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Enhancing Learner Support with Culturally Responsive Pedagogy in Rural South African Schools Using Technology

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Abstract: Educators in South African rural secondary schools encounter the dual challenge of addressing diverse learner needs across cultural, linguistic, and socioeconomic contexts while contending with inadequate technology utilisation. This conceptual paper examines the intersection of culturally responsive pedagogy and technology to propose a contextually relevant framework for learner support, emphasising the role of action research in developing responsive methodologies. A theory synthesis narrative literature review of peer-reviewed journals and case studies was conducted, guided by three analytical frameworks: Constructivist Learning Theory (individual knowledge construction), African Ubuntu philosophy ("I am because we are" communal epistemology), and Connectivism (networked learning). Six inductively derived themes emerged: learner support dimensions; pedagogical integration of technology; cultural and technological barriers; diversity, equity, and inclusion in pedagogy; best practices in technology utilisation; and technology for future preparedness. Findings suggest that technology can enhance academic and motivational support but may inadequately address emotional needs without deliberate integration. Cultural barriers, resistance from learners and educators, and historical inequalities between affluent and rural schools, exacerbated by limited resources and infrastructure, contribute to uneven outcomes and leave learners ill-prepared for rapid technological change. The proposed framework, grounded in the three analytical perspectives, outlines pathways for application within action research paradigms. Partnerships among rural schools, the Department of Basic Education, universities, and communities are recommended to foster innovative, culturally responsive teaching and enable continuous refinement. Cautious integration of emerging technologies is advocated to decolonise conventional methods, with community collaboration and experimentation central to sustainable pedagogical transformation.

Keywords: Culturally responsive pedagogy, rural secondary schools, educational technology integration, learner support, diversity and inclusion, Ubuntu philosophy.

1. Introduction

This conceptual paper aims to develop and advocate for culturally responsive, technologically integrated pedagogies that support diverse learners and enhance their educational outcomes in South African rural secondary schools. The needs and methods of instruction are rapidly evolving, driven by technological advancements in the contemporary era. It is widely recognised that such change is expected and inevitable (Sibanda & Marongwe, 2022; Ladson-Billings, 2014). Consequently, educators and learners must adopt responsive and relevant pedagogies that enhance learner support. Teachers are confronted with the challenge of addressing the diverse needs of learners in today's classrooms, which are characterised by varying cultural, linguistic, and socio-economic backgrounds (Musundire, 2025; Athiemoolam & Vermaak, 2021; Forghani-Arani, Cerna, & Bannon, 2019). A culturally responsive pedagogy (CRP) framework is essential to address these challenges. While managing diversity and integrating technology both require intentional, context-sensitive pedagogical strategies, they differ in that the former focuses on affirming learners' identities, whereas the latter emphasises the utilisation of digital tools for meaningful learning experiences. Effectively

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addressing both aspects can promote inclusion, engagement, and future readiness, whereas neglecting them risks exacerbating existing inequities and further marginalising rural learners in an increasingly digital landscape. CRB values learners' cultural identities, enabling educators to create more inclusive and effective learning environments (Samuels, 2018; Ladson-Billings, 2014). It is imperative for teachers and other stakeholders in education to explore and implement culturally appropriate and responsive, technologically oriented pedagogies that meet the expectations and needs of the digitally adept generation of learners. The ongoing discourse surrounding technology in education is gaining prominence, as it increasingly impacts pedagogical practices. Most scholars concur that technology presents both opportunities and challenges for the implementation of culturally responsive practices (Musundire, 2025; Hubelbank, 2024; Gay, 2018).

CRB is grounded in the understanding that learners achieve optimal learning when their cultural references are integrated into the educational process. According to Gay (2018), the CRP approach fosters learner engagement and cultivates a sense of belonging and identity, a sentiment echoed by Samuel (2018). Furthermore, the literature affirms that CRP encourages educators to reflect on their cultural backgrounds and biases, thereby facilitating an understanding of diverse perspectives within the classroom (Musundire, 2025; Hubelbank, 2024; Gay, 2018). In light of these concepts, teacher reflection emerges as a valuable practice in the contemporary technological landscape, where digital tools can both support and hinder inclusivity.

It is widely acknowledged that the integration of technology in education has significantly transformed teaching and learning practices, providing innovative methods to engage students and facilitate personalised learning experiences (Hattie, 2019; Gay, 2018). However, the digital divide continues to pose a considerable barrier, with inequalities in access to technology disproportionately affecting learners from marginalised communities (Chisango & Marongwe, 2021; Warschauer, 2004). Consequently, it is imperative to investigate how technology can be effectively employed within the framework of CRB to enhance learner support and address these disparities.

Contemporary classrooms are increasingly characterised by diverse learners who encounter educational inequalities and disparities that require immediate attention (Chisango & Marongwe, 2021). Therefore, examining the role of technology in supporting CRB corresponds with current educational trends and the growing dependence on digital tools in teaching and learning. This conceptual paper concentrates on six themes: dimensions of learner support; pedagogical integration of technology; cultural and technological barriers; diversity, equity, and inclusion in pedagogy; best practices in the utilisation of technology; and technology for future preparedness, which were inductively developed from recurring patterns identified in the reviewed literature. This conceptual paper aims to bridge the gap between the increasing utilisation of technology in education and the necessity for culturally responsive pedagogical approaches in rural secondary schools. It underscores the importance of transcending mere technology adoption to focus on how technology can enhance culturally responsive teaching practices, thereby strengthening learner support.

1.1 Purpose

The purpose of this conceptual paper is to advocate for the development and implementation of culturally responsive and technologically integrated pedagogies that address the diverse needs of learners in today's classrooms. This advocacy is driven by rapid technological changes and the necessity for teachers to adapt to the evolving expectations of a tech-savvy generation. The paper emphasises the need for a framework such as CRB to tackle the challenges and opportunities presented by technology in diverse learning environments.

1.2 Themes

In developing the six themes, we initially conducted a comprehensive literature review to familiarise ourselves with existing research, followed by a more systematic knowledge-synthesis review as

detailed in the methods section. Throughout this iterative process, we identified recurring patterns and points of convergence in the literature, and through inductive analysis, we generated and refined the six themes. Employing a theory synthesis methodology, we systematically derived six themes from the literature review by analysing peer-reviewed journals and case studies on CRB and technology in education. Each theme was developed from recurring patterns and insights identified in the reviewed literature, and together these six themes provide an integrative perspective on how CRB and technology can enhance learner support in rural South African secondary schools. The themes are:

- *Learner support dimensions*: This theme was identified by examining studies that highlighted the critical role of emotional, academic, and social facets of learner support in effective learning environments.
- *Pedagogical integration of technology*: We found that successful integration of technology into teaching practices was frequently discussed in the literature, emphasising the necessity for pedagogical strategies that align with learners' cultural contexts.
- *Cultural and technological barriers*: Empirical evidence from various studies indicates specific cultural barriers that hinder the effective use of technology in classrooms, such as resistance from learners and teachers stemming from historical and socio-cultural factors.
- *Diversity, equity, and inclusion in pedagogy*: This theme, developed from the literature, emphasises inclusive practices that cater to diverse learner backgrounds, ensuring equitable access and opportunities for all students. *Best practices in technology use*: We analysed successful case studies in which technology was effectively utilised to enhance learning outcomes, providing a framework adaptable to similar contexts.
- *Technology for future preparedness*: This theme was developed from discussions in the literature about preparing learners for future challenges, emphasising the integration of technology to equip them for a rapidly changing world.

To substantiate our claims regarding the limitations of technology in providing emotional support, we drew on studies that highlighted how cultural barriers can significantly shape the emotional climate of the classroom. For instance, Dalle, Aydin, and Wang (2024) and Chan and Lee (2023) concurred that when cultural contexts are not considered, learners exhibit resistance to technology, which can hinder the emotional support that technology might otherwise provide. Additionally, studies by Altavilla (2025) in the New England region of the United States of America and by Moleko and Xulu-Gama (2024) in the Eastern Cape Province of South Africa demonstrated that without addressing historical inequalities and resource limitations, the emotional needs of learners in rural settings remain unmet, leading to a disconnect between technology use and learner support.

1.3 Analytical frameworks

The conceptual paper is grounded in three complementary analytical frameworks that collectively provide a multifaceted approach to examining technology-enhanced learner support in rural South African secondary schools. The three theories are Constructivist Learning Theory (individual knowledge construction) by Lev Vygotsky (1978), African *Ubuntu* philosophy ("I am because we are" communal epistemology), and Connectivism (networked learning) by Siemens (2008).

Constructivist Learning Theory (CTL) emphasises that learners actively construct knowledge through experience and interaction (Zajda, 2021; Mattar, 2018), a perspective particularly relevant when examining the pedagogical integration of technology and best practices in its application. This approach posits that genuine learning occurs when learners actively engage in the construction of knowledge across various dimensions, intellectual, cultural, emotional, and social, rather than merely receiving information passively (Zajda, 2021; Mattar, 2018). The efficacy of constructivist approaches is contingent upon multiple factors, including learners' personal attributes, developmental stages, cultural backgrounds, and levels of motivation, alongside teaching strategies

and the contexts within which learning occurs (Zajda, 2021; Mattar, 2018). As highlighted by the aforementioned authors, educators must engage learners in activities that are relevant to their interests and contexts. Teachers should be attuned to their learners' backgrounds and incorporate examples and illustrations that resonate with them to facilitate meaningful learning (Boughey & McKenna, 2021).

However, this Western-oriented theory (Culturally Responsive Teaching, CTL) alone may not fully encapsulate the communal aspects of African education (Moore & Coulibaly-Willis, 2025), which is where Ubuntu philosophy becomes essential. Ubuntu's emphasis on communal existence ("I am because we are") (Issah, 2025; Adeola, 2024; Hess, 2020) provides a cultural framework for understanding how technology can be integrated in ways that respect and enhance community values, pertinent when addressing diversity, equity, and inclusion in pedagogy (Mugumbate et al., 2024; Ngubane & Makua, 2021; Shadrach, 2025), as well as cultural barriers to technology adoption. In many rural South African contexts, Ubuntu already implicitly shapes relationships, decision-making, and notions of shared responsibility in secondary schools; thus, it can serve as a familiar entry point for understanding and accepting new pedagogical approaches. By explicitly linking Ubuntu values with the principles of CRB and the collaborative potential of digital tools, the philosophy can function both as a platform for making technology more accessible to communities rooted in Ubuntu and as a broader framework within which CRB and technology integration are understood as collective, community-enhancing practices rather than individualistic or externally imposed innovations. Shalo Tchombe (2024) argues that African development initiatives should be grounded in community needs, incorporate traditional African values, and align with the strategic framework of Agenda 2063, "an integrated, prosperous and peaceful Africa, driven by its citizens and representing a dynamic force in the international arena."

In this conceptual paper, Ubuntu serves not only as a philosophical lens but also underpins our choice of action research as a methodological orientation, since both emphasise collective agency, reciprocity, and knowledge generated with rather than for communities. Framing the work within Ubuntu-informed action research contributes to the epistemological decolonisation of research and knowledge production by positioning rural teachers, learners, and communities as co-creators of socially just pedagogies rather than passive recipients of externally imposed innovations.

The world is rapidly evolving due to technological advancements, and it is imperative that learners receive instruction aligned with these developments to maintain relevance and responsiveness to contemporary demands. Sibanda and Marongwe (2022) contend that educators should embrace innovative pedagogies that correspond to the requirements of 21st-century skills, knowledge, and dispositions. The aforementioned theories demonstrate a digital divide; consequently, we have sought to supplement them with connectivism, which is more pertinent and adaptive to the contemporary technological landscape. This perspective aligns with John Dewey's assertion that “if we teach today’s students as we taught yesterday’s, we rob them of tomorrow” (Draves & Coates, 2011, p. 41). Numerous changes have emerged as a result of increased access to information and the evolving technological landscape, which may compel teachers, particularly in rural areas of South Africa, to adopt and adapt their teaching strategies without fully comprehending or accommodating the unique individualities of their learners.

Connectivism, as a learning theory pertinent to the digital age, integrates various perspectives by elucidating how knowledge is distributed across networks of individuals and technology (Kop & Hill, 2008; Dziubaniuk, 2023; Chandrappa, 2018). For instance, Siemens (2008) contends that technological advancements and social software significantly transform the ways in which learners access information, acquire knowledge, and interact with educators and peers. Siemens (2008) asserts that developments in technology and the emergence of social software have profoundly altered the educational landscape (Mampota et al., 2023). According to Siemens's perspective, it is evident that

learners have traditionally sourced information primarily from textbooks, lectures, and direct instruction from teachers. However, with the advent of technologies such as social software (e.g., online forums, collaborative platforms, and social media), learners now possess unprecedented access to a vast array of information and knowledge sources (Mampota et al., 2023). This paradigm shift enables learners to engage with content in a more interactive and participatory manner. For example, learners can now independently research topics, collaborate with peers remotely, and receive real-time feedback from educators via digital platforms. This democratisation of information signifies that knowledge is no longer confined to the classroom or restricted to the expertise of a single educator; rather, it becomes a collective endeavour that encompasses multiple perspectives and resources (Sonia, 2017). In contexts such as rural South Africa, where educators have historically been regarded as primary custodians of knowledge and where intergenerational hierarchies remain significant, this shift has the potential to redistribute facets of epistemic power. Learners who acquire digital competencies may at times surpass their instructors in navigating online spaces and tools. Such changes can both challenge and enrich traditional familial and intergenerational power dynamics, necessitating the development of pedagogical approaches that respect the authority and experience of elders while also valuing learners' burgeoning digital expertise and positioning technology use as a collaborative rather than purely top-down learning process.

However, these technological developments enhance academic learning and can also present challenges, particularly concerning emotional support. Cultural barriers and historical inequalities can hinder the effectiveness of these technologies, especially in underserved contexts such as rural South African secondary schools. Resistance may arise from both learners and educators when technology is not integrated thoughtfully. For instance, if educators do not consider the unique needs and backgrounds of their students (Boughey & McKenna, 2021), the emotional connection necessary for effective learning may be compromised. Therefore, Siemens's assertion highlights the potential benefits of technology in fostering collaborative learning environments and the critical need for careful integration to ensure that all learners can access the emotional and academic support they require (Mampota et al., 2023). While Constructivism focuses on individual knowledge construction and Ubuntu on communal values, Connectivism explains how these can be integrated within a technology-enhanced learning environment. We contend that aligning educational strategies with the principles of Constructivist Learning Theory, African Ubuntu philosophy, and Connectivism can guide the effective use of technology while addressing the specific challenges faced by diverse learner cohorts in rural settings.

Figuratively, the three frameworks can be seen as overlapping circles in a Venn diagram, much like the three legs of a stool that must all be present to maintain stability, as reflected in Figure 1. Constructivism highlights how learners build knowledge; Ubuntu anchors this process in communal and cultural relations, filling gaps that Constructivism might overlook; and Connectivism extends learning into digital networks, addressing digital learning in ways that Ubuntu alone may not. In the overlapping areas, what one framework risks leaving implicit, such as culture, community, or technology, the others make explicit, so that where Connectivism might seem overly technology-focused, Constructivism and Ubuntu steady it by re-centring human experience, relationships, and cultural values.

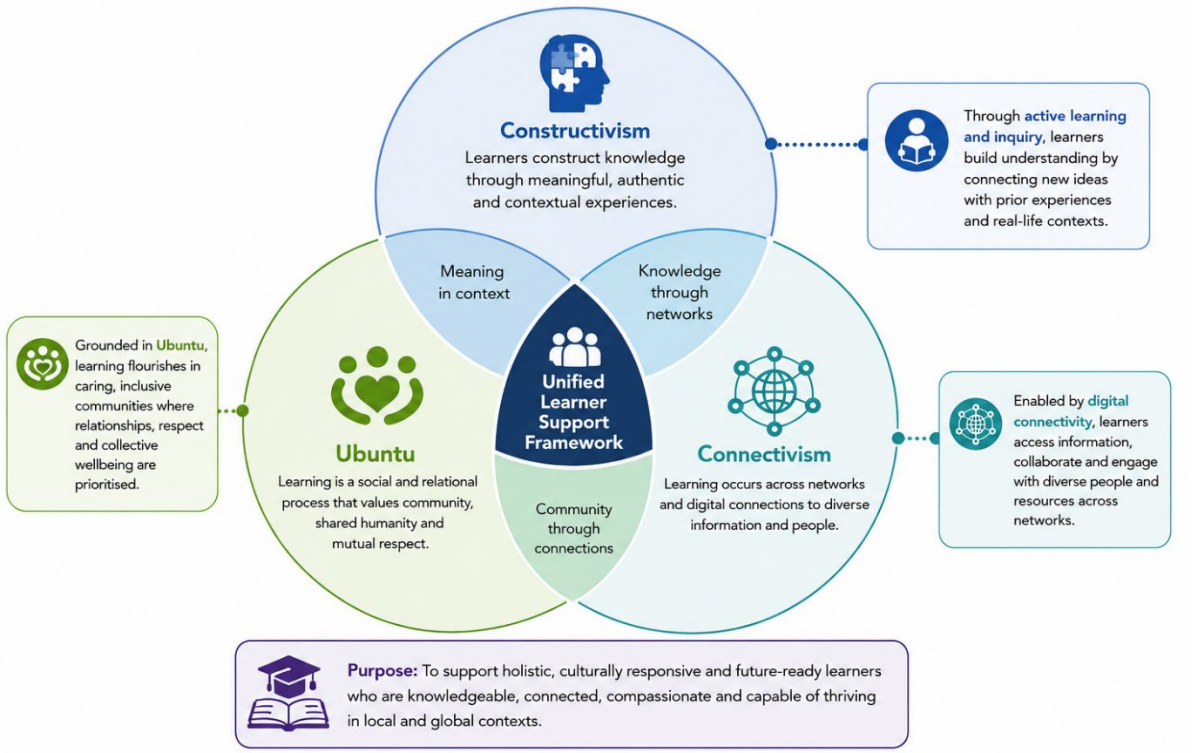

Figure 1: *Integrating Constructivism, Ubuntu, and Connectivism in a unified learner support framework*

When analysing the six themes, the analytical frameworks operate synergistically. For instance, in the examination of learner support dimensions, Constructivism informs the understanding of individual learning needs, Ubuntu ensures cultural responsiveness, and Connectivism addresses the integration of technology. Similarly, in the context of cultural and technological barriers, Ubuntu aids in identifying cultural concerns, Constructivism proposes learning-based solutions, and Connectivism provides insights into technological perspectives. This theoretical triangulation facilitates a comprehensive analysis that acknowledges individual learning (Constructivism), cultural values (Ubuntu), and technological advancement (Connectivism) within the realm of rural South African education.

2. Methodology

We employed a theory- or knowledge-synthesis methodology. Campbell et al. (2014) and Cooper et al. (eds.) (2019) define theory or knowledge synthesis as involving a critical review, assessment, and integration of information from various studies to formulate a new, more comprehensive understanding of a concept, idea, or theory. This methodological process identifies patterns, addresses inconsistencies, and uncovers knowledge gaps, resulting in a robust, evidence-based, and generalisable conceptual framework (Campbell et al., 2014; Cooper et al. (eds), 2019). The notable scholars associated with this methodology include Sandelowski, J.C., Tricco, A.C., Cooper, H., Hedges, L., Halligan, K.E.H., and Newman, E.M., among others. Tricco et al. (2016) assert that knowledge synthesis methodology enables researchers to integrate and evaluate existing literature and theoretical perspectives, thereby generating an understanding of the topic and constructing a framework. We employed the knowledge synthesis methodology, incorporating narrative and realist reviews to enhance understanding and provide insights by developing frameworks that systematically integrate findings from diverse studies and interpret them within our predefined analytical frameworks. Campbell et al. (2014), Akudjedu et al. (2026), and Greenhalgh et al. (2007) concur that the knowledge synthesis review approach, as an emerging methodological advancement,

has the potential to inform practice and policy while improving systems such as education and healthcare.

Our primary objective was to synthesise research and theoretical insights to develop a conceptual framework that integrates CRB with technology in rural South African secondary schools. While we constructed the framework conceptually, it is grounded in the principles of Participatory Action Research (PAR), which emphasise collaboration and stakeholder involvement. We designed it with the potential for future co-creation with stakeholders, such as local teachers, learners, and community members, to ensure contextual appropriateness and practical applicability (Wood, 2019). By aligning knowledge synthesis with an Ubuntu-informed action research stance, the study aims to support epistemological decolonisation by focusing on contextually grounded, participatory knowledge production that centres marginalised rural voices in the design of culturally responsive, technology-enhanced pedagogy. This conceptual study provides the foundation for the practical development of the framework and envisions a scenario in which local teachers, learners, and community members contribute significantly. Through hypothetical engagement and simulated scenarios, the study illustrates how stakeholder feedback could shape the framework, thereby increasing its relevance and applicability.

Since theory synthesis design involves integrating multiple theories or literature streams to achieve conceptual consolidation (Campbell et al., 2014; Snyder, 2019; Cooper et al. (eds), 2019), this study employed three analytical frameworks: (i) Constructivism, which connects with the theme of pedagogical integration and supports learners in constructing knowledge through localised and culturally diverse experiences; (ii) the African Ubuntu philosophy, which aligns with the promotion of diversity, equity, and inclusion, emphasising community and interconnectedness in education; and (iii) Connectivism, which relates to technology-enhanced future preparedness, highlighting the importance of digital networks in learning. This methodological approach is appropriate for this study as it draws upon various theoretical and philosophical domains to address the six themes.

Through a computer-aided narrative literature review of peer-reviewed journals and case studies, this paper examines the relationship between CRB and technology in supporting diverse learners, with the intention of developing a contextually relevant framework for learner support. The process of theory synthesis, as outlined by MacInnis (2011) and Akudjedu et al. (2026), involves constructing a new or enhanced view of a concept by creatively linking previously disparate or seemingly incompatible elements. By synthesising theories from different fields, such as Constructivism, African Ubuntu philosophy, and Connectivism, the study seeks to develop a new perspective that reimagines the integration of technology in academic settings using CRB in South African secondary rural schools. This novel perspective explores the integration of technology while considering the cultural, linguistic, and ethical implications of technological applications in rural secondary schools with limited technological infrastructure.

The chosen methodology facilitated the proposal of a framework grounded in the aforementioned three theories and suggested pathways for its application within action research paradigms. By fostering more partnerships with local rural secondary schools and with South Africa's Department of Basic Education, universities can make meaningful contributions to the advancement of innovative teaching methods rooted in culturally responsive education. Consequently, this learner support framework can be continuously tested and refined, aligning with the principles of action research to address educational challenges in underserved rural secondary schools in South Africa.

2.1 Inclusion criteria

Studies focusing on the dimensions of learner support systems in rural secondary schools emphasise cultural responsiveness and technological integration. These studies address cultural and technological barriers to implementing digital solutions and explore strategies for diversity, equity,

and inclusion through digital pedagogy. Publications identify best practices in technology use that respect cultural values and educational needs. Additionally, studies discuss the application of Constructivism, Ubuntu philosophy, and Connectivism in academic contexts, as well as the use of technology to support learning in rural South African schools. Research from the last 15 years is included to ensure contemporary relevance. Furthermore, studies that demonstrate collaborative efforts and participatory approaches in educational settings ensure that the framework is built on collective input.

2.1.1 Our exclusion criteria were

Studies that do not concentrate on rural education or fail to provide insights into the CRB. Research that neglects to address local contextual needs and resources. Articles that are exclusively focused on urban educational settings without offering insights applicable to rural contexts. Research that is not related to the integration of technology in education. Outdated publications, defined here as studies published more than 15 years ago and/or studies that do not reflect current technological advancements or contemporary cultural considerations. Exclude studies that do not engage with community or stakeholder perspectives, as these are inconsistent with the participatory nature of the research.

2.1.2 Our process description

A comprehensive literature search was conducted, concentrating on peer-reviewed journals, reputable sources, conference proceedings, and academic texts. The search was filtered according to predefined themes, with a particular emphasis on participatory action research. This included an examination of studies related to learner support in rural contexts, CRB, Ubuntu-informed educational practices, and the integration of technology within collaborative, community-based, or action-oriented methodologies. The studies were evaluated based on their relevance and quality in relation to the identified themes and criteria. This process facilitated iterative cycles of literature review and refinement. Insights were synthesised to develop a framework that acknowledges local cultural perspectives and fosters technology-enhanced preparedness for future challenges.

2.1.3 Justification

We integrated these themes to ensure that the framework is comprehensive and pertinent to the specific educational and cultural context of rural South Africa. Our position was to emphasise best practices and local cultural values in order to cultivate an inclusive educational environment that is both technologically advanced and culturally sensitive. The incorporation of PAR principles aimed to ensure that the framework is theoretically robust and practically relevant, as well as culturally grounded, thereby promoting ownership and sustainability of educational innovations in rural contexts (Wood, 2019; Zuber-Skerritt & Wood, 2020). The selected criteria guarantee that the review remains focused and relevant to the distinct educational and cultural context of rural South Africa. Our emphasis on recent literature enabled the framework to reflect contemporary challenges and opportunities in the integration of technology with CRB.

2.2 Ethical consideration

This article presents a conceptual analysis; no human or animal participants were directly involved in the study, nor were any new empirical data generated. The work is based entirely on secondary sources, all of which have been appropriately cited and acknowledged in accordance with academic integrity and copyright requirements. In constructing the conceptual arguments, careful attention was given to accurately represent the positions of authors and to avoid misattribution or plagiarism. The paper conceptually draws on a larger empirical project that received ethical clearance from the North-West University Research Ethics Committee, assigned ethics number NWU-00330-22-A2. This project adheres to NWU's policies on informed consent, confidentiality, voluntary participation, data

security, and the protection of vulnerable groups. Although the present paper does not present primary data, it remains aligned with these ethical principles and with broader guidelines for responsible and respectful scholarship in decolonial and rural education research.

3. Theoretical and Philosophical Analysis of Themes

This section provides a theoretical analysis and discussion of the six themes that were inductively developed from the knowledge-synthesis process. Utilising the three guiding frameworks, Constructivism, Ubuntu philosophy, and Connectivism, we interpret the contributions of each theme to the understanding of culturally responsive, technology-enhanced learner support in rural South African secondary schools. In Sections 3.1–3.6, each theme is examined in turn, with an emphasis on its conceptual significance and the interconnections with the other themes.

3.1 Dimensions of learner support in rural South Africa

Technological integration and cultural responsiveness emerged from the studies we consulted as we examined the dimensions of learner support systems in rural South African secondary schools. Most scholars argue that these aspects are fundamental to establishing learning environments that address learners' emotional, academic, and social needs. We explored how CRB, supported by technology, can enhance learner support in these schools by drawing on the theories of Constructivism, African Ubuntu philosophy, and Connectivism.

The studies we consulted agreed that Constructivism emphasises the importance of learners actively constructing knowledge through experiences relevant to their cultural context (Zajda, 2021; Mattar, 2018; Piaget & Inhelder, 2008; Mampota et al., 2023; Boughey & McKenna, 2021). In rural South African secondary schools, where resources may be limited, integrating technology can provide diverse and localised learning experiences. For example, using digital storytelling tools can enable learners to create and share narratives that reflect their cultural heritage and community values. This approach supports the development of critical thinking and problem-solving skills (Mukhlis et al., 2024), affirming learners' identities and experiences, which are fundamental to constructivist pedagogy.

The African Ubuntu philosophy, which emphasises community and interconnectedness, aligns well with the goals of diversity, equity, and inclusion in education (Mugumbate et al., 2024; Ngubane & Makua, 2021; Shadrach, 2025). According to the aforementioned authors, it is pivotal to create an environment in rural South African secondary schools where learners feel a sense of belonging and mutual respect. Following the principles of PAR, teachers can promote collaborative learning by using technology-enabled group projects in which learners work together to solve problems or engage in discussions that reflect Ubuntu principles (Ngubane & Makua, 2021; Shadrach, 2025). We contend that this approach will enhance social support and encourage learners to appreciate different perspectives and cultures, thereby promoting a more inclusive educational environment.

Connectivism, a learning theory for the digital age, highlights the role of technology in preparing learners for the future by emphasising the importance of digital networks (Mukhlis et al., 2024; Siemens, 2005; Mampota et al., 2023; Alam, 2024). Literature attests that access to information and resources can be challenging in rural secondary schools, particularly in certain parts of South Africa, where the digital divide has widened and been exacerbated by the COVID-19 pandemic (Chisango & Marongwe, 2021; Hart, 2023). It is therefore argued that such a gap can be closed by integrating technology and providing learners with access to expertise and a wide range of learning materials. Rural learners often miss opportunities; however, through the infusion of technology, exposure to online platforms that connect rural learners with urban secondary schools or international teachers can expand their learning opportunities and prepare them for a globalised world (Alam, 2024; Mukhlis et al., 2024). This technological integration supports learners in developing the digital literacy skills essential for future success.

The integration of CRB with technology in rural South African secondary schools can significantly enhance learner support systems. By drawing on Constructivism, Ubuntu philosophy, and Connectivism, teachers can create learning environments that are technologically enriched, culturally affirming, and community-oriented. These approaches ensure that learners are equipped with the 21st-century skills and knowledge necessary to thrive in a rapidly changing world (Sibanda & Marongwe, 2022), while maintaining strong ties to their cultural heritage.

3.2 Integrating technology in diverse rural classrooms

A comprehensive understanding of local contextual needs and resources is essential for educators seeking to integrate technology into culturally diverse rural learning environments. This theme underscores the necessity of aligning pedagogical strategies with the cultural contexts of learners to ensure effective teaching practices. The literature indicates that successful technology integration entails more than merely providing digital tools; it necessitates a holistic approach that considers cultural relevance and community engagement. Constructivism, which asserts that learners construct knowledge through experience, serves as a foundational theory in this context. By incorporating technology into constructivist learning environments, educators can create opportunities for learners to engage with content that reflects their cultural backgrounds (Zajda, 2021; Mattar, 2018; Piaget & Inhelder, 2008; Mampota et al., 2023). For instance, utilising localised digital content, such as cultural narratives or community-based projects, enables learners to connect new information to their existing knowledge base. This approach enhances understanding and supports the cultural identities of learners. To foster a sense of belonging, as emphasised by the African Ubuntu philosophy, the use of technology allows educators to promote peer-to-peer learning, wherein learners collaborate, thereby enhancing social cohesion. The principles of PAR further inform this methodology by highlighting the significance of involving community stakeholders in the educational process (Wood, 2019; Zuber-Skerritt & Wood, 2020; Kemmis & McTaggart, 2005; Reason & Bradbury, 2008; Bradbury et al., 2019). To ensure the cultural relevance and responsiveness of content and pedagogies to local needs, educators are encouraged to engage with local communities and other stakeholders during the design and implementation of technology-enhanced learning. This participatory approach cultivates a sense of ownership and accountability among all stakeholders, leading to more sustainable and impactful educational outcomes.

The pedagogical integration of technology in culturally diverse rural learning environments necessitates strategies informed by Constructivism, Ubuntu philosophy, Connectivism, and participatory principles. Educators can create supportive and conducive learning environments that enhance learner support and prepare learners for future success by aligning technology use with local cultural contexts and engaging community stakeholders.

3.3 Barriers to digital learning in rural South Africa

Implementing digital learning solutions in rural South African secondary schools frequently encounters cultural and technological barriers. Empirical evidence from various studies highlights specific cultural obstacles, such as resistance from both learners and teachers, which are rooted in historical and socio-cultural factors (Howie et al., 2017; Hart, 2023; Mensah & Baidoo-Anu, 2022). These barriers can impede the effective use of technology in classrooms. Understanding and addressing these challenges necessitates an approach informed by Constructivism, African Ubuntu philosophy, Connectivism, and participatory principles such as PAR.

Constructivism underscores the importance of learners actively engaging with content that is meaningful within their cultural context (Zajda, 2021; Mattar, 2018; Piaget & Inhelder, 2008; Mampota et al., 2023). Resistance may arise when digital learning tools do not align with local cultural values or when they lack contextual relevance. For instance, digital content that does not reflect the learners' cultural narratives can lead to disengagement. Consequently, educators must

customise digital materials to incorporate culturally relevant examples and scenarios, thereby making learning more relatable and compelling.

The African Ubuntu philosophy, which emphasises community and interconnectedness, can inform strategies to overcome resistance. Cultivating an inclusive environment in which educators, learners, and community members participate in the technology integration process can foster a sense of ownership and acceptance (Mugumbate et al., 2024; Ngubane & Makua, 2021; Shadrach, 2025; Mugumbate & Nyanguru, 2013). For example, involving local leaders and parents in discussions regarding the benefits and implementation of digital learning can help bridge cultural gaps and address concerns, rendering technology adoption more community-driven.

Connectivism highlights the importance of digital literacy and the ability to navigate digital networks (Alam, 2023; 2024; Siemens, 2005; Mampota et al., 2023; Mukhlis et al., 2024). Schools and policymakers should ensure that both educators and learners are equipped with the necessary skills to effectively utilise technology. Professional development programmes that focus on digital literacy for educators can help build confidence and reduce resistance to new technologies. Furthermore, the government should prioritise infrastructure development to ensure reliable internet access and provide the resources that rural secondary schools require. As previously noted, PAR principles advocate for the involvement of all stakeholders in the educational process (Wood, 2019; Zuber-Skerritt & Wood, 2020; Kemmis & McTaggart, 2005; Reason & Bradbury, 2008; Bradbury et al., 2019). By engaging educators, learners, community members, and other stakeholders in identifying technological needs and cultural considerations, effective solutions can be co-created to address barriers. This participatory approach ensures that digital learning initiatives are sustainable and culturally responsive.

In conclusion, addressing cultural and technological barriers in the implementation of digital learning solutions necessitates a multifaceted approach informed by Constructivism, Ubuntu philosophy, Connectivism, and participatory principles. By developing culturally relevant, community-driven, and skills-oriented strategies, teachers, policymakers, and communities can collaboratively enhance learner support and overcome resistance to technology in rural South African schools.

3.4 Strategies to advance diversity and equity in rural digital learning

Promoting diversity, equity, and inclusion in rural education settings through culturally responsive digital pedagogy is essential for addressing the varied needs of learners in South Africa, a nation celebrated as a "rainbow nation" yet confronted by deep-seated inequalities stemming from apartheid and exacerbated by the COVID-19 pandemic and other factors (Moyo & Ndlovu-Gatsheni, 2024; Tshipetane, 2025). The term “rainbow nation” denotes South Africa’s post-apartheid ideal of a society in which multiple racial, ethnic, linguistic, and cultural groups coexist with equal dignity and recognition; however, this vision is often undermined by persistent structural and educational inequalities (Bollaert et al., 2019). The integration of digital tools in education presents an opportunity to bridge these gaps by ensuring equitable access for all learners. Strategies informed by Constructivism, African Ubuntu philosophy, Connectivism, and participatory principles, such as PAR, can guide this integration.

Constructivism emphasises the importance of learners actively constructing knowledge through experiences that resonate with their cultural backgrounds (Zajda, 2021; Mattar, 2018; Piaget & Inhelder, 2008; Mampota et al., 2023). In rural South African secondary schools, digital pedagogy can be customised to include culturally relevant content, such as local narratives or community issues, thereby enabling learners to connect new information to their lived experiences. For instance, digital platforms can facilitate projects in which learners document community histories or local environmental challenges, promoting an inclusive learning environment that values each learner's

contributions. In the spirit of the African Ubuntu philosophy, which underscores the significance of community togetherness, educators can leverage technology to cultivate collaborative learning experiences and foster a sense of community within diverse classrooms. As previously noted, group projects facilitated through digital tools can encourage learners from diverse backgrounds to collaborate, reinforcing mutual respect and collective learning. This not only enhances social cohesion but also empowers learners to appreciate diversity, aligning with the principles of PAR, by positioning learners as active co-creators of knowledge who collaborate to address shared challenges within their educational context.

Connectivism accentuates the critical role of digital networks in contemporary learning, highlighting the significance of digital literacy and connectivity (Alam, 2023, 2024; Siemens, 2005; Mampota et al., 2023; Mukhlis et al., 2024). Governments, policymakers, schools, school governing bodies (SGBs), and other stakeholders, including non-governmental organisations (NGOs) and non-profit organisations (NPOs), should prioritise infrastructure development to ensure that all learners, irrespective of their location, have access to digital resources. Providing educators with training in the effective utilisation of technology in their teaching can enhance their capacity to deliver inclusive and equitable education. For instance, online platforms can be employed to connect rural students with peers and educators from other regions, broadening their perspectives and fostering a more inclusive educational experience.

Strategies for promoting diversity, equity, and inclusion through culturally responsive digital pedagogy in rural South African secondary schools must be informed by Constructivism, Ubuntu philosophy, Connectivism, and participatory principles. By addressing the historical and socio-economic challenges that persist in South Africa, secondary schools and policymakers can create inclusive learning environments that empower all students to thrive in a rapidly changing world.

3.5 Best practices in tech use for rural schools

Identifying best practices in technology use that align with cultural values and educational needs is crucial for rural South African secondary schools seeking to enhance learning outcomes. Through the analysis of successful case studies, a framework of best practices can be derived and adapted to similar contexts. This approach is informed by Constructivism, African Ubuntu philosophy, Connectivism, and participatory principles such as PAR, which together provide a comprehensive strategy for integrating technology in education.

Constructivism emphasises learners' active engagement with content that reflects their cultural and contextual realities (Zajda, 2021; Mattar, 2018; Piaget & Inhelder, 2008; Mampota et al., 2023). In rural South African schools, technology can be harnessed to create interactive learning environments that incorporate local knowledge and traditions. For example, a successful case study in the Eastern Cape employed digital storytelling, enabling learners to document and share their community's oral histories (Bidwell et al., 2010; Winschiers-Theophilus et al., 2025; Ladeira et al., 2014; Letseka, 2022). This not only enhances engagement but also preserves cultural heritage, illustrating how technology can support constructivist learning by connecting learners' experiences with academic content.

The African Ubuntu philosophy, which emphasises community and interconnectedness, offers a perspective on technology integration as a means of promoting inclusive educational practices (Mugumbate et al., 2024; Ngubane & Makua, 2021; Shadrach, 2025; Mugumbate & Nyanguru, 2013). For instance, in a project in Kenya, technology facilitated cooperative learning among learners from diverse ethnic backgrounds, promoting a sense of unity and shared purpose (Wangui et al., 2024; Mustakim et al., 2025). By utilising technology to connect learners, educators can cultivate environments in which diversity is celebrated and community ties are strengthened, thereby aligning with the principles of Ubuntu.

Connectivism underscores the significance of digital networks in learning, highlighting the necessity to equip learners with the skills to navigate an increasingly interconnected world (Mukhlis et al., 2024; Siemens, 2005; Mampota et al., 2023; Alam, 2024). In rural South Africa, a programme in Limpopo utilised mobile technology to provide learners with access to global educational resources and online courses, significantly improving academic performance and digital literacy (Mojapelo & Durodolu, 2022; Manyadze, 2023; Thangeni, 2022). This approach demonstrates how connectivist strategies can prepare learners for future challenges by expanding their access to information and expertise beyond their immediate environment. Similarly, PAR principles advocate for the involvement of all stakeholders in educational initiatives (Wood, 2019; Zuber-Skerritt & Wood, 2020; Kemmis & McTaggart, 2005; Reason & Bradbury, 2008; Bradbury et al., 2019). For example, in Malawi and Zambia, a community-driven project involved teachers, parents, and local leaders in the design and implementation of a technology-enhanced curriculum, ensuring that it was culturally relevant and met the community's educational needs (McIntosh & Bowman, 2019; Kaziya, 2025). This participatory approach not only ensured the programme's success but also empowered the community by fostering a sense of ownership and responsibility.

Identifying best practices in technology use that align with cultural values and educational needs in rural South African schools necessitates a multifaceted approach informed by Constructivism, Ubuntu philosophy, Connectivism, and participatory principles. By drawing on successful case studies and adapting these practices to local contexts, educators, policymakers, and communities can enhance learner support and improve educational outcomes in rural settings.

3.6 Framework for tech-enhanced rural preparedness

Developing a framework for technology-enhanced future preparedness that respects and incorporates local cultural perspectives in rural education is essential for equipping learners in underserved South African schools to navigate the challenges of a rapidly changing world. This framework, grounded in Constructivism, African Ubuntu philosophy, and Connectivism, seeks to integrate technology in a manner that honours cultural values while preparing learners for global engagement, as illustrated in Figure 2.

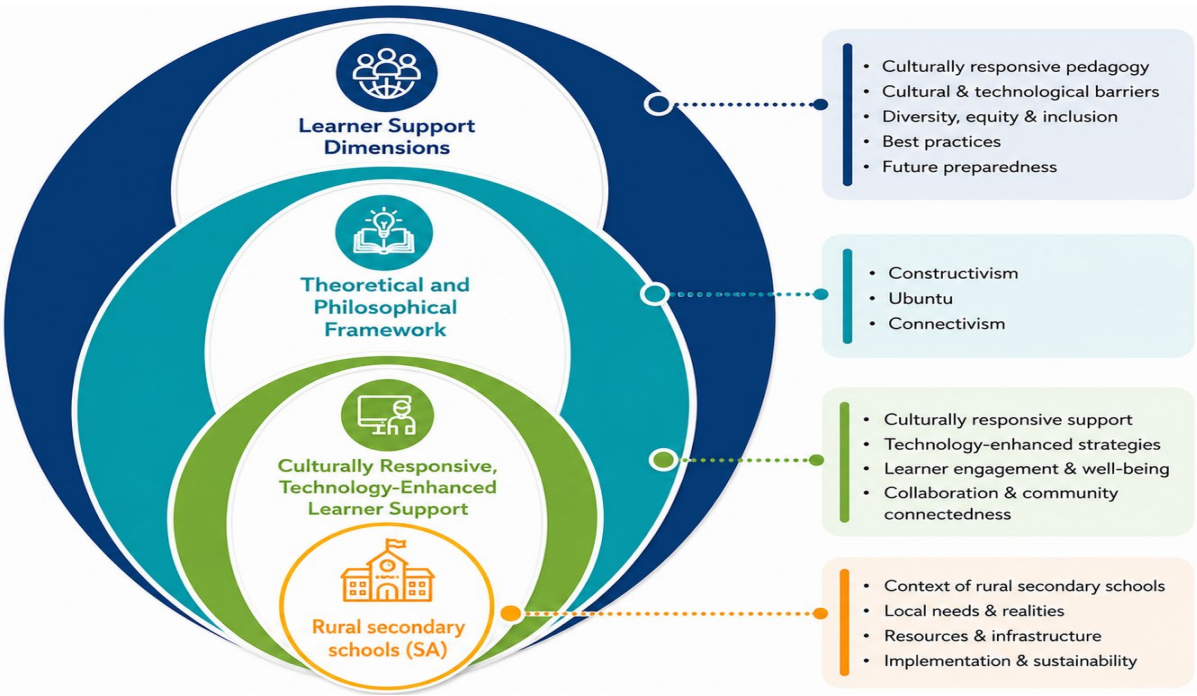

Figure 2: *Framework for technology-enhanced learner support (2025)*

Figure 2 presents a non-linear framework that integrates Constructivism, Ubuntu, and Connectivism, accompanied by six inductively developed themes designed to guide culturally responsive, technology-enhanced learner support in rural South African secondary schools. The central goal of this framework is situated within three intersecting analytical frameworks and six interrelated thematic domains, which can be combined in various configurations rather than adhered to as a fixed sequence.

At the core of this framework lies Constructivism, which asserts that learners construct knowledge through experiences that resonate with their cultural context (Zajda, 2021; Mattar, 2018; Piaget & Inhelder, 2008; Mampota et al., 2023). By leveraging technology to create interactive and culturally pertinent learning experiences, educators can cultivate meaningful understanding and engagement among learners. For instance, digital platforms can host projects that enable learners to explore and document local traditions, thus linking new knowledge to their community's cultural heritage. This approach not only enhances learning but also fosters a sense of pride and ownership over their cultural identity.

The African Ubuntu philosophy highlights the significance of community and interconnectedness, principles that are essential in cultivating inclusive educational environments (Mugumbate et al., 2024; Ngubane & Makua, 2021; Shadrach, 2025; Mugumbate & Nyanguru, 2013). By employing technology to promote collaborative learning opportunities, this framework encourages solidarity and mutual respect among learners. Online forums and group projects can facilitate connections among learners from diverse backgrounds, fostering a sense of unity and shared purpose. These interactions enrich the educational experience and prepare learners to engage with a variety of perspectives within the global community.

Connectivism emphasises the importance of digital networks in contemporary education, highlighting the necessity of digital literacy and connectivity (Mukhlis et al., 2024; Siemens, 2005; Mampota et al., 2023; Alam, 2024). This framework advocates for equipping learners with the competencies required to navigate digital environments effectively. By incorporating technology that provides access to global resources and expertise, learners can expand their knowledge and prepare for future challenges. For example, virtual exchanges with peers worldwide can enhance learners' understanding of international issues and develop cross-cultural communication skills.

To ensure the relevance and sustainability of this framework, partnerships with local rural secondary schools, South Africa's Department of Basic Education, and higher education institutions are essential. These collaborations can facilitate the ongoing testing and refinement of the framework, aligning with the principles of action research (Wood, 2019; Zuber-Skerritt & Wood, 2020; Kemmis & McTaggart, 2005; Reason & Bradbury, 2008; Bradbury et al., 2019). By engaging stakeholders in the iterative evaluation and enhancement of the framework, it remains responsive to the evolving educational needs of rural communities, as illustrated in Fig. 2.

This framework for technology-enhanced future preparedness, infused with Constructivism, the African Ubuntu philosophy, and Connectivism, provides a culturally responsive approach to education in rural South African secondary schools. By integrating technology in a manner that honours cultural values and prepares learners for global engagement, this framework addresses the educational challenges faced by underserved communities and equips learners to thrive in a rapidly changing world.

5. Conclusions

Addressing the educational challenges in rural South African secondary schools necessitates a multifaceted approach that integrates CRB with emerging technologies. Grounded in Constructivism, African Ubuntu philosophy, and Connectivism, our proposed framework emphasises the importance of aligning digital learning initiatives with local cultural values and

educational needs. We advocate for innovative educational strategies that carefully integrate emerging technologies into rural secondary schools, as this is vital for meaningfully decolonising conventional, uncritical methods of technology integration, which often overlook the unique geographical contexts and diverse learner populations they serve. By fostering community partnerships, schools can access additional resources and support for technology initiatives, thereby creating an environment that encourages experimentation with innovative teaching methods. Such alliances, alongside active stakeholder engagement, ensure that educational practices remain relevant, inclusive, and effective in preparing learners for future challenges. This approach will ultimately enhance learner support and empower communities, contributing to a more equitable and dynamic educational landscape.

6. Declarations

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