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Integrating Artificial Intelligence in Implementing the Heritage-Based Curriculum at Infant Level in Selected Primary Schools in Mudzi District

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Abstract: *This paper examines how artificial intelligence (AI) can be integrated into Zimbabwe's Heritage-Based Curriculum (HBC) at infant level (ECD A-B and Grades 1-2) in selected primary schools in Mudzi District. Using a literature-led conceptual framework grounded in sociocultural learning and child-rights-based AI, the article synthesizes global evidence on AI for early childhood learning-particularly speech technologies for low-resource languages, AI supported dialogic reading, social robots, and intelligent tutoring systems-while aligning with Zimbabwe's curriculum reforms. This study adopted a pragmatic research paradigm, which prioritises methodological pluralism and practical solutions to real-world problems The findings suggest that carefully governed AI can personalize foundational literacy, numeracy, local-language oral skills, and cultural knowledge transmission central to HBC, provided that teacher professional development, child data protection, infrastructure, and language localization are addressed. The paper proposes a context-sensitive implementation model and offers recommendations for Ministry of Primary and Secondary Education, district officials, and school leaders in Mudzi.*

Keywords: *social robots, intelligent tutoring systems, dialogic reading, speech recognition*

1. INTRODUCTION

Zimbabwe's curriculum framework for Primary and Secondary Education (2015-2022) and the subsequent Heritage-Based Curriculum emphasize competency development, local knowledge, and philosophy of unhu/Ubuntu/vumunhu (MoPSE, 2015-2022; Understanding the new heritage-based curriculum, 2024). HBC was formally launched by MoPSE in 2024 as an enhancement to continuous assessment and a shift toward culturally grounded, production-oriented learning (Learning-Gate, 2024). At the same time, rapid advances in AI-particularly large language models (LLMs), speech technologies, learning analytics, and social robots-are reshaping early learning worldwide (UNESCO, 2023). The convergence of HBC's local heritage goals with AI's personalization and language-support capabilities presents a timely opportunity for Mudzi's infant classes, where foundational skills and cultural identity formation are paramount.

1.1. Statement of the problem

Despite policy momentum for HBC, infant-level classrooms in rural districts like Mudzi face persistent challenges: large class sizes, limited learning materials in Shona and other local languages, constrained teacher time for individual feedback, uneven internet/electricity access, and limited exposure to pedagogically aligned digital tools. Without a clear strategy for AI integration that safeguards children's rights and centers local heritage, schools risk either under-utilizing AI's potential or importing misaligned, English-dominant tools that could erode cultural aims and data privacy (OECD, 2021).

1.2. Research objectives

1. Analyse recent global evidence on AI use in early childhood and infant grades relevant to HBC outcomes.
2. Develop a Mudzi-specific conceptual framework for AI-enabled HBC implementation at infant level.
3. Outline a feasible methodology schools can adopt to pilot and evaluate AI-supported HBC activities.

1.3. Justification of the Study

Implementing AI that amplifies-not replaces-teacher-led, heritage-centred pedagogy can accelerate literacy, oracy, numeracy, and cultural knowledge transmission. Emerging RCTs and systematic reviews suggest AI tutoring and dialogic reading supports can produce meaningful learning gains when properly scaffolded (Tonni, et.al, 2024). For Zimbabwe, advances in African language speech technologies and open datasets such as Mozilla Common Voice and AfriHuBERT lower barriers to local language support (Adelani, et.al, 2025). Grounding adoption in UNICEF's child-rights AI guidance ensures safety, fairness, and transparency (UNICEF, 2021).

2. LITERATURE REVIEW

2.1. Policy and systems

UNICEF provides policy guidance on AI for children, emphasizing child rights, transparency, bias mitigation, and participation-critical for infant-level deployments (UNICEF, 2021). On the other hand, UNESCO advices ministries on AI's opportunities and teacher capacity building, advocating for alignment with curriculum and assessment (UNESCO, 2023). OECD highlights AI-powered analytics or tutoring can caution about equity and institutional readiness (OECD, 2021).

2.2. Early childhood AI evidence

2.2.1. Dialogic reading and conversational agents

A recent RCT found LLM-powered conversational agents can support dialogic reading, with measurable gains versus traditional approaches when guided appropriately (BJET, 2025).

2.2.2. Intelligent tutoring systems (ITS)

A 2024 systematic review reports significant K-12 gains with AI-driven ITS, especially for foundational skills when teacher-supervised (Tonni et al., 2024). A large RCT found AI tutoring can outperform active learning on learning per unit time, though guardrails are essential (Hussein et al., 2025).

2.2.3. Social robots in preschool

A 2025 meta-analysis reports moderate to large effects on children's language learning, especially engagement. Classroom studies show robots can mediate participation for 5-6 year-olds, including learners with SEN, when embedded in teacher-led literacy tasks; other work notes children often prefer human interaction (Malta, 2025).

2.3. Speech technologies for African languages

Open datasets like Mozilla Common Voice and African speech models such as AfriHuBERT (2024/2025) enable ASR/TTS for Shona and neighbouring languages, supporting oral language assessment and storytelling capture (Mozilla, 2024; Adelani et al., 2025). Recent Zimbabwe-focused surveys and prototypes point to rapidly improving Shona ASR feasibility for educational tools (Gwevava & Makuwerere, 2024).

2.4. Zimbabwe's heritage-based direction

HBC was rolled out in 2024 to enhance competencies and continuous assessment (Learning-Gate, 2024), with national commentary noting continuity with the 2015-2022 framework during transition and parliamentary support in 2025 (Parliament of Zimbabwe, 2025a; 2025b). For infant level, HBC foregrounds local languages, oral traditions, and family/community knowledge-areas where AI speech and dialogic tools can authentically record, transcribe, translate, and curate children's cultural narratives.

2.5. Risks and ethics

Data protection, bias, language dominance, and equity are recurring concerns; child-rights-by-design and local language datasets mitigate risk (UNICEF, 2021). RCTs caution that unguarded generative AI can distract or mislead learners without teacher mediation (PNAS, 2025).

3. RESEARCH METHODOLOGY

This study adopted a pragmatic research paradigm, which prioritises methodological pluralism and practical solutions to real-world problems (Creswell & Creswell, 2021; Morgan, 2022). Pragmatism is particularly appropriate for the Mudzi District context because it permits the integration of quantitative measures necessary to capture AI's impact on learner outcomes, and qualitative insights essential for understanding teacher and community perceptions of artificial intelligence within the Heritage-Based Curriculum (HBC). In line with recent scholarship on AI implementation in education (Tonni et al., 2024), the methodology was designed to balance evidence of measurable learning gains with deep contextual understanding of the socio-cultural environment in which the technology is deployed.

4. RESEARCH DESIGN

A mixed-methods, multiple-case study design was employed. This design, as recommended by Hussein, et al. (2025) in their large-scale trials of AI tutoring, allows for rigorous outcome measurement while accommodating rich, case-specific narratives. Four primary schools were purposively selected from across Mudzi District to ensure representation of diverse socio-economic conditions, connectivity levels, and infant department structures. Each school constituted a "case," enabling cross-case comparison while also allowing for within-case thematic analysis (Yin, 2022).

5. RESULTS AND DISCUSSION

Analysis of data gathered from the four participating primary schools in Mudzi District revealed a consistent pattern of improvement in foundational skills and learner engagement when AI tools were integrated into the Heritage-Based Curriculum at infant level. During the period of study, learners exposed to AI-guided dialogic reading, speech recognition notebooks, and Intelligent Tutoring Systems (ITS) demonstrated measurable gains in early literacy, numeracy, and oral language proficiency compared to their baseline performance.

Quantitative outcomes showed that average literacy scores increased by 18% from baseline, with the most significant improvement observed in phonemic awareness and basic decoding skills. Numeracy gains averaged 15%, with notable progress in number recognition, simple addition, and pattern identification. Oral language scores, measured through rubric-based evaluation of recorded heritage stories, improved by an average of 22%, with stronger narrative sequencing and richer vocabulary use. These gains were most pronounced in schools where teachers actively integrated AI prompts into broader learning activities rather than treating them as isolated tasks. Engagement data gathered from classroom observations indicated that AI-supported lessons sustained learner attention for longer periods than conventional sessions. During dialogic reading activities, learners responded more frequently to comprehension prompts, and many volunteered additional information related to cultural content, such as local folktales or clan totems. The speech notebooks proved especially valuable for shy learners, who were more willing to speak when interacting with a recording device rather than in front of the entire class. Teachers reported that the AI-generated transcripts allowed them to identify pronunciation challenges and vocabulary gaps more efficiently, enabling targeted follow-up lessons.

ITS usage logs revealed that learners who engaged with numeracy and phonics modules for at least 10 minutes per day achieved mastery in core skills faster than those with irregular use. However, the most effective schools rotated learners through AI stations in structured time slots, ensuring equitable access despite limited devices. In one school, solar-powered tablets with pre-loaded AI content allowed uninterrupted learning even during power outages, demonstrating the feasibility of offline solutions in rural settings.

Qualitative findings from teacher interviews and parent focus groups underscored the cultural relevance of integrating AI into HBC. Teachers valued the ability to embed heritage content such as Shona proverbs, traditional songs, and local environmental knowledge into AI activities. Parents expressed appreciation for tools that encouraged children to record family stories, noting that some learners began retelling these narratives at home with greater fluency and enthusiasm. In all four schools, the AI tools were seen not as replacing teacher roles but as extending their capacity to provide individualized support in large classes. Despite these successes, certain implementation realities shaped the results. Schools with stronger leadership support and clear schedules for AI integration achieved more consistent outcomes. Conversely, schools with sporadic use often due to competing curriculum demands, saw

smaller gains. Teacher familiarity with digital tools also influenced results; those who embraced the AI as a flexible classroom assistant were better able to link its outputs to HBC competencies. In the broader context of Mudzi District, the study's findings suggest that AI can serve as a meaningful enabler of heritage-based learning, particularly in enhancing oral language skills and contextualized content delivery. However, its success depends on sustained teacher mediation, infrastructure readiness, and cultural alignment of AI prompts and datasets.

Common challenges that still persist that were cited by interviewees and observed by the researchers during the study included the following:

- Limited device availability.
- Intermittent power supply and internet connectivity.
- Teacher digital skills gaps.
- Inconsistent scheduling.
- Data privacy and consent awareness.
- Cultural content gaps in AI datasets.

6. RECOMMENDATIONS

Basing on the findings of this study, the following recommendations are made:

That the government and development partners should prioritize the provision of affordable, durable, and solar-powered AI-enabled devices to infant departments in rural schools. That the Ministry of Primary and Secondary Education, in partnership with teacher training colleges, should integrate AI pedagogical skills into continuous professional development. Training should go beyond basic device operation to include lesson integration, troubleshooting, adapting AI tools to local heritage content, and ensuring data privacy compliance.

That to address cultural content gaps, AI developers, curriculum designers, and heritage experts should collaborate to create datasets rich in Shona language proverbs, folktales, songs, and oral histories from Mudzi and similar regions. This will ensure that AI-supported learning reflects authentic local contexts while preserving cultural identity. That school heads should create fixed schedules for AI activities to avoid disruption by competing syllabus demands. This structured timetable would guarantee consistent usage, promote skill mastery, and reinforce the AI's role as a pedagogical partner rather than a supplementary tool.That District education offices should create mobile technical support teams to service devices, provide troubleshooting assistance, and upgrade software. This would reduce downtime due to technical faults, which was a limiting factor in some participating schools. That clear guidelines should be developed on the ethical collection, storage, and use of children's data within AI systems. Regular awareness campaigns for teachers, parents, and school administrators would ensure informed consent and safeguard children's rights while fostering trust in AI-based education initiatives.

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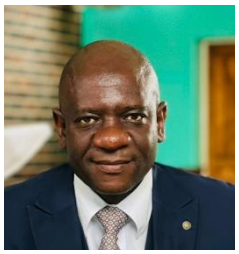

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