledge generation is substantially limited (Bacevic, 2021). While research on epistemic injustices has gained traction in fields such as medicine, philosophy, law, and sociology in regions like the Americas, Australia, and Africa, there remains a paucity of research addressing epistemic injustices in teacher education within Zimbabwean universities (Nyanchoga, 2014). This paper explores this under-researched area, contributing to the broader discourse on epistemic justice in higher education.

Background

Universities have historically served as the epicentres of knowledge generation and dissemination, playing a pivotal role in societal advancement. They are tasked with teaching, research, community service, and innovation, activities that collectively underpin their social responsibility to both students and communities. However, the processes of knowledge production, dissemination, and consumption have not been universally equitable. The dominance of Western epistemic traditions has led to significant imbalances, particularly within African institutions of higher learning. These imbalances are deeply rooted in the historical legacies of colonialism and have been exacerbated by globalisation, creating an enduring epistemic hegemony.

The term 'epistemic injustice' has gained traction in academic discourse as a way to describe the exclusion or marginalisation of certain groups in the processes of knowledge production and dissemination. Fricker (2007) describes epistemic injustice as the denial of individuals' or groups' capacity to contribute to knowledge due to prejudice or systemic biases. This can manifest in two forms: testimonial injustice, where a person's knowledge is devalued based on identity-related prejudices, and hermeneutical injustice, where marginalised groups are denied the interpretative resources to make sense of their experiences. In the African context, such injustices are frequently tied to the prioritisation of Eurocentric knowledge systems over Indigenous perspectives.

African universities, including those in Zimbabwe, have largely operated within frameworks inherited from colonial powers, perpetuating a Western-centric epistemology. This dominance influences curricula, research agendas, governance models, and institutional priorities, often sidelining Afrocentric knowledge systems. Scholars (e.g., Ndofirepi & Gwaravanda, 2019; Shizha, 2013) argue that these practices have resulted in a "crisis of African higher education," where local knowledge is displaced, silenced, or marginalised. Attempts to integrate Indigenous knowledge systems and address epistemic inequalities are often constrained by lingering colonial legacies and the pressures of globalisation.

In response, Zimbabwe has adopted the heritage-based Education 5.0 philosophy (henceforth HbE 5.0), which aims to centre local heritage and innovation within higher education. This framework redefines the mission of universities by promoting teaching, research, community service, innovation, and industrialisation through the lens of national heritage. By doing so, it

challenges the historical dominance of Western knowledge systems and addresses epistemic injustices in various fields, including science teacher education. This study situates itself within this transformative context, exploring how heritage-based Education 5.0 can mitigate epistemic injustices and foster a more inclusive and equitable knowledge production landscape.

Statement of the problem

Despite efforts by some African universities to reform science teacher education curricula and incorporate Indigenous and local knowledge systems, remnants of the colonial past and the pervasive influence of globalisation persist. In Zimbabwe, the heritage-based Education 5.0 policy has been lauded for broadening the traditional mission of universities from the three core pillars of teaching, research, and community service to a fivefold mandate that includes innovation and industrialisation. However, the policy's emphasis on heritage, particularly its incorporation of indigenous and local knowledge systems, remains underexplored. Western-centric models continue to dominate the epistemic landscape in higher education, often at the expense of Afrocentric knowledge systems. This imbalance raises questions about whether the heritage-based Education 5.0 policy can effectively mitigate the entrenched hegemony of Western epistemologies or inadvertently reinforce it.

While modern university curricula may benefit from a synthesis of diverse knowledge systems, the marginalisation or outright disregard of Indigenous African knowledge systems poses significant risks to national development agendas. Such neglect can hinder the alignment of education with local socio-economic needs and undermine efforts to achieve sustainable development. Therefore, this study examines the extent to which Zimbabwe's heritage-based Education 5.0 policy addresses these challenges, particularly in the context of science teacher education. By doing so, it sheds light on the policy's potential to foster epistemic justice and promotes a more inclusive framework for knowledge production.

Theoretical framework

This study is grounded within the ongoing scholarly debates on decolonisation (Ndofirepi & Gwaravanda, 2017; Khoo et al., 2020; Ndofirepi & Cross, 2017) and cognitive justice (Coolsaet, 2016; de Santos, 2007; Oliveira, 2017). Cognitive justice advocates for the recognition and coexistence of diverse epistemologies and knowledge systems (Coolsaet, 2016; Zembylas, 2017). Santos (2014, as cited

in Coolsaet, 2016 p. 167) refers to this as an "ecology of knowledge," wherein various forms of knowledge and practices, including modern, scientific, Indigenous, and non-scientific paradigms, are allowed to exist in generative dialogue.

In contributing to this discourse, the study employs decolonial theory as its primary lens, advocating for science teacher education practices that, in Oliveira's (2017) terms, democratise learning spaces. Such practices enable all participants, whether dominant, subjugated, minority, marginalised, or stigmatised, to make their representations, narrate their life experiences, and actively engage across all forms of knowledge systems.

The decolonial theory extends postcolonial theory, moving beyond addressing self-identity issues in postcolonial curricula to actively challenging and confronting existing epistemic practices. While postcolonial theory focuses on "combating the residual effects of colonialism" (Kariwo, 2017, p. 67), decolonial theory directly interrogates the colonial mindset and the inequalities perpetuated through Western imperialism, now revived under neoliberalism and neoliberal university systems (Dominguez, 2021). The decolonial theory is particularly relevant to this study because it provided a robust framework to confront epistemic injustices and combat what Dubgen (2016 p. 3) described as "epistemicide"—the deliberate suppression and extinction of certain cultural and knowledge systems through cultural imperialism. Despite criticism by some scholars (Colpani et al., 2022; Maldonado-Torres, 2020; Murrey & Jackson, 2022), dismissing decolonial theory as rhetorical or infeasible within the rigid structures of academia, it remains an essential tool for advancing equity in science teacher education.

The application of the decolonial theory to science teacher education is twofold. Firstly, it facilitates the confrontation of entrenched stereotypes about science learning, raising awareness of the barriers faced by underprivileged and marginalised groups in science education. By fostering a shift in mindsets, it promotes inclusive pedagogical practices. A decolonial pedagogy extends beyond traditional approaches, equipping students with the skills to disrupt conventional epistemic practices, including assessment methods, learning experiences, and the distribution of power within the classroom (Dominguez, 2021). Secondly, the decolonial theory offers a critical lens to examine and address the construction of cognitive injustices in educational contexts, practices, and policies. As Zembylas (2018) observes, this interrogation is vital to developing transformative frameworks that advance epistemic equity and inclusion.

Literature Review

Epistemic (in)justice, defined earlier, comes as a central construct to this study. Fricker (2013), is credited for coining the construct identified two cases-testimonial and hermeneutical. Drawing from the layperson's use of the word testimony, Fricker (2013) espoused that a disregard for the testimonies of certain epistemic agents due to some negative societal stereotypes and a low socio-economic status ascribed to them resulted in testimonial (in)justice (Dubgen, 2016). The disregard for these agents' voices created scenarios where they were prejudiced, and their stories and experiences are considered incredible (Koskinen & Rolin, 2019). Credibility in this sense is when the agent's voice is considered worthwhile to listen to particularly because they are viewed both as subjects of knowledge and in high esteem by society. Whereas the testimonies of those suffering deflated levels of credibility are suspicious not because of their lack of inherent value but because holders are regarded as objects of knowledge and of inferior standing.

Unlike testimonial injustice, hermeneutical injustice refers to situations where agents can neither articulate nor make sense of their disadvantaged position because of a gap in their linguistic expression, evidently caused by the same position (Dubgen, 2016). Citing Wylie (2011), Lohkivi, Velbaum and Eigi (2012) defined hermeneutical injustice as a misrecognition that brings about systematic gaps in the interpretive, conceptual, and communicative resources available to agents that disadvantage them socially, intellectually, and materially. Stroupe (2021 p. 4) asserts that marginalised people can suffer oppression, limited opportunities, and less impactful knowledge claims because "…power relations, structural prejudice, and a lack of epistemic resources undermine the knower's ability to make sense of their own experiences, or to explain their knowledge to others." Thus, the ability of epistemic agents to learn, interpret, conceptualise, and communicate is largely determined by the number of resources available to them.

Regrettably, a lack of such resources which Dubgen (2016) refers to as hermeneutical resources, hamper the person's full capacity to interact and engage socially. In other words, hermeneutical injustice occurs in exemplar situations where a teacher who was deprived of hermeneutical resources during pre-service training inadequately conceptualizes science, technology, engineering, and mathematics (STEM) education and consequently is not capable of integrating or finding the connections in his/her STEM teaching (Koskinen

& Rolin, 2019), Unfriendly working environments, inequitable distribution of learning resources, hostile communication patterns, and gender segregation and stereotyping can culminate in both testimonial and hermeneutical injustices (Lohkivi et al., 2012).

Methodology

This study examines the Heritage-Based Education 5.0 (HbE 5.0) philosophy as a policy initiative aimed at addressing entrenched epistemic injustices in science teacher education. The methodological approach employed is Critical Policy Analysis (CPA), a framework pivotal to discussions on knowledge creation. The CPA emphasises the primacy of knowledge as a key driver of production, superseding labour, capital, and land (Ndofirepi & Cross, 2017). It provides a structured and scientific approach to policy analysis, focusing on three core aspects essential to cognitive justice notably:

i) Deconstructing claims
ii) Evaluating evidence about those claims
iii) Reconstructing understanding (Kariwo, 2017)

According to Kariwo (2017), the CPA's strength lies in its ability to interrogate ideologies, underlying beliefs, and proposed solutions. It reveals the connections between a policy's context, content, and processes. Unlike traditional policy analysis, which merely weighs the advantages and disadvantages of policy options, CPA critically examines the interplay between context, process, and policy impacts (Kariwo, 2017). This approach sheds light on the nexus between policy and power, highlighting how these are constructed and perceived by various policy stakeholders. As Crowe et al. (2011) suggest, a theory-driven approach that elucidates causal links and the impact of policy initiatives is well-suited to defining the critical components, communication, content, methods, and practicality, of a policy's implications.

To analyse the components of HbE 5.0, several source documents were examined, including:

- *The Constitution of Zimbabwe (2013)*
- *The Education Act (1987)*
- *National Development Strategy 1 (Ministry of Finance and Economic Development, 2020)*
- *Ministerial Strategic Plans*
- *The Heritage-Based Education 5.0 Doctrine (MHTESTD, 2018)*

A deductive content analysis approach was employed. This structured method focused on a priori themes derived from existing theory or literature, ensuring alignment between the findings and the study's purpose (Linneberg & Korsgaard, 2019). Following the framework proposed by Linneberg and Korsgaard (2019), the researcher read and re-read the data for familiarisation and sense-making; identified units of analysis; assigned labels (codes) to these units and categorised the codes into epistemic (in)justice-related themes based on literature.

The four predetermined themes used to guide the analysis were:

i) *clusion rather than exclusion and silencing*
ii) *Valuing learners' status and communicative practices*
iii) *Trust rather than mistrust in learners*
iv) *Building on rather than distorting learners' history, experiences, and contributions.*

These themes were matched to corresponding codes generated from field notes based on the source documents (see Table 1).

Findings

The findings from the document analysis reveal that Heritage-Based Education 5.0 (HbE 5.0) functions both as a philosophy and a government policy. As a philosophical framework, HbE 5.0 advocates for teaching and learning in higher education institutions to be grounded in the utilisation of locally available resources while integrating universal scientific and technological knowledge. The primary aim is to drive innovations that contribute to industrial growth and national development (Ministry of Higher and Tertiary Education, Science and Technology Development [MHTESTD], 2018). This philosophy underscores the importance of aligning education with local contexts and national priorities, fostering a balance between global knowledge systems and indigenous resources.

As a government policy, HbE 5.0 provides comprehensive operational guidelines for all institutions under the Ministry of Higher and Tertiary Education, Science and Technology Development. The policy is derived from an amalgamation of statutes, policies, and regulations, as highlighted in the HbE 5.0 Doctrine:

> ***The Ministry's activities shall be guided by the following legislative policies: Manpower Planning and Development Act Chapter [28:02] of 2001 and its related Statutory Instruments, the Zimbabwe Council of Higher Education Act of 2010, Zimbabwe National Qualifications Framework of 2018, the Research Act of 1986, National Biotechnology Act Chapter [14:31]***

of 2006, the Zimbabwe National Geospatial and Space Agency (ZINGSA) Constitution of 2013, and the Second Science, Technology and Innovation Policy of 2012" (MHTESTD, 2018, p. 01).

The amalgamation of these legislative provisions underscores the policy's intent to promote equitable and just opportunities across various domains, including science teacher education. It aims to address knowledge construction and distribution disparities while fostering inclusivity in epistemic practices.

An analysis of related documents, including the Constitution of Zimbabwe (2013), the Education Act (1987), and the National Development Plan (2020), supports the finding that HbE 5.0 integrates legislative provisions aimed at creating fair and inclusive opportunities. These statutes collectively advocate for the alignment of educational practices with principles of equity, cultural relevance, and cognitive justice, further cementing HbE 5.0's role as a transformative policy and philosophical framework. The findings thus position HbE 5.0 as a critical vehicle for addressing epistemic injustices in science teacher education and beyond, as detailed in Table 1.

Table 1: Notes, codes, and deductive themes from the analysis key documents on the HbE 5.0 philosophy

Researcher Notes and/or direct quotes from source documents	**Codes**	**Deductive Themes [relating to Epistemic (in)justice] Allocated to Codes**
1. Zimbabwe Constitution [Sections 3 & 6]		
Zimbabwe is founded on respect for the following values and principles—the supremacy of the Constitution a) fundamental human rights and freedoms b) the diverse cultural, ethnic, racial, cultural, linguistic, and religious groups; and traditional values c) recognition of rights of persons with disabilities; women, the elderly, youths, and children.	• Inclusive science education • Equal access • Gender sensitivity/equality • Lifelong learning • Student Diversity • Justice, accountability, and responsiveness. • Heritage-informed practices • Multicultural practices/teaching • Ubuntu-informed practices/operations • Community responsiveness	• Inclusion rather than exclusion and silencing • Value learners' status and communicative practices • Trust rather than mistrust learners • Build on rather than distort learners' history/experiences/contributions

Recognition of Language diversity, gender equality, respect, and value of people	Inclusive science education Student Diversity Multicultural Ubuntu-informed practices/ operations Community responsiveness	Inclusion rather than exclusion and silencing Value learners' status and communicative practices
2. Education Act: Chapter 25 [Sections 3, 4-6, 13]		
Premised on section 75 of the constitution Right to Education (RTE) basic State-funded education, including adult basic education; further education, expansion of institutions opens to all stakeholders ensure quality, continuous learning	• Enhancing quality/ relevance of science education • Cultivating 21st century competencies • Fostering Lifelong Learning • Collaborative programmes	• Inclusion rather than exclusion and silencing • Value learners' status and communicative practices • Trust rather than mistrust learners • Build on rather than distort learners' history/experiences/ contributions
Disadvantaged group inclusivity, favourable conditions for students	• Creating a conducive learning climate • Sensitivity to disadvantaged groups	• Inclusion rather than exclusion and silencing • Value learners' status and communicative practices • Trust rather than mistrust learners
School curricula shall as far as possible reflect the culture of the people of every language used or taught in terms of this section- IK, Culture, and science	• Community responsive Science Programmes • Cultural inclusive • Gender Inclusive • Linguistic accommodation	• Inclusion rather than exclusion and silencing • Value learners' status and communicative practices • Trust rather than mistrust learners

3. National Development Strategy 1 2021-2015 [pages 54, 66, 643, 649-650, 645]		
Home and Community context, Operating context, ICT	• Digital literacy • Access to information and resources • Adaptability • Sensitive to the students • Knowledge of the community • Transformative community engagement projects	• Value learners' status and communicative practices • Build on rather than distort learners' history/experiences/ contributions
The country to reinvigorate and re-orient itself towards a transformative agenda-Redesigning of curriculum, Application of knowledge	• Innovative Science programs • Transformative programmes Innovative science teaching/pedagogy • Integrative STEM education programme • Science Knowledge integrating curriculum • Innovative teaching and research	• Inclusion rather than exclusion and silencing
Deliberate efforts shall be made to increase the use of Indigenous languages as prescribed in the Constitution of Zimbabwe	• Language competency • Knowledge of diverse culture • Knowledge of specific competences	• Value learners' status and communicative practices

Education and Training are instrumental in creating innovative societies through improved access to quality, equitable, and inclusive Education; Increased uptake and application of STEM/ STEAM Subjects; and improved relevant demand-driven skills for industry, commerce, and the public sector. broadening access and participation to quality, equitable, and inclusive education by disenfranchised populations that are found in remote places and over-crowded urban areas	• Access • Inclusivity • Responsiveness • Heritage	• Value learners' status and communicative practices • Trust rather than mistrust learners • Inclusion rather than exclusion and silencing
Gender inclusivity and boosting of enrolment strategies -promote uptake of science at all levels of learning, equip laboratory	• Gender inclusivity • STEAM/STEM Classroom practices • Access to information and resources	• Inclusion rather than exclusion and silencing

Table 1 summarises key aspects obtained from source documents, such as the Zimbabwe Constitution, Education Act, and National Development Strategy 1, which revealed several critical insights into how the HbE 5.0 framework addresses epistemic (in)justice in science teacher education. The following were thus noted, firstly the realisation that HbE5.0 exhibit inclusion rather than exclusion and silencing. In other words, HbE 5.0 promotes inclusive practices to ensure equitable access to education and opportunities for all learners, particularly those from disenfranchised or marginalised groups.

The Constitution of Zimbabwe recognises fundamental human rights, including the rights of diverse cultural, ethnic, linguistic, and gender groups. It emphasises inclusivity in education through multicultural teaching, gender sensitivity, and community-responsive practices. The Education Act was noted as ensuring quality, state-funded education, highlighting inclusivity

for disadvantaged groups and cultural representation in curricula, including Indigenous Knowledge Systems (IKS). The National Development Strategy 1, on the other hand, advocates for broadening access and participation in STEM/STEAM subjects, particularly for learners in remote and overcrowded areas, and promotes gender inclusivity in science education.

The other finding noted that HbE 5.0 values learners' status and communicative practices. This theme reflects the emphasis on recognising and respecting the diverse cultural, linguistic, and socio-economic backgrounds of learners. The Constitution of Zimbabwe highlights linguistic diversity and Ubuntu-informed practices to value learners' contributions and experiences while the Education Act calls for culturally responsive and linguistically inclusive science programmes, and the NDS1 encourages leveraging community knowledge, integrating STEM education, and engaging learners in transformative projects to connect education with their lived experiences.

The other notable outcome was that there is an emphasis on accountability, justice, and responsiveness, which build trust in learners' abilities. Within the learning environments, calls and guarantees are made to support conditions that are sensitive to disadvantaged or marginalised groups hence the promotion of collaborative and inclusive STEM teaching practices to build trust and encourage active participation among diverse learners. This way, learners are trusted by the system rather than mistrusted.

By and large, the HbE 5.0 stresses the importance of grounding science education in learners' cultural and historical contexts wherein heritage-informed practices that integrate learners' histories and traditional knowledge into educational frameworks are prioritised. The curricula thus are expected to reflect cultural diversity and incorporate Indigenous Knowledge Systems alongside science education. From this understanding, the development blueprint of the country thus calls for a focus on knowledge of the community, transformative community engagement projects, and integrative STEM education, thereby ensuring that learners' contributions are valued and built upon.

The analysis of the policy documents generated specific codes reflective of HbE 5.0's alignment with epistemic justice. These codes regard:

Inclusive Science Education: *To promote equity in learning opportunities.*

Gender Sensitivity: *To boost female participation in STEM.*

Lifelong Learning: *To encourage continuous access to education.*

Heritage Practices: *To integrate local knowledge into curricula.*

Multicultural Practices: *To reflect cultural diversity in teaching methods.*

Transformative Pedagogy: *To engage learners through innovative, integrative approaches.*

These findings, therefore, illustrate that HbE 5.0, through its policies and guidelines, actively works to mitigate epistemic injustices in science teacher education. By fostering inclusivity, valuing diversity, building trust, and integrating heritage-based practices, the framework positions itself as a significant tool for educational equity and epistemic justice.

Discussion

The findings of this study note that Heritage-Based Education 5.0 (HbE 5.0) is a transformative framework that integrates policy, philosophy, and curriculum to address Zimbabwe's socio-economic and educational needs. Its alignment with principles of epistemic justice, inclusion, and heritage-informed innovation makes it a pivotal tool for reforming science teacher education in a way that is both locally grounded and globally relevant. This discussion synthesises insights from the background, theoretical framework, methodology, and findings to provide a comprehensive analysis of HbE 5.0's potential to mitigate epistemic injustices.

Universities have historically served as centres for knowledge production, often dominated by Western epistemologies. This has led to the marginalisation and silencing of Indigenous knowledge systems, a phenomenon extensively critiqued within decolonisation and cognitive justice discourses (Ndofirepi & Gwaravanda, 2019; Coolsaet, 2016). The legacy of colonialism in African higher education persists through curricula, governance models, and institutional priorities that prioritise Eurocentric perspectives. HbE 5.0, therefore, disrupted this hegemony by reframing higher education through its five pillars, notably, teaching, research, community service, innovation, and industrialisation, by rooting them in Zimbabwe's heritage. This heritage encompasses the country's history, traditions, cultures, and natural resources, aligning with decolonial theory's emphasis on situating African knowledge systems at the centre of academic practice. By integrating local epistemologies and fostering an "ecology of knowledge" (Santos, 2014), HbE 5.0, thus, provides a model for achieving cognitive justice and fostering inclusivity.

The findings highlight HbE 5.0's strong emphasis on inclusion, a theme echoed in Zimbabwe's Constitution, Education Act, and National Development Strategy 1 (NDS1). These legislative frameworks mandate equitable access to education, respect for diversity, and the integration of indigenous knowledge into curricula. For example, the Constitution's recognition of diverse cultural and linguistic groups, as well as the rights of marginalised populations, provides a foundational basis for inclusive science teacher education. The Education Act's provisions for state-funded education, gender inclusivity, and linguistic accommodation further reinforce the importance of creating equitable learning environments. Similarly, the NDS1 promotes access to STEM/STEAM subjects for disenfranchised populations in remote and overcrowded areas, fostering a more inclusive and participatory education system.

A key aspect of HbE 5.0 is its take on building upon learners' histories, experiences, and cultural contexts. This aligns with the principles of decolonial pedagogy, which advocate for educational practices that respect and amplify the voices of marginalised groups (Dominguez, 2021). The integration of Indigenous Knowledge Systems (IKS) into science teacher education reflects this commitment. By incorporating local traditions and community knowledge into STEM curricula, HbE 5.0 enriches learning experiences and addresses epistemic injustices stemming from the marginalisation of African epistemologies. The findings reveal codes such as *heritage-informed practices, community-responsive programmes,* and *knowledge of diverse cultures,* which underscore the importance of grounding education in learners' lived realities.

HbE 5.0's operationalisation through the National Science Technology Innovation System (NSTI) highlights its emphasis on innovation and transformative pedagogy. The NSTI mandates collaboration between universities, research councils, and indigenous knowledge systems, fostering integrative STEM education and research aligned with local needs. Epistemic tools, as described by Stroupe et al. (2019), play a crucial role in this transformative approach. These tools, whether physical, symbolic, or discursive, facilitate collaborative learning and participatory knowledge construction. HbE 5.0's focus on integrative STEM education, innovative teaching, and transformative community engagement projects exemplifies the practical application of these concepts, creating opportunities for learners to actively participate in and shape the knowledge production process.

Another critical theme that emerged from HbE 5.0 is the emphasis on trusting learners rather than mistrusting them. This involves creating an educational environment that respects learners' agency and values their contributions. Codes such as *gender sensitivity, justice, accountability, linguistic accommodation,* and *sensitivity to disadvantaged groups* highlight the framework's commitment to fostering trust and inclusivity. Theoretical insights from Nieminen and Lahdenpera (2021) further support this approach, advocating for alternative assessment methods that empower learners through self-assessment, peer collaboration, and diverse communicative practices. Such practices not only build trust but also address participatory epistemic injustices, where learners' voices are often marginalised or ignored (Koskinen & Rollin, 2019).

The operationalisation of HbE 5.0 is supported by robust infrastructure and strategic frameworks. For instance, the development of industrial parks and innovation hubs at universities and the expansion of secondary school science teacher education to include previously primary-focused colleges illustrate the government's commitment to scaling the framework. However, challenges remain, including resource constraints, infrastructural disparities, and the need for continuous professional development for educators to adopt transformative pedagogies.

Heritage-Based Education 5.0 provides a visionary model for rethinking higher education in Zimbabwe, addressing both historical and structural inequalities. Integrating local knowledge systems, fostering inclusion, and promoting innovation, aligns with decolonial and cognitive justice theories to create a more equitable and responsive education system. However, its success depends on sustained commitment, resource mobilisation, and institutional collaboration to overcome implementation challenges.

Conclusion

The HbE 5.0 policy endeavoured to invoke a philosophy in which heritage plays a cross-cutting role in the structural and inherent organizational processes of both administrative and curriculum pillars (teaching, research, community engagement, innovation, and industrialization) of higher education. The heritage philosophy was situated largely in the decolonisation debate seeking cognitive justice through the recognition of epistemic diversity and the coexistence of knowledge systems. That implied having to use the country's heritage and cultural resources to democratise the learning spaces to enable all participants to be able to make their representations, narrate their life experiences, and

engage actively across all forms of knowledge systems despite the diversity in backgrounds. While this is an ambitious plan with the potential to remain a 'white elephant' paper if inadequate resources and political will to implement it are left to chance. Thus, despite the good intentions of the HbE 5.0 policy as espoused in its various support documents, there is a need for science teacher education programmes to adopt aggressive implementation strategies to fully realise the objectives of the policy.

Financial resources, among other things, were noted to be paramount at all levels of the pillars of science teacher education programmes. At the level of teaching, for example, transformative teaching and learning have been suggested in the HbE 5.0 source documents. There is evidence from research that teaching in these institutions of higher learning remains traditional rather than transformative. Birt et al. (2019 p. 2) aver that efforts to reform science teaching are sometimes met with limited success because of "…complex interactions between structural relics of our education system and pre-existing beliefs of the STEM instructors". Thus, to transform deep-seated traditional beliefs existing within individual science teachers and challenge traditional dominant discourses and college norms of science teacher education as identified in some literature (e.g. Chen & Mensah, 2022).

The study also desires the Continuous Professional Development (CPD). CPD in science teacher education programmes can focus on the implementation of a decolonial pedagogy. As argued earlier a decolonial pedagogy goes beyond ordinary pedagogical models by equipping students with skill sets that disrupt traditional epistemic practices, inclusive of assessment, learning experiences, and distributive power in the classrooms (Dominguez, 2021). Furthermore, the CPD can also focus on multicultural and multi-language approaches in science teaching and learning. Such language-inclusive ideology allows the use of diverse languages rather than language-exclusive ideologies premised on the mistaken belief of language monopolies in science teaching (Lemmi et al., 2019).

Finally, the study recommends the use of epistemic resources and tools to also strengthen HbE 5.0 implementation strategies. Epistemic tools situate science teacher education in a four-axis dimension critical for HbE 5.0 as follows: (a) socio-cognitive experiences of student learning, (b) learning contexts that are social, cultural, historical and physical, (c) collaborative community engagement, and (d) open class opportunities for learning, inquiry, participation, and communicative practices. Accordingly, such broader goals for epistemic tools

are at the centre of disrupting historic norms for classroom participation and building cultures fostering epistemic justice (Stroupe et al., 2019).

Acknowledgments

The author acknowledges the contributions of the Organisers of the British Academy Writing Workshop (April- May 2022) for budding researchers, under whose tutelage this paper was produced, and a special thanks to Prof. Simon McGrath, of the University of Nottingham, who became my guiding mentor in the workshop and writing process.

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