Artificial intelligence in Education: Perspective from South African higher education context.

[1]**Nnenna, F. Ezeonwuachusi** (STADIO College of Education, Musgrave Center, Durban, KwaZulu-Natal, South Africa)
E-mail: NnenaE@stadio.ac.za

[2]**Adesoji Ojuri King** (Durban University of Technology, South Africa)
E-mail: kingalive100@gmail.com

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ABSTRACT

This systematic literature review examines the integration of artificial intelligence (AI) in everyday educational practices within South African contexts, with particular emphasis on teacher and student experiences at institutions like STADIO College of Education and Durban University of Technology, Durban. Through a comprehensive analysis of 30 Scopus-indexed studies published between 2020 and 2026, this research reveals that South African educational institutions employ a diverse array of 57 different technologies, blending mainstream communication platforms (WhatsApp, Zoom, Microsoft Teams) with emergent AI-enabled systems, including automated assessment tools, adaptive learning platforms, and intelligent tutoring systems. The study identifies critical contextual factors unique to South Africa—including infrastructure constraints, the digital divide, socioeconomic disparities, and policy-practice misalignments—that significantly shape AI adoption patterns. While COVID-19 accelerated digital transformation, it simultaneously exposed profound inequities in access and readiness. Teachers demonstrate positive attitudes toward AI integration but face substantial barriers related to skills development, resource limitations, and ethical concerns. This research contributes novel insights by synthesizing South African-specific evidence on everyday AI use, highlighting the tension between technological potential and contextual realities, and proposing equity-centered recommendations for policy and practice.

I. INTRODUCTION

The Fourth Industrial Revolution (4IR) has ushered in unprecedented technological transformations across global education systems, with artificial intelligence (AI) emerging as a pivotal force reshaping teaching and learning practices (Mhlanga & Moloi, 2020). In South Africa, the integration of AI in education occurs within a complex landscape characterized by historical inequalities, infrastructure challenges, and ambitious national development goals. The South African higher education sector, including teacher education institutions such as STADIO College of Education in Durban, KwaZulu-Natal,

stands at a critical juncture where technological innovation intersects with persistent socioeconomic disparities.

Recent evidence suggests that South African universities have collectively deployed 57 different technologies to support teaching and learning, supplementing traditional learning management systems with communication platforms like WhatsApp, Zoom, and Microsoft Teams (Moloi et al., 2022). However, adoption patterns remain uneven, with historically disadvantaged institutions facing greater barriers to adoption than well-resourced universities (Khunou et al., 2024). The COVID-19 pandemic served as both a catalyst and a revealer, accelerating digital transformation while simultaneously exposing the depth of the digital divide affecting students, teachers, and institutions across the country (Mhlanga et al., 2022).

1.2 Research Gap and Novelty

Despite growing international literature on AI in education, there exists a significant gap in understanding how AI technologies are integrated into everyday educational practices within the specific South African context. Most existing studies focus on policy frameworks, institutional strategies, or theoretical potential, with limited empirical evidence documenting the lived experiences of teachers and students engaging with AI tools in their daily teaching and learning activities (Mbangeleli et al., 2024). Furthermore, the unique contextual factors shaping AI adoption in South Africa—including load shedding, multilingual classrooms, rural-urban divides, and post-apartheid educational transformation agendas—remain underexplored in systematic research.

This study addresses these gaps by providing a comprehensive systematic literature review that synthesizes evidence on everyday AI use in South African education, with particular attention to: - Specific AI tools and platforms used in practice - Teacher integration experiences, challenges, and successes - Student perspectives and engagement patterns - Contextual factors unique to the South African environment - Policy frameworks and institutional responses - Innovative approaches emerging from local contexts.

2.1 Global Context of AI in Education

Artificial intelligence has transformed educational landscapes globally, offering capabilities for personalized learning, automated assessment, intelligent tutoring, and data-driven decision-making. International research demonstrates that AI-powered systems can enhance student engagement, provide tailored feedback, support differentiated instruction, and improve learning outcomes when implemented with appropriate pedagogical frameworks (Opesemowo & Adekomaya, 2024). However, the global literature also highlights persistent concerns regarding algorithmic bias, data privacy, academic integrity, and the potential for technology to exacerbate rather than ameliorate educational inequalities.

2.2 AI Adoption in South African Higher Education

South African higher education institutions have engaged with AI and 4IR technologies through multiple pathways. Research indicates that universities are actively debating policy approaches to generative AI, exploring pedagogical applications, and developing institutional guidance documents, though these

efforts often emphasize risk control—particularly academic misconduct and plagiarism—rather than enabling innovation (Patel et al., 2024). A scoping review of AI use in South African universities identified rising adoption of AI-powered tools alongside concerns about cheating, access inequities, and data security (Mbangeleli et al., 2024).

The integration of AI in South African higher education is characterized by exploratory and uneven adoption patterns. Leading institutions have invested in adaptive learning platforms, automated assessment systems, and data analytics for student retention and progression, while resource-constrained universities struggle with basic infrastructure requirements (Lubinga et al., 2023). This disparity reflects broader patterns of inequality within the South African higher education system, where historically disadvantaged institutions continue to face systemic barriers to technological transformation (Khunou et al., 2024).

2.3 Teacher Education and AI Competencies

Teacher education represents a critical leverage point for sustainable AI integration in education. South African research emphasizes the need to integrate AI competencies into teacher preparation programs, developing practical skills for pedagogical use rather than merely technical literacy (Mnguni, 2024). Pre-service teachers demonstrate mixed attitudes toward AI integration, recognizing pedagogical benefits while expressing concerns about practical limitations and philosophical implications for teaching and learning (Mnguni, 2024).

Professional development initiatives for in-service teachers remain inconsistent across institutions. Universities that have invested in ongoing training report moderate to strong teacher competency improvements and enhanced teaching quality, while many institutions lack systematic capacity-building programs (Moloi et al., 2022). The literature converges on recommendations for competency-based frameworks, scaffolded online modules, practicum-based workshops, peer networks, and mentoring to build practical AI pedagogical skills among teachers.

2.4 Contextual Barriers and Enablers

Multiple South African studies identify infrastructure, policy gaps, capacity shortfalls, and equity risks as primary constraints on AI implementation. Unreliable connectivity, device shortages, and uneven access across urban-rural and institutional lines constitute central obstacles to scalable AI use (Mhlongo et al., 2023). The pandemic amplified a "multi-layered digital divide" that maps onto historical inequalities, limiting equitable access to AI tools and digital learning resources (Isaacs, 2020).

Financial constraints, particularly at historically disadvantaged universities and under-resourced schools, restrict investment in AI systems and staff development (Lubinga et al., 2023). Additionally, policy-practice conflicts emerge in contexts such as rural schools, where institutional bans on learners' personal devices contradict national broadband and connectivity goals (Mwapwele et al., 2019). These contextual factors create a complex implementation environment where technological potential confronts structural realities.

II. METHODOLOGY

3.1 Systematic Literature Review Approach

This study employed a systematic literature review (SLR) methodology following established protocols for comprehensive, transparent, and replicable evidence synthesis. The SLR approach enables rigorous identification, evaluation, and synthesis of relevant research on AI integration in South African education, providing a robust foundation for evidence-based recommendations.

3.2 Search Strategy

A comprehensive search strategy was implemented across multiple academic databases to ensure thorough coverage of relevant literature. The search was conducted in two phases:

Phase 1: Deep Review Search - Database: SciSpace - Search query: "AI in education in South Africa" - Results: 410 papers retrieved - Focus: Broad coverage of AI and educational technology in South African contexts

Phase 2: Multi-Database Targeted Search - Databases: SciSpace, Google Scholar, ArXiv (9 sources total) - Search queries: Targeted terms focusing on South African research, including "artificial intelligence education South Africa," "4IR higher education South Africa," "digital transformation South African universities," "teacher AI integration South Africa" - Results: 580 papers retrieved - Post-processing: Merged and reranked to 221 unique papers

3.3 Inclusion and Exclusion Criteria

Inclusion Criteria: - Published between 2020 and 2026 - Focus on South African educational contexts (primary, secondary, or higher education) - Empirical studies, systematic reviews, or policy analyses - Peer-reviewed journal articles from Scopus-indexed publications - English language publications - Direct relevance to AI, 4IR technologies, or digital transformation in education

Exclusion Criteria: - Publications before 2020 - Non-peer-reviewed sources (conference abstracts, opinion pieces, blog posts) - Studies without a South African context or data - Purely technical papers without an educational focus - Duplicate publications

3.4 Selection Process

The selection process followed a multi-stage screening approach:

1. Initial screening: Title and abstract review of 221 unique papers
2. Relevance filtering: Application of inclusion/exclusion criteria
3. Quality assessment: Evaluation of methodological rigor and relevance
4. Final selection: Top 30 papers selected based on relevance ranking, citation impact, and contribution to understanding everyday AI use in South African education

3.5 Data Extraction and Analysis

Data extraction focused on: - Study characteristics (methodology, sample, context) - AI tools and technologies identified - Teacher experiences and integration practices - Student outcomes and perspectives - Contextual factors and barriers - Policy frameworks and recommendations - Innovative approaches and success factors

Thematic analysis was conducted to identify patterns, convergences, and divergences across studies, with particular attention to South African-specific contextual factors and everyday implementation experiences.

3.6 Methodological Limitations

This review acknowledges several limitations. First, the focus on Scopus-indexed journals may exclude relevant grey literature, institutional reports, and conference proceedings. Second, the rapid evolution of AI technologies means that recent developments may not yet be reflected in peer-reviewed literature. Third, the review relies on published research, which may exhibit publication bias toward positive findings or well-resourced institutions. Finally, the scarcity of fine-grained empirical studies documenting everyday AI use in South African classrooms limits the depth of evidence available for synthesis.

Table 1. Systematic Literature Review Methodology Summary

Phase	Activity	Details	Outcome
Planning	Research question formulation	Focus on everyday AI use in South African education contexts	Clear scope and objectives defined
Search Phase 1	Deep review search	Database: SciSpace; Query: "AI in education in South Africa."	410 papers retrieved
Search Phase 2	Multi-database targeted search	9 sources (SciSpace, Google Scholar, ArXiv); South Africa-specific queries	580 papers retrieved
Deduplication	Merge and rerank	Remove duplicates, relevance ranking	221 unique papers
Filtering	Apply the inclusion criteria	Years: 2020-2026; Scopus-indexed journals; South African context	Refined corpus
Selection	Quality assessment	Methodological rigor, relevance, citation impact	Top 30 papers selected
Extraction	Data extraction	Tools, experiences, contexts, policies, innovations	Structured evidence-based
Synthesis	Thematic analysis	Pattern identification, convergence analysis	Key findings and themes
Reporting	Manuscript preparation	APA 7th edition, MIR Journal format	Final article

III. RESULTS AND DISCUSSION.

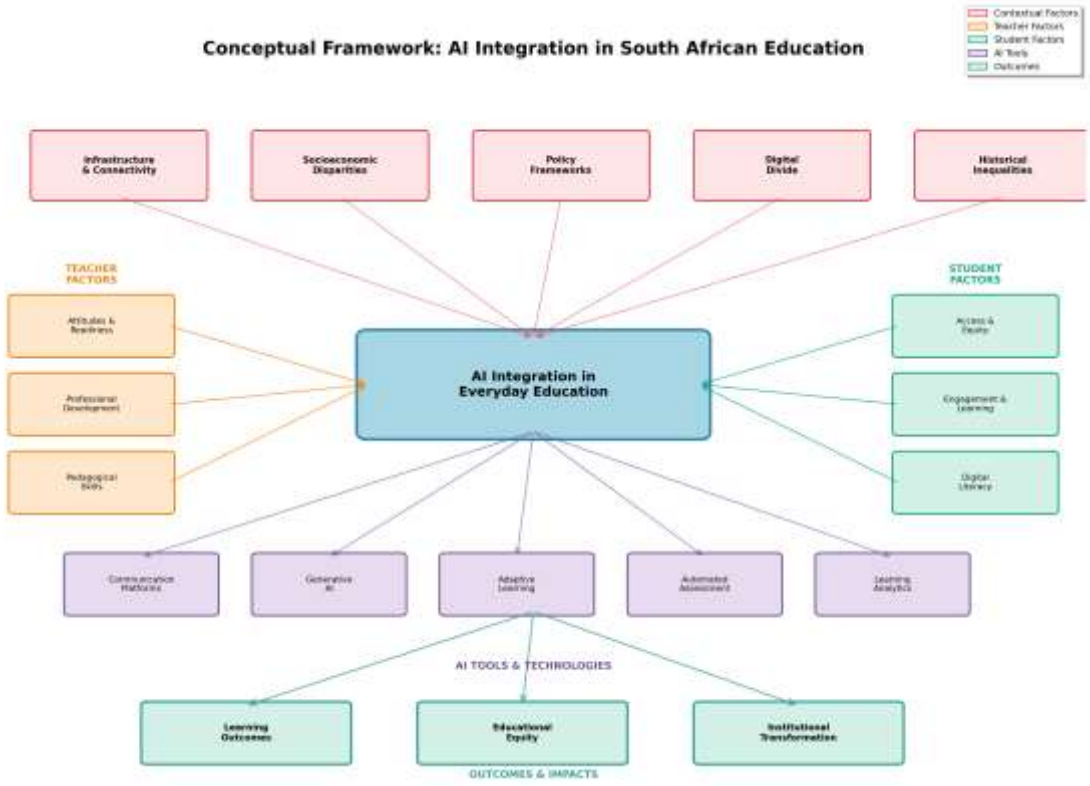

Figure 1: Conceptual Framework

Figure 1 illustrates the multi-layered conceptual framework guiding this analysis. The framework positions AI integration in everyday education at the center, influenced by contextual factors (infrastructure, socioeconomic disparities, policy frameworks, digital divide, historical inequalities), mediated by teacher factors (attitudes, professional development, pedagogical skills) and student factors (access, engagement, digital literacy), implemented through various AI tools and technologies (communication platforms, generative AI, adaptive learning, automated assessment, learning analytics), and ultimately affecting outcomes including learning outcomes, educational equity, and institutional transformation.

4.1 Current State of AI Adoption in South African Education

The synthesis of 30 high-quality studies reveals a complex and uneven landscape of AI adoption across South African educational institutions. Universities and higher education institutions demonstrate more active engagement with AI technologies compared to primary and secondary schools, though adoption remains exploratory and institution-dependent (Patel et al., 2024; Funda et al., 2024).

A landmark institutional survey found that South African universities collectively deployed 57 different technologies to facilitate teaching and learning, with teaching platforms supplemented by communication tools including WhatsApp, Zoom, and Microsoft Teams (Moloi et al., 2022). This diversity reflects both innovation and fragmentation, as institutions pursue varied technological pathways without a coordinated national strategy. The COVID-19 pandemic served as a critical accelerator, prompting rapid deployment of 4IR and AI tools from primary to tertiary levels, though this acceleration

simultaneously exposed significant gaps in infrastructure, capacity, and equity (Mhlanga & Moloi, 2020).

Adoption patterns reveal stark disparities between well-resourced and historically disadvantaged institutions. Leading universities have piloted intelligent tutoring systems, adaptive learning platforms, and sophisticated learning analytics, while resource-constrained institutions struggle with basic connectivity and device access (Khunou et al., 2024; Lubinga et al., 2023). This uneven adoption mirrors broader patterns of inequality within South African society and education, raising concerns that AI integration may widen rather than narrow existing achievement gaps.

4.2 AI Tools and Platforms in Everyday Use

Table 1 synthesizes evidence on AI tools and platforms identified across the reviewed literature, categorized by function and implementation context.

Table 2. AI Tools and Technologies in South African Educational Institutions

Category	Specific Tools/Platforms	Primary Use Context	Evidence Source
Communication & Collaboration	WhatsApp, Zoom, Microsoft Teams	Universities, schools (hybrid/remote teaching)	Moloi et al., 2022
Generative AI	ChatGPT, generative AI tools	Universities (writing support, academic literacy)	Patel et al., 2024
Automated Assessment	Automated grading systems, AI-powered feedback tools	Higher education institutions	Funda et al., 2024
Adaptive Learning	Intelligent tutoring systems, personalized learning platforms	Universities (pilot implementations)	Opesemowo & Adekomaya, 2024
Learning Analytics	Student retention analytics, progression tracking systems	University administration	Nwosu et al., 2023
Process Automation	Robotic process automation (RPA), administrative AI	Leading universities	Lubinga et al., 2023
NLP & Translation	Natural language processing, content adaptation tools	E-learning platforms	Funda et al., 2024

The evidence reveals several important patterns. First, mainstream communication platforms (WhatsApp, Zoom, Teams) are more widely adopted than purpose-built educational AI systems, reflecting pragmatic responses to immediate needs during COVID-19 rather than strategic AI integration (Moloi et

al., 2022). Second, generative AI tools like ChatGPT have rapidly entered university discourse, primarily framed through the lens of academic integrity concerns rather than pedagogical opportunities (Patel et al., 2024). Third, sophisticated AI applications—adaptive learning, intelligent tutoring, and advanced analytics—remain concentrated in well-resourced institutions, with limited evidence of systematic deployment across the sector (Mbangeleli et al., 2024).

Notably, the literature reveals insufficient evidence to construct comprehensive institution-by-institution inventories of specific branded AI products in regular classroom use. This gap reflects both the exploratory nature of current adoption and the limited empirical research documenting everyday implementation practices.

4.3 Teacher Integration Experiences and Challenges

Teachers represent the critical mediators of AI integration, and their experiences, attitudes, and capacities fundamentally shape implementation outcomes. The reviewed literature provides nuanced insights into how South African teachers engage with AI technologies in everyday practice.

Positive Experiences and Perceived Benefits

Multiple studies document positive teacher attitudes toward AI integration. University lecturers reported that AI technologies increased student learning and engagement, creating more inclusive and interactive classroom environments in some cases, with reduced student disengagement during sessions (Opesemowo & Adekomaya, 2024). Teachers recognize AI's potential to support personalized learning, provide timely feedback, reduce routine workload, and enable data-driven instructional decisions (Funda et al., 2024).

A study of rural teachers found that the vast majority were optimistic about ICT use for teaching and learning, demonstrating positive attitudes despite significant contextual constraints (Mwapwele et al., 2019). This optimism suggests latent readiness for AI integration when appropriate support structures are provided. Pre-service life sciences teachers similarly acknowledged pedagogical benefits of AI, including enhanced content delivery, differentiated instruction capabilities, and access to diverse learning resources (Mnguni, 2024).

Challenges and Barriers

Despite positive attitudes, teachers face substantial barriers to meaningful AI integration. Infrastructure limitations and unreliable connectivity constitute primary obstacles, particularly in rural and township schools (Mhlongo et al., 2023). Teachers report a lack of technical know-how and insufficient professional development opportunities to build AI pedagogical competencies (Lubinga et al., 2023). Resource constraints—including limited devices, software licenses, and technical support—further impede implementation efforts (Olaitan et al., 2024).

Ethical concerns shape teacher integration experiences significantly. Teachers express reservations about plagiarism and academic integrity in the context of generative AI, data privacy and security implications, algorithmic bias and fairness in AI-enabled assessment, and philosophical concerns about the role of technology in teaching and learning (Mnguni, 2024; Patel et al., 2024). These concerns reflect thoughtful engagement with the normative dimensions of AI integration rather than mere resistance to change.

Policy-practice conflicts create additional challenges. In rural schools, institutional bans on learners' personal devices contradict national broadband goals and limit opportunities for bring-your-own-device (BYOD) approaches to technology integration (Mwapwele et al., 2019). University policies often focus narrowly on academic misconduct rather than providing enabling frameworks for pedagogical innovation (Patel et al., 2024).

Success Factors

Institutions that invested in ongoing professional development reported moderate to strong teacher competency improvements and enhanced teaching quality (Moloi et al., 2022). Success factors identified across studies include sustained, practice-based professional development rather than one-off training, peer learning networks and communities of practice, institutional support structures including technical assistance, clear pedagogical frameworks guiding AI use, and leadership commitment to innovation and experimentation (Nwosu et al., 2023; Olaitan et al., 2024).

4.4 Student Experiences and Perspectives

Student experiences with AI in South African education are reported primarily through institutional observations and lecturer perspectives rather than large-scale direct student surveys, reflecting a gap in the empirical literature.

Engagement and Learning Outcomes

Studies report that AI tools can increase student engagement and enable personalized learning experiences in higher education settings (Opesemowo & Adekomaya, 2024). Lecturers observed reduced disengagement and more active participation when AI-enabled interactive tools were employed (Opesemowo & Adekomaya, 2024). Adaptive learning systems, when implemented, provided students with tailored content and pacing, potentially supporting diverse learning needs and styles (Funda et al., 2024).

Access and Equity Concerns

Student experiences are profoundly shaped by access inequalities. The COVID-19 pandemic exposed a "multi-layered digital divide" affecting students' ability to participate in online and AI-enabled learning (Isaacs, 2020). Students from low-income households, rural areas, and historically disadvantaged communities faced compounded barriers, including a lack of devices, unreliable connectivity, inadequate learning spaces at home, and limited digital literacy (Chomunorwa et al., 2023).

Reviews flagged increased opportunities for cheating and unequal access to AI tools as immediate student-facing concerns (Mbangeleli et al., 2024). Students with resources could leverage generative AI for academic support, while those without access fell further behind, potentially widening achievement gaps.

Need for Student-Centered Research

The literature reveals a significant gap in direct, large-scale empirical evidence from students about their everyday experiences with AI tools. Most studies rely on institutional data or educator perspectives, limiting understanding of student agency, preferences, challenges, and learning strategies in AI-enabled environments. Future research should prioritize student voices

through surveys, interviews, focus groups, and participatory methods to develop a more comprehensive understanding of AI's impact on learning experiences.

4.5 Contextual Factors Unique to South Africa

South African AI adoption in education is shaped by distinctive contextual factors that differentiate implementation challenges and opportunities from those in other national contexts.

Infrastructure and Connectivity Constraints

Persistent infrastructure limitations and uneven internet access constitute the most frequently cited barrier to AI adoption (Mhlongo et al., 2023; Mhlanga et al., 2022). South Africa's digital infrastructure is characterized by urban-rural divides, with metropolitan areas enjoying relatively robust connectivity while rural and township communities face limited or unreliable access. Load shedding—scheduled power outages—compounds connectivity challenges, though direct empirical evidence quantifying its specific impact on AI adoption remains limited in the reviewed literature.

The South Africa Connect national broadband policy (2013) established universal access targets, but implementation gaps persist at institutional and community levels (Mwapwele et al., 2019). Schools and universities in under-resourced areas lack basic technological infrastructure—reliable electricity, internet connectivity, computer labs, and devices—necessary for AI integration.

Socioeconomic Disparities and the Digital Divide

The digital divide in South Africa maps onto historical patterns of inequality rooted in apartheid-era segregation and ongoing socioeconomic stratification (Isaacs, 2020). Students from low-income households lack devices and connectivity for home-based learning, creating profound disadvantages in contexts requiring digital engagement. The pandemic amplified these disparities, with privileged students transitioning relatively smoothly to online learning while disadvantaged students faced exclusion (Mhlanga & Moloi, 2020).

This multi-layered digital divide operates at multiple levels: access to devices and connectivity, digital literacy and skills, quality of digital learning experiences, and ability to leverage technology for educational advancement (Akomolehin et al., 2025). AI integration risks exacerbating these inequalities unless deliberately designed with equity-centered approaches.

Teacher Capacity and Professional Development Gaps

South African teachers demonstrate positive attitudes toward technology integration but face significant capacity gaps (Mwapwele et al., 2019). Many teachers lack formal training in digital pedagogy and AI integration, reflecting gaps in both pre-service teacher education and in-service professional development (Aluko et al., 2022). Resource constraints limit institutions' ability to provide sustained, high-quality professional learning opportunities.

The literature emphasizes the need for competency-based teacher education reforms incorporating practical AI integration skills, pedagogical frameworks for technology use, critical perspectives on AI ethics and equity, and ongoing support structures (Mnguni, 2024; Olaitan et al., 2024).

Language Diversity and Cultural Context

While linguistic and decolonial concerns are raised in broader critiques of digital transformation, the reviewed literature provides limited direct empirical

evidence on how South Africa's multilingual context specifically affects AI adoption. South Africa's 11 official languages create both challenges and opportunities for AI integration, particularly regarding natural language processing, content localization, and culturally responsive pedagogy. This represents an important area for future research.

Policy-Practice Misalignments

Tensions between policy aspirations and implementation realities characterize South African AI adoption. National policies promote digital transformation and 4IR readiness, yet institutional policies often focus narrowly on risk management rather than enabling innovation (Patel et al., 2024). Rural schools enforce device bans that contradict connectivity goals (Mwapwele et al., 2019). Universities develop AI guidance documents emphasizing academic integrity concerns without providing pedagogical frameworks for constructive use (Patel et al., 2024).

These misalignments reflect broader governance challenges in coordinating national vision, institutional autonomy, and classroom practice within a complex, unequal educational system.

Table 3. Challenges and Opportunities Framework for AI Integration in South African Education

Dimension	Challenges	Opportunities	Evidence-Based Strategies
Infrastructure	Unreliable connectivity; device shortages; load shedding; urban-rural divide	Decentralized/edge computing; mobile-first approaches; offline-capable systems	Invest in robust infrastructure; explore low-bandwidth AI solutions; leverage ubiquitous platforms (WhatsApp)
Equity & Access	Digital divide; socioeconomic disparities; unequal institutional resources	Potential to democratize access; personalized support for diverse learners	Dedicated funding for disadvantaged institutions; BYOD policies with device support; equity-centered design
Teacher Capacity	Limited AI pedagogical skills; insufficient professional development; workload pressures	Teacher enthusiasm and positive attitudes; existing ICT competencies	Sustained, practice-based PD; peer learning networks; competency frameworks;

			action research support
Student Experience	Unequal access to tools; digital literacy gaps; limited voice in implementation	Enhanced engagement; personalized learning; expanded resources	Student-centered research; participatory design; digital literacy programs; accessible interfaces
Policy & Governance	Fragmented policies; risk-focused rather than enabling; policy-practice gaps	Emerging national frameworks; institutional innovation; stakeholder engagement	Comprehensive national AI-education policy; enabling institutional frameworks; coordinated implementation
Pedagogy	Uncertainty about effective integration, academic integrity concerns, and resistance to change	Innovation opportunities; pedagogical renewal; differentiated instruction	Pedagogical frameworks for AI use; ethical guidelines; teacher-led innovation; evidence-based practices
Research	Limited empirical evidence on everyday use; lack of student voice; methodological gaps	Growing research community; contextual expertise; novel research opportunities	Fine-grained empirical studies; longitudinal research; algorithmic audits; participatory methods

4.6 Policy and Institutional Frameworks

South African institutions and policymakers have developed various frameworks to guide AI integration, though implementation remains uneven and often reactive rather than strategic.

National Policy Context

National policy initiatives include the South Africa Connect broadband strategy, 4IR Commission recommendations, and higher education transformation frameworks that reference digital innovation (Mwapwele et al., 2019). However, the literature reveals gaps in comprehensive, coordinated national AI-in-education policy. Multiple studies call for a dedicated national AI education policy, special funding mechanisms to address the digital divide, ethical governance frameworks for AI in educational decision-making, and

coordination mechanisms across national, provincial, and institutional levels (Patel et al., 2024; Olaitan et al., 2024).

Institutional Strategies

Universities have developed varied institutional responses to AI. Some institutions created AI task forces and guidance documents, primarily focused on generative AI and academic integrity (Patel et al., 2024). Others integrated AI into broader digital transformation strategies aligned with Education 5.0 visions (Mavuso et al., 2024). Leading institutions invested in learning analytics infrastructure and adaptive learning pilots (Nwosu et al., 2023).

However, institutional strategies often lack pedagogical frameworks for constructive AI use, mechanisms for equitable access and support, professional development systems for staff, and evaluation frameworks to assess impact (Patel et al., 2024). The focus on risk management over opportunity development limits transformative potential.

Proposed Models and Frameworks

Researchers have proposed several models to guide AI integration in South African contexts. One study developed an AI 8-Point Model providing strategic guidance for higher education institutions (Patel et al., 2024). Others recommend equity-centered ICT integration frameworks prioritizing access, teacher agency, and learner-centered design for township and rural classrooms (Mwale et al., 2025). These frameworks emphasize contextual adaptation, stakeholder participation, phased implementation, continuous evaluation, and explicit attention to equity and inclusion.

Figure 2. Adoption Timeline

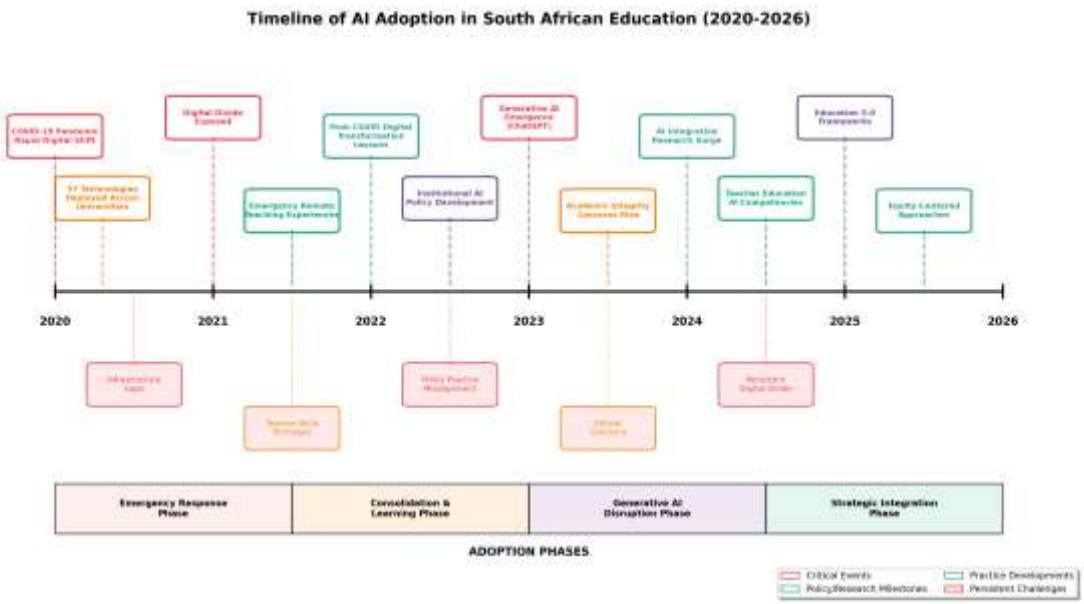

Figure 2 presents a chronological overview of key events, milestones, and persistent challenges in AI adoption across South African education from 2020 to 2026. The timeline identifies four distinct phases: Emergency Response Phase

(2020-2021.5), Consolidation & Learning Phase (2021.5-2023), Generative AI Disruption Phase (2023-2024.5), and Strategic Integration Phase (2024.5-2026). Critical events include the COVID-19 pandemic catalyst, deployment of 57 technologies across universities, emergence of generative AI, and development of Education 5.0 frameworks. Persistent challenges, including infrastructure gaps, teacher skills shortages, policy-practice misalignment, ethical concerns, and the digital divide, are shown below the timeline.

Despite challenges, South African educators and institutions have developed innovative approaches to AI integration that offer valuable lessons and future directions.

Pragmatic Technology Blending

South African institutions demonstrate pragmatic innovation by blending mainstream communication platforms with educational purposes. The widespread use of WhatsApp for teaching communication, assignment submission, and peer collaboration represents contextually appropriate innovation leveraging ubiquitous technology (Moloi et al., 2022). This approach suggests that effective AI integration may involve adapting accessible technologies rather than implementing sophisticated but resource-intensive systems.

Community-Based and Participatory Approaches

Research recommends participatory approaches involving teachers, students, and communities in AI integration planning and implementation (Mwale et al., 2025). Community-based models that leverage local resources, knowledge, and networks may prove more sustainable and equitable than top-down technology deployments.

Decentralized and Edge Computing

Technical research suggests exploring decentralized or edge computing approaches to deliver AI functionality in low-connectivity contexts (Mhlongo et al., 2023). These approaches could enable AI-powered learning tools to function with intermittent connectivity, addressing infrastructure constraints while raising important questions about privacy and security.

Teacher-Led Innovation and Action Research

The literature highlights the potential of teacher-led innovation and action research to develop contextually appropriate AI integration practices (Mnguni, 2024). Supporting teachers as researchers and innovators, rather than merely technology users, may generate locally relevant pedagogical approaches and build sustainable capacity.

Future Research Priorities

The review identifies several high-priority areas for future research:

1. Fine-grained empirical studies documenting everyday AI use in South African classrooms through ethnographic and observational methods
2. Large-scale student surveys and qualitative studies capturing learner experiences, perspectives, and outcomes
3. Longitudinal studies tracking AI integration trajectories and long-term impacts
4. Algorithmic audits and equity analyses examining bias and fairness in AI-enabled educational systems

5. Comparative institutional studies identifying success factors and transferable practices
6. Research on language diversity, cultural responsiveness, and decolonial approaches to AI in education
7. Policy implementation studies examining gaps between policy intentions and classroom realities.

IV. CONCLUSION AND RECOMMENDATIONS

This systematic literature review provides comprehensive evidence on AI integration in South African education, revealing a landscape characterized by innovation and inequality, opportunity and constraint, optimism and caution. South African institutions have demonstrated remarkable adaptability, deploying diverse technologies and developing pragmatic approaches to digital transformation. However, profound contextual challenges—infrastructure gaps, socioeconomic disparities, capacity constraints, and policy-practice misalignments—limit equitable and effective AI integration.

The review contributes novel insights by synthesizing South African-specific evidence on everyday AI use, highlighting the critical role of contextual factors in shaping adoption patterns, documenting teacher experiences and perspectives, and identifying research gaps requiring urgent attention. For institutions like STADIO College of Education, Durban, these findings underscore the importance of preparing teachers with both technical competencies and critical perspectives, modeling equitable and pedagogically sound AI integration, and contributing to the evidence base through locally grounded research.

Moving forward, South African education requires coordinated action across multiple levels: national policy providing vision and resources, institutional strategies enabling innovation while protecting equity, professional development building teacher capacity, and research documenting experiences and outcomes. Only through such coordinated, equity-centered approaches can South Africa realize AI's transformative potential while avoiding the reproduction of historical inequalities in new technological forms.

The everyday integration of AI in South African education remains a work in progress—characterized by experimentation, learning, and adaptation. This review provides a foundation for evidence-based practice and policy, while highlighting the continued need for research that centers South African voices, contexts, and experiences in global conversations about AI and education.

This systematic literature review reveals a complex picture of AI integration in South African education, characterized by:

Diverse but Uneven Adoption: South African institutions employ 57 different technologies, blending mainstream platforms with emergent AI systems, but adoption remains exploratory, fragmented, and highly unequal across institutions (Moloi et al., 2022).

Contextual Constraints: Infrastructure limitations, connectivity gaps, socioeconomic disparities, and the digital divide constitute primary barriers to equitable AI integration, with these constraints mapping onto historical patterns of inequality (Isaacs, 2020; Mhlongo et al., 2023).

Teacher Readiness and Challenges: Teachers demonstrate positive attitudes and recognize AI's pedagogical potential but face substantial barriers related to skills development, resources, ethical concerns, and policy-practice misalignments (Mnguni, 2024; Lubinga et al., 2023).

COVID-19 as Catalyst and Revealer: The pandemic accelerated digital transformation while simultaneously exposing profound inequities in access, readiness, and support (Mhlanga & Moloi, 2020; Mhlanga et al., 2022).

Policy-Practice Gaps: Existing policies emphasize risk management over enabling innovation, with insufficient coordination between national vision, institutional strategy, and classroom practice (Patel et al., 2024).

Research Gaps: The literature lacks fine-grained empirical evidence on everyday AI use, student experiences, and contextually grounded implementation practices, limiting evidence-based guidance for practitioners and policymakers.

Implications for Practice

For Teachers and Teacher Educators: - Develop AI pedagogical competencies through practice-based professional development - Engage critically with AI tools, balancing opportunities with ethical considerations - Participate in peer learning networks and communities of practice - Advocate for enabling policies and adequate support structures - Conduct action research to develop contextually appropriate integration practices

For Institutional Leaders: - Move beyond risk-focused policies to develop enabling frameworks for pedagogical innovation - Invest in sustained professional development rather than one-off training - Prioritize equity in technology access and support - Create institutional structures supporting experimentation and learning - Develop evaluation frameworks to assess AI integration impact.

For Policymakers: - Develop comprehensive national AI-in-education policy coordinating across levels - Establish dedicated funding mechanisms to address the digital divide - Create ethical governance frameworks for AI in educational decision-making - Support research documenting implementation experiences and outcomes - Balance innovation promotion with equity protection.

Implications for STADIO College of Education, Durban

As a teacher education institution, STADIO College of Education, Durban, occupies a strategic position to shape future teachers' AI competencies and pedagogical approaches. Implications include:

Curriculum Integration: Incorporate AI literacy and pedagogical integration competencies into teacher education programs, emphasizing practical skills, critical perspectives, and ethical considerations.

Modeling Best Practices: Demonstrate effective AI integration in teacher education pedagogy, providing pre-service teachers with direct experience of AI-enabled learning.

Contextual Preparation: Prepare teachers for the realities of South African classrooms, including resource constraints, diverse student populations, and infrastructure challenges.

Research and Innovation: Establish STADIO as a hub for research on AI in South African education, conducting studies that document local experiences and develop contextually appropriate approaches.

Community Engagement: Partner with schools, communities, and other stakeholders to support equitable AI integration across KwaZulu-Natal and beyond

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