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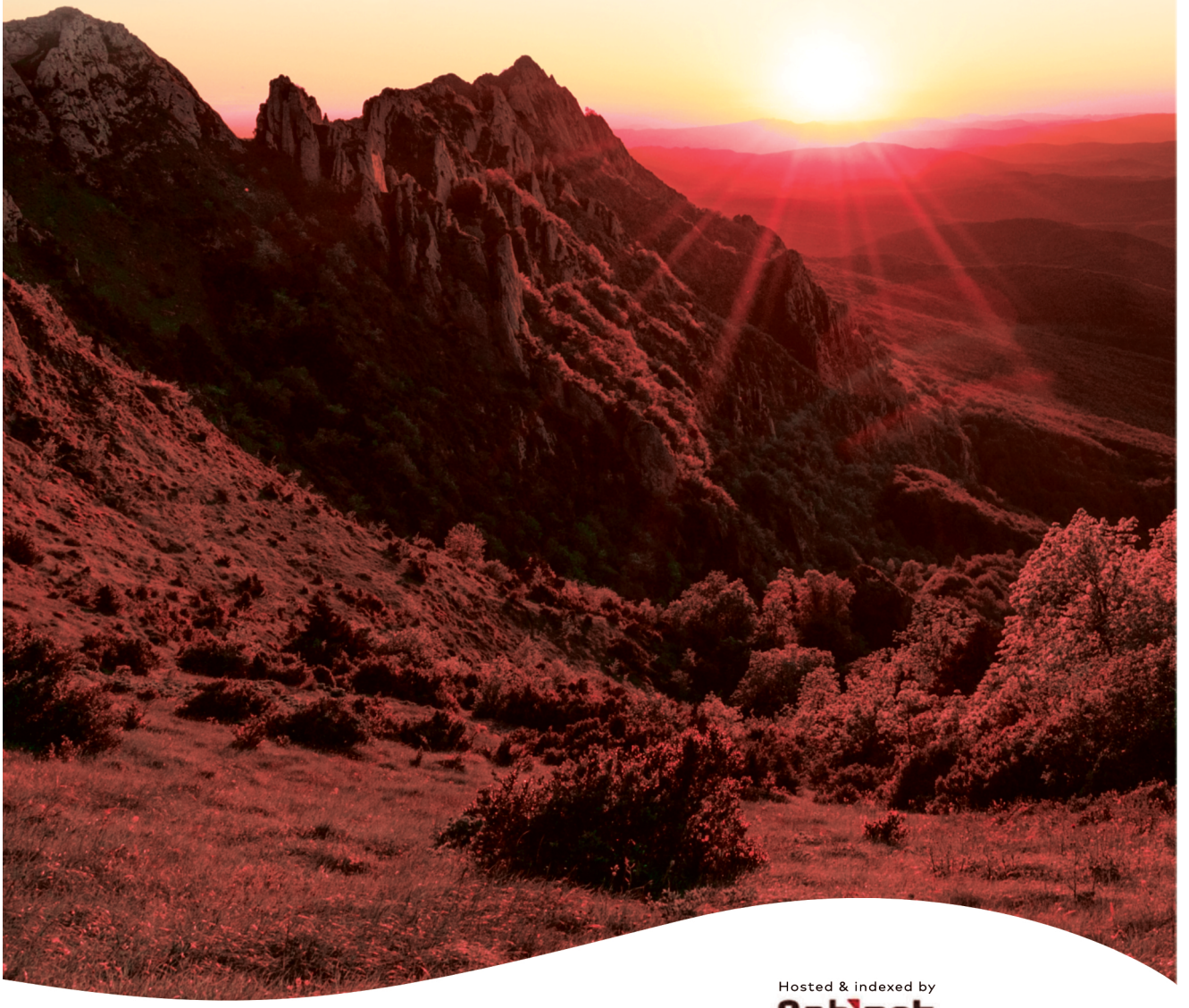

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Bridging competency and context: Integrating cross cutting themes in mathematics education

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Abstract

The study explores the integration of cross-cutting themes in the teaching and learning of mathematics in Zimbabwean secondary schools. Informed by the philosophy of Education 5.0 and the heritage-based curriculum, the research investigates current pedagogical practices, challenges encountered by teachers and learners, and the role of school leadership in facilitating integration. A qualitative case study design was employed, using interviews, classroom observations, and document analysis to collect data from mathematics teachers, heads of departments, and school administrators. The findings indicate growing awareness among educators of the importance of themes such as environmental sustainability, gender equality, and ICT in mathematics education. However, integration remains inconsistent and often superficial. Teachers reported limited training opportunities, inadequate teaching resources, and insufficient institutional support as key barriers. Students demonstrated positive engagement when cross-cutting themes were contextualised and linked to real-life experiences, although curriculum rigidity and exam-focused instruction limited broader exploration. The study recommends targeted professional development to enhance teacher capacity for integrating cross-cutting themes into mathematics lessons. It also calls for clearer school-level policies, resource provision, and structured support systems. Collaboration among teachers, reflective practice, and continuous monitoring are emphasised as strategies for improving classroom implementation.

Key Terms: Cross-Cutting Themes, Heritage-Based Curriculum, Sustainable Development Goals (SDGs), Curriculum Integration, Zimbabwean Curriculum Framework

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Introduction

Informed by the philosophy of Education 5.0, the heritage-based curriculum, the research investigates current pedagogical practices, challenges encountered by teachers Zimbabwean secondary schools. and learners, and the role of school leadership in facilitating integration.

A qualitative case study design was employed, using interviews, classroom observations, and document analysis to collect data from mathematics teachers, heads of departments, and school administrators.

The findings indicate growing awareness among educators of the importance of themes such as environmental sustainability, gender equality, and information and communication technology (ICT) in mathematics education. However, integration remains inconsistent and often superficial. Teachers reported limited training opportunities, inadequate teaching resources, and insufficient institutional support as key barriers. Students demonstrated positive engagement when cross-cutting themes were contextualised and linked to real-life experiences, although curriculum rigidity and exam-focused instruction limited broader exploration.

The study recommends targeted professional development to enhance teacher capacity for integrating cross-cutting themes into mathematics lessons. It also calls for clearer school-level policies, resource provision, and structured support systems. Collaboration among teachers, reflective practice, and continuous monitoring are emphasised as strategies for improving classroom implementation.

By identifying both challenges and possibilities, the research contributes to curriculum reform discourse and underscores the need for systemic support. It advocates for a more inclusive and responsive mathematics education that advances both academic achievement and the broader transformative objectives of Zimbabwe's Education 5.0 agenda.

The study was guided by three key research questions. First, it sought to examine the extent to which Education for Sustainable Development (ESD) principles are integrated into the secondary school curriculum in Zimbabwe. This question was aimed at assessing the alignment between the mathematics curriculum and global ESD goals, thereby providing a foundational framework

for analysis. Second, the study explored the challenges that educators encounter in implementing ESD and integrating cross-cutting themes within the classroom context. This was essential for identifying practical and structural barriers to effective implementation. Third, the research investigated the impact of integrating cross-cutting themes on learners' competencies, values, and attitudes toward sustainability. This question provided insight into the educational outcomes and the broader relevance of ESD integration for student development and transformative learning.

ESD and Cross-Cutting Themes in Mathematics

Cross-cutting themes are foundational to achieving the objectives of Education for Sustainable Development (ESD), as they foster the development of real-world competencies and critical consciousness (UNESCO, 2023; Lafuente-Lechuga et al., 2020; Banda & Ndlovu, 2023). In Zimbabwe, the Curriculum Framework for Primary and Secondary Education (2024–2030) mandates the integration of these themes, including gender equality, environmental sustainability, and information and communication technology (ICT), across all subjects, including mathematics. The rationale is to ensure contextual relevance, promote critical thinking, and prepare learners to navigate complex socio-economic and environmental challenges (Ministry of Primary and Secondary Education [MoPSE], 2023).

Despite the policy commitment to integration, practical implementation remains uneven. Empirical findings by Chikowore and Mupfiga (2023) highlight limited teacher preparedness, inadequate instructional resources, and structural inefficiencies as persistent barriers. These challenges suggest a disjuncture between curriculum reform intentions and classroom realities.

From a theoretical perspective, Social Constructionism (Berger & Luckmann, 1966) provides a useful lens for analysing how teachers construct curricular meaning. In the Zimbabwean context, where examination performance, league tables, and managerial accountability regimes dominate, teachers often construct knowledge in ways that prioritise testable content over transformative education (Mhlanga, 2023). The result is the reproduction of normative pedagogies that marginalise cross-cutting themes, perceived as peripheral to 'real teaching'. This resistance reflects entrenched institutional narratives that constrain innovation, despite curricular reform.

The emergence of ESD as a global educational imperative reflects a broader recognition of the role of education in addressing climate change, inequality,

and global citizenship. Brundtland's (1987 p. 7) seminal definition of sustainable development, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", underpins the intergenerational ethos that ESD seeks to instil. ESD is not merely about knowledge transmission but about transformative pedagogy that empowers learners to engage ethically and practically with local and global challenges (UNESCO, 2017; Sterling, 2014).

At the international level, the United Nations Sustainable Development Goals (SDGs) adopted in 2015 serve as a blueprint for global development. Of particular relevance is Goal 4: Quality Education, with Target 4.7 explicitly calling for the integration of ESD and global citizenship into curricula. Kioupi and Voulvoulis (2019) argue that SDG-aligned education systems must go beyond disciplinary silos to cultivate ecological literacy, civic responsibility, and ethical reasoning—competencies essential for sustainable societies.

Zimbabwe's heritage-based curriculum framework mirrors these global aspirations through its emphasis on cross-cutting themes such as human rights, disaster risk reduction, enterprise skills, and HIV and AIDS (MoPSE, 2023; Mukorera & Zulu, 2023). These themes are designed not as standalone subjects but as integrative elements across all learning areas. In mathematics, this approach aims to move beyond abstract content by embedding socio-cultural and environmental issues into instruction, thereby enhancing learner engagement and contextual relevance (Dambudzo, 2015).

When effectively integrated, cross-cutting themes serve as conceptual bridges linking academic content with lived realities. For instance, statistical concepts can be taught using public health data to illuminate the prevalence of HIV/AIDS, thereby reinforcing both mathematical skills and social awareness. According to UNESCO (2023), cross-cutting themes, such as equity, peace, climate change, and inclusion, cut across disciplines and are critical to holistic learning that cultivates cognitive, ethical, and emotional maturity.

Nevertheless, the successful implementation of such integration remains fraught with challenges. Many teachers report limited exposure to interdisciplinary teaching methods and express uncertainty about how to operationalise ESD within core subjects (Chikowore & Mupfiga, 2023). These findings are echoed in regional studies. Laiser and Mugyenyi (2018), for instance, found that educators in East Africa struggled with curriculum integration due to insufficient pedagogical training and the persistence of traditional, subject-centred teaching.

Comparative experiences from other postcolonial contexts further highlight these structural constraints. South Africa's Curriculum and Assessment Policy Statement (CAPS), which promotes transversal themes such as ICT integration and environmental education, has faced similar implementation challenges. Chimbi and Jita (2023) note that while policy frameworks are progressive, classroom-level execution remains hindered by assessment regimes and pedagogical inertia. These regional parallels suggest that Zimbabwe's challenges are not isolated but symptomatic of broader systemic tensions within curriculum reform in sub-Saharan Africa.

One of the most significant obstacles lies in the dominance of examination-driven pedagogy. National assessments in Zimbabwe remain largely disconnected from the broader objectives of ESD, thereby disincentivising the inclusion of non-examinable themes in classroom practice (Banda & Ndlovu, 2023). As a result, teachers prioritise 'core content', and themes perceived as peripheral are marginalised. This reflects a classic policy–practice gap, where innovation at policy level is not sufficiently supported by systemic professional development or institutional infrastructure.

Bridging this gap requires a multi-pronged approach. First, teacher education, both pre-service and in-service, must be reimagined to foreground sustainability, interdisciplinarity, and pedagogical flexibility (Moreno-Pino et al., 2022). Educators need support not only in understanding the theoretical underpinnings of ESD but also in acquiring practical tools for its classroom enactment. Second, assessment frameworks must evolve to accommodate and reward broader learning outcomes such as ethical reasoning, collaboration, and applied knowledge (Hove & Mazvimba, 2024). Third, school leadership must play a proactive role in fostering a culture of reflection, innovation, and continuous learning. While the integration of cross-cutting themes into mathematics and other subjects holds immense potential for advancing ESD, its success hinges on systemic transformation. This includes teacher empowerment, curricular alignment, responsive assessment systems, and institutional support. Only through such holistic reform can the aspirational goals of Zimbabwe's Education 5.0 and the global SDGs be meaningfully realised within classrooms.

Methodology

This qualitative study, grounded in the interpretivist paradigm, explored how mathematics teachers in Zimbabwean secondary schools integrate cross-cutting themes within the heritage-based curriculum. The interpretivist worldview,

informed by Berger and Luckmann (1966), conceptualises reality as socially constructed through human interaction, making it particularly suitable for examining teachers' perceptions and instructional experiences. A multiple case study design (Denzin & Lincoln, 2005) enabled an in-depth, context-sensitive exploration across three purposively selected secondary schools. Participants comprised six mathematics teachers and three Heads of Department (HODs), selected through purposive sampling (Teddlie & Yu, 2007) to ensure relevant curriculum implementation experience. Data were gathered using structured questionnaires, semi-structured interviews, and classroom observations, which collectively captured teachers' conceptual understanding, pedagogical strategies, and institutional support mechanisms related to the integration of themes such as environmental sustainability, gender equity, and financial literacy.

Thematic content analysis was employed to systematically identify and interpret emerging patterns within the qualitative data (Braun & Clarke, 2019). Interview transcripts, observation notes, and questionnaire responses were coded both inductively and deductively, allowing for theory-informed and data-driven insights. Key themes included teachers' conceptual understanding of cross-cutting themes, strategies for pedagogical integration, and contextual challenges inhibiting implementation. Triangulation across data sources enhanced the credibility and trustworthiness of the findings (Ngulube, 2015). To further ensure trustworthiness, the study adhered to criteria of credibility, transferability, dependability, and confirmability (Creswell, 2022). Instruments were pilot tested to improve clarity (Mhlanga & Ncube, 2003), and ethical clearance was obtained prior to data collection. Informed consent was secured from all participants, and pseudonyms were used to protect confidentiality, in accordance with ethical guidelines (Chiromo, 2009; Welfel, 1998). Data were securely stored, and participants' dignity and rights were safeguarded throughout the research process.

Table 1: *Summary of Data Collection Instruments and Participants*

Instrument	Participants	Number Used	Purpose
Questionnaires	Mathematics Teachers	6	To capture teachers' understanding and experiences
Interviews	Heads of Department (HODs)	3	To explore administrative support and perspectives
Lesson Observations	Mathematics Teachers (sample)	3 (1 per school)	To identify integration of themes during instruction

Results

Teachers' conceptual understanding of cross-cutting themes

The findings revealed that mathematics teachers possess a limited conceptual understanding of cross-cutting themes. While participants demonstrated general awareness of themes such as HIV/AIDS, gender equity, and environmental issues, as outlined in the curriculum, they lacked clarity on how to meaningfully integrate these into mathematics instruction. Notably, all six teachers reported having received neither pre-service nor in-service training specifically targeting the integration of cross-cutting themes. This concern was echoed by the three HODs, who confirmed the absence of professional development initiatives in this area.

One teacher remarked:

> ***I was never taught about cross-cutting themes; I only see them in the syllabus. Exams haven't changed, so I still teach the same way.***

This statement encapsulates a broader sentiment among participants, where curriculum awareness did not translate into pedagogical action. Teachers' continued reliance on traditional, examination-focused teaching reflects a misalignment between curriculum reform intentions and actual classroom practice. This observation is consistent with Esau and Mpofu (2017), who found that Zimbabwean educators often exhibit superficial familiarity with new

curricular content. Similarly, Mukorera and Zulu (2023) highlight the critical need to equip teachers with both subject matter and pedagogical strategies to implement reform effectively. In the absence of structured orientation and support, teachers tend to revert to entrenched methods that prioritise examinable content, thereby undermining the holistic goals of Education for Sustainable Development (ESD).

Challenges in Integrating Cross-Cutting Themes

The study identified several structural and pedagogical barriers that constrain the integration of cross-cutting themes in mathematics instruction. Teachers cited large class sizes, rigid timetables, and a lack of appropriate teaching materials as key impediments. Limited access to ICT infrastructure and inadequate provision of textbooks further exacerbated these challenges. Additionally, the prevalence of exam-oriented teaching, reinforced by performance-based incentives such as 'Best Teacher' awards, discouraged the incorporation of non-examinable content. These challenges were consistent across all three data sources (questionnaires, interviews, and lesson observations), as summarised in Table 2. The findings suggest that without systemic support, including resource provision and curriculum-aligned assessments, cross-cutting themes risk remaining rhetorical rather than operational components of Zimbabwean mathematics education.

Table 2: *Key Challenges in integrating cross-cutting themes*

Challenge	**Source**
Lack of training on integration	Questionnaires, Interviews
Inadequate textbooks and materials	Questionnaires
Emphasis on exam performance	Questionnaires, Interviews
Overcrowded classes	Questionnaires, observations
Time-consuming lesson preparation	Observations
Limited ICT literacy	Questionnaires, Interviews

The findings revealed a significant disconnect between curriculum policy and school-level practices, particularly in supervision and assessment. Heads of Department (HODs) reported that standard teacher evaluation instruments do not include indicators for integrated teaching, thus offering little incentive for teachers to incorporate cross-cutting themes. As one HOD noted:

> ***Our focus is improving pass rates, so we end up not assessing the integration of cross-cutting themes.***

This highlights a systemic contradiction wherein the philosophical aspirations of the curriculum, rooted in ESD, are undermined by the performance-driven priorities of schools. The dominance of examination-oriented teaching further reinforces this contradiction. One teacher stated:

> ***Honestly, the education system today feels like it's all about cramming in order to pass exams. We are teaching to the test, not nurturing the minds… and learners like it that way.***

This comment reflects the socially constructed expectations surrounding success, where both teachers and learners equate educational achievement with examination results rather than with deeper learning or the development of transformative competencies. Such tendencies are reinforced by an assessment system that prioritises test performance, thereby marginalising broader educational outcomes (Naong, 2008).

Consistent with studies by Laiser and Mugyenyi (2018) and Mukorera and Zulu (2023), this study found that teachers were insufficiently prepared to implement context-based, interdisciplinary content. The lack of structured professional development, curriculum clarity, and supportive supervisory tools contributed to the marginalisation of cross-cutting themes. This supports prior research by Zhuwau and Shumba (2018), and Chikowore & Mupfiga (2023), which identified fragmented curriculum rollouts and ineffective policy dissemination as barriers to effective implementation. Collectively, these findings underscore the need for systemic reforms that move beyond policy rhetoric to include coordinated training, assessment reform, and alignment of supervision instruments.

Impact on Learner Competencies and Values

Although the integration of cross-cutting themes was generally inconsistent, lesson observations indicated that, where implemented, such integration significantly enriched learner engagement and understanding. For example, in one observed lesson on hire purchase, the teacher successfully embedded enterprise and financial literacy. Learners not only calculated instalment costs but also discussed optimal payment strategies, demonstrating both mathematical competence and practical financial reasoning. These engagements allowed students to contextualise abstract concepts, applying them to everyday decision-making.

Such instances suggest that when cross-cutting themes are purposefully integrated, they enhance not only academic achievement but also learners' ability to critically engage with real-life problems. This supports the argument by Moreno-Pino et al. (2022) that embedding sustainability-oriented content in mathematics can cultivate responsible, reflective, and action-oriented citizenship. Likewise, UNESCO (2018, 2023) emphasises that cross-cutting themes provide avenues for fostering core values and competencies essential for sustainable living.

However, these benefits were confined to the few instances where teachers made deliberate efforts to align content with learners lived experiences. Without systemic incentives or structured guidance, such practices remain sporadic. As evidenced in the data, the absence of supportive policy frameworks, resources, and accountability mechanisms limits the potential of cross-cutting themes to function as transformative tools within the mathematics classroom. The findings are summarised in Table 3.

Table 3: *Observed integration in lessons (Sample)*

Teacher	Topic	Integrated Themes	Notes
T1	Linear Inequalities	Collaboration, Communication	Minimal integration; no thematic linkage to real-world issues
T2	Statistics	Environmental Issues (indirect)	Data used not contextualized deeply The illustration didn't come out clearly
T3	Algebra	No cross-cutting themes	Traditional instruction was prevalent

Overall, the study found that while the curriculum encourages integration of cross-cutting themes for holistic learner development, practical implementation remains limited due to systemic, institutional, and professional barriers. There is dominance of exam-oriented pedagogies at the expense of transformative pedagogies. Teachers often taught for examinations rather than fostering competency and values-based learning. As Dube & Chinyenze (2023) and Fullan (2001) observe,

curriculum change without adequate teacher preparation is unlikely to succeed.

The gap between curriculum policy and classroom practice reflects deeper issues in teacher capacity, resource availability, and pedagogical mindset. Addressing these challenges requires a coordinated effort involving teacher training, policy reform, and resource provision. If properly supported, mathematics education can indeed be a vehicle for achieving the Sustainable Development Goals (SDGs) through values-based instruction that equips learners with both knowledge and life skills.

Conclusions

This study has demonstrated that the integration of cross-cutting themes within secondary school mathematics education in Lower Gweru remains in its formative stages, characterised by uneven implementation and conceptual ambiguity. Although the curriculum framework advocates for the inclusion of themes such as sustainability, gender equality, and ICT, their incorporation into mathematics instruction is hindered by several factors. These include inadequate professional development, resource constraints, and entrenched teaching practices oriented towards examination performance. The findings reveal a persistent disconnect between curriculum intentions and classroom realities—a gap that is shaped not only by institutional limitations but also by teachers' professional identities, beliefs, and interpretations of their roles. In line with social constructionist perspectives, this study underscores how teachers' pedagogical choices are influenced less by policy texts and more by the socio-cultural dynamics of everyday classroom life and high-stakes assessment regimes (Mhlanga, 2023).

The study's originality lies in its illumination of how cross-cutting theme integration is mediated by teacher agency within contextually specific constraints. While some educators demonstrated innovative pedagogical practices, others struggled to reconcile cross-cutting objectives with subject content, reflecting variability in professional autonomy and curricular ownership. Overall, the integration of these themes remains peripheral rather than embedded, requiring systematic support to become an integral component of mathematics teaching and learning.

In conclusion, the integration of ESD and cross-cutting themes within mathematics education represents a necessary and transformative curricular

shift. However, realising this vision, particularly in contexts such as Zimbabwe, requires more than policy alignment. It demands the reorientation of pedagogical approaches, the restructuring of assessment frameworks, and sustained investment in teacher capacity development. Ultimately, the success of ESD implementation hinges on the active engagement of educators, alignment of institutional mechanisms, and shared stakeholder commitment to fostering inclusive, equitable, and sustainability-focused education. When these conditions are met, education transcends content delivery and becomes a catalytic force for nurturing critical, responsible, and future-ready learners.

Recommendations

The study recommends a multi-stakeholder approach to strengthen the integration of cross-cutting themes in mathematics education. For the MoPSE, it is essential to develop and mandate targeted professional development programmes that equip teachers with practical strategies for integrating themes such as sustainability, gender equality, and ICT into mathematics instruction. This should be supported by the revision of mathematics textbooks to include contextualised examples, and by aligning assessments to reflect competencies beyond procedural knowledge.

At the school level, leaders and inspectors should incorporate theme integration into teacher evaluation tools and facilitate cluster-based staff development workshops that promote interdisciplinary collaboration. Establishing resource centres and increasing access to digital tools would further support implementation. Curriculum developers may provide clear, subject-specific integration guidelines and involve classroom teachers in curriculum reviews to ensure practical relevance.

Finally, future researchers are encouraged to conduct focused studies on individual cross-cutting themes to generate deeper insights that can inform targeted interventions. Together, these actions can bridge the gap between policy intentions and classroom practice, advancing the transformative goals of Education for Sustainable Development.

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