Journal of Educational Research on Children, Parents & Teachers, Volume 7, Number 2, 2026, 127-152
ISSN: 2664-3812, https://ercptjournal.org/

PERCEIVED ROLE OF SCHOOL LEADERS IN INTEGRATING ARTIFICIAL INTELLIGENCE FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT

Nombuso Khanyisile Ndimande[1], Peter Babajide Oloba[2], Respect Bangu[3] & Sadi Seyama[4]
[1]Department of Education Leadership and Management
Faculty of Education, University of Johannesburg, Johannesburg, South Africa
0009-0007-3314-0666, nombusondimande@yahoo.com
[2]Department of Languages, Cultural Studies and Applied Linguistics
Faculty of Humanities, University of Johannesburg, Johannesburg. South Africa
0000-0002-1201-4341, olobapeter4u@gmail.com
[3]Department of Language Arts and Culture, Unisa, Johannesburg. South Africa
0000-0002-0061-6978, Ressiebangu13@gmail.com
[4]Department of Education Leadership and Management
Faculty of Education, University of Johannesburg. South Africa
0000-0002-5234-0555, sseyama@uj.ac.za
Correspondence email: nombusondimande@yahoo.com

Abstract
Artificial Intelligence (AI) is increasingly recognised as a transformative technology with the potential to enhance Education for Sustainable Development (ESD) by promoting innovative pedagogies, personalised learning, and sustainable educational practices. However, the successful integration of AI within schools depends largely on the strategic vision and leadership of school leaders, particularly in resource-constrained contexts where infrastructural and capacity challenges persist. This study examined school leaders' visions for integrating AI into ESD in South African schools. Guided by the constructivist paradigm, the study employed a qualitative approach and a generic qualitative research design. Data were collected through semi-structured interviews with 12 purposively selected school leaders, comprising four principals, four deputy principals, and four heads of department, and analysed using thematic analysis. The findings revealed that school leaders envision AI integration through seven interconnected leadership dimensions: providing visionary leadership, undertaking strategic advocacy, promoting AI-enabled experiential learning, enhancing global competitiveness and equitable access to information, improving teacher efficiency through automated planning and assessment, fostering entrepreneurial agency, and advocating for structural and financial infrastructure readiness. These findings demonstrate that effective AI integration extends beyond technology adoption to encompass strategic leadership, ethical governance, capacity building, and sustainable institutional development. The study contributes to the growing scholarship on AI-enabled educational leadership by extending transformational leadership theory within the context of ESD and offering a contextually grounded leadership framework for resource-constrained educational settings. The study concludes that successful AI integration requires collaborative action among school leaders, policymakers, and other stakeholders and recommends sustained investment in digital infrastructure, leadership development, continuous professional learning, and

comprehensive AI policy frameworks to promote equitable and sustainable educational transformation.

Keywords: Artificial Intelligence, Educational leadership, Experiential learning, School leaders, Sustainable development

Introduction

Artificial Intelligence (AI) is rapidly transforming education by reshaping teaching, learning, assessment, and school management, while Education for Sustainable Development (ESD) has become a global priority for preparing learners to address complex environmental, social, and economic challenges. Through Sustainable Development Goal (SDG) 4.7, the United Nations emphasises the importance of equipping learners with the knowledge, skills, values, and attitudes needed to promote sustainable development and responsible global citizenship (Brockwell et al., 2024). AI has considerable potential to strengthen ESD by supporting personalised learning, adaptive assessment, intelligent tutoring, real-time feedback, and innovative pedagogical approaches that enhance learner engagement and critical thinking. However, the successful integration of AI into education depends not only on technological infrastructure but also on visionary school leadership capable of aligning technological innovation with ethical governance, educational equity, and sustainability objectives (Chigbu & Makapela, 2025; Khalil et al., 2026). Consequently, school leaders play a pivotal role in creating strategic direction, fostering innovation, mobilising resources, and cultivating school cultures that embrace responsible AI adoption in support of sustainable education.

In South Africa, the integration of AI into ESD remains at an emerging stage despite national commitments to the Fourth Industrial Revolution and the Sustainable Development Goals. Many schools continue to experience persistent challenges, including inadequate digital infrastructure, unequal access to technology, insufficient teacher preparedness, and limited institutional capacity, particularly within historically disadvantaged communities (Mienye et al., 2024; Mamba & Beharry-Ramraj, 2026). Although national policies advocate digital transformation, translating these aspirations into meaningful AI-enabled teaching and learning practices remains difficult. These realities underscore the need for school leaders who can develop and communicate a clear vision for integrating AI in ways that promote inclusive, equitable, and sustainable educational practices.

Although existing scholarship has examined AI adoption, digital leadership, and ESD as separate areas of inquiry, limited research has explored how school leaders envision integrating AI to advance ESD, particularly within resource-constrained South African schools. Much of the available literature is situated in Global North contexts and focuses primarily on teachers' digital competencies or technology adoption, providing limited understanding of leadership perspectives within developing educational systems characterised by socio-economic inequalities and infrastructural constraints (Cambeses-Franco & Cambeses-Franco, 2026; Okoye et al., 2025; Saal et al., 2025). This lack of contextually grounded evidence creates an important knowledge gap regarding how

school leaders conceptualise AI-enabled educational transformation that simultaneously promotes sustainability, equity, and innovation. Addressing this gap is essential for informing educational policy, leadership preparation, teacher professional development, and strategic planning aimed at strengthening equitable AI integration and advancing sustainable education in South African schools.

Aim of the Study

The aim of this study was to examine school leaders' visions for integrating Artificial Intelligence into education for sustainable development in South African schools.

Theoretical and Empirical Context

Transformational Leadership Theory (Bass, 1985; Bass & Riggio, 2006) provides the theoretical foundation for this study because it explains how leaders inspire organisational change, cultivate innovation, motivate followers towards shared goals, and create enabling environments for continuous improvement. The theory is particularly relevant to AI integration within ESD because successful implementation requires school leaders to articulate a compelling vision, intellectually stimulate teachers to embrace emerging technologies, provide individualised support for professional development, and mobilise organisational resources to facilitate sustainable educational transformation. Within the context of AI-enabled education, transformational leadership extends beyond administrative management to fostering ethical AI governance, collaborative partnerships, digital innovation, and equitable access to technological opportunities. Consequently, the theory provides an appropriate analytical lens for examining how school leaders envision their roles in promoting AI integration that advances sustainability, educational equity, and institutional capacity.

Existing empirical studies further demonstrate that effective AI integration depends substantially on leadership practices rather than technological availability alone. International research has shown that transformational and visionary school leadership positively influence teachers' willingness to adopt AI technologies by establishing a shared organisational vision, promoting continuous professional learning, and creating supportive school cultures for innovation (Ahmad & Mohebi, 2025; Karakose & Tulubas, 2025). Similarly, studies conducted in diverse educational contexts indicate that school leaders play a central role in coordinating stakeholder collaboration, mobilising financial and technological resources, strengthening digital competencies, and ensuring that AI implementation aligns with ethical principles and sustainable educational goals (Ali et al., 2025; Assefa & Mujtaba, 2025; Ghosh & Taylor, 2026).

Despite these advances, the majority of empirical studies have concentrated on teachers' acceptance of AI, learners' experiences, or institutional technology adoption within higher-income countries. Comparatively little attention has been devoted to understanding how school leaders in resource-constrained South African schools conceptualise their leadership roles in integrating AI specifically to advance ESD. Furthermore, limited research has examined leadership perspectives regarding AI-enabled experiential learning, entrepreneurial development, equitable access to knowledge, and the structural conditions necessary for sustainable AI implementation. Addressing these empirical gaps

contributes to a more contextually grounded understanding of educational leadership and provides evidence that can inform policy, leadership development, and future AI implementation strategies within South African schools.

Methodology

The study employed a qualitative research approach to obtain an in-depth understanding of school leaders' perceptions, experiences, and aspirations regarding AI integration for ESD. A qualitative approach was considered appropriate because the study aimed to explore participants' viewpoints, beliefs, and interpretations rather than quantify relationships between variables. This approach enabled participants to articulate their visions of AI integration within their unique school contexts while providing rich, descriptive data that captured the complexities of educational leadership in an evolving technological environment. Hence, the qualitative approach facilitated a nuanced understanding of how school leaders conceptualise their roles in promoting AI-enabled sustainable education. The study adopted a generic qualitative research design, which is well suited to investigations that seek to understand how individuals interpret and make sense of particular phenomena in their natural settings. The design enabled the researchers to explore school leaders' perceptions of AI integration for ESD without being constrained by the methodological requirements of more specific qualitative traditions such as phenomenology, ethnography, or grounded theory. A generic qualitative design provided the flexibility required to investigate participants' experiences, leadership practices, and future-oriented visions while generating practical insights into the perceived roles of school leaders in facilitating AI-driven educational transformation.

The study population comprised school leaders from South African public schools who occupy strategic leadership positions and are directly involved in educational decision-making, curriculum implementation, and school improvement initiatives. A purposive sampling technique was employed to select participants who possessed the knowledge, leadership experience, and professional responsibility necessary to provide rich information on AI integration for ESD. The final sample consisted of 12 school leaders, including four principals, four deputy principals, and four heads of department. Participants were selected based on the following criteria: (i) currently occupying a formal school leadership position; (ii) having a minimum of three years' leadership experience; (iii) actively participating in curriculum leadership and school management; and (iv) demonstrating familiarity with digital technologies or AI-related educational initiatives within their schools. The purposive selection of information-rich participants ensured that the study generated detailed and contextually relevant insights into school leaders' visions for AI-enabled sustainable education.

Data were collected through semi-structured individual interviews, which provided participants with the opportunity to express their perceptions, experiences, and visions regarding the integration of AI for ESD. Semi-structured interviews were selected because they combined a flexible conversational format with a predetermined interview guide aligned to the study objectives and research questions. This approach enabled the researcher to probe participants' responses for clarification and elaboration while maintaining consistency across interviews. With participants' informed consent, all

interviews were audio-recorded to ensure accurate capture of responses and subsequently transcribed verbatim for analysis. Conducting interviews in participants' natural professional settings further enhanced the credibility and authenticity of the data by allowing school leaders to reflect on their lived experiences within their institutional contexts. The interview data were analysed using thematic analysis, following the systematic procedures proposed by Braun and Clarke (2006; 2021). The analysis began with repeated reading of the interview transcripts to achieve familiarity with the data, followed by the generation of initial codes that captured meaningful features relevant to the research objective. Related codes were subsequently organised into broader categories and refined into coherent themes representing school leaders' perceived roles in integrating AI for ESD. Throughout the analysis, themes were reviewed, defined, and interpreted in relation to the constructivist paradigm and the study's theoretical lens of transformational leadership theory. This analytical process ensured that the findings accurately reflected participants' perspectives while producing credible and meaningful interpretations of the data.

Findings

1. Visionary Leadership

Visionary leadership emerged as a key role that school leaders perceived as essential for successfully integrating AI to promote ESD. Participants described visionary leaders as individuals who embrace innovation, anticipate future educational needs, inspire teachers to adopt emerging technologies, and create an enabling environment for continuous learning. They emphasised that school leaders should not only champion AI adoption but also model lifelong learning, provide strategic direction, invest in professional development, and encourage innovative teaching practices that prepare learners for an increasingly digital and interconnected world. One of the principals explained that visionary leadership requires school leaders to take the lead in AI implementation by creating opportunities for teacher development and fostering innovation within the school:

> *"As school leaders, we need to take the initiative and be at the forefront of making AI work effectively in our schools. Leadership should ensure that teachers have access to regular workshops and professional development so that they gain the knowledge and confidence to use AI meaningfully in their teaching. Not every educator is familiar with AI, but through continuous training, collaboration with specialists, and sharing best practices, teachers can develop the necessary skills. Leaders should also create an environment where educators feel encouraged to experiment, innovate, and design creative learning activities that make the best use of AI technologies."*

A deputy principal emphasised that visionary leadership begins with a willingness to embrace change and continuously develop one's own knowledge and digital competence:

> *"As leaders, we must be prepared to learn continuously because education is constantly changing. We cannot remain stagnant while technology continues to evolve. If we resist change, AI and other emerging technologies will become significant obstacles rather than opportunities. Effective leaders need to embrace*

lifelong learning, remain open-minded, and ensure that they are equipped to guide teachers confidently through digital transformation."

Another deputy principal highlighted that visionary leaders should demonstrate curiosity, confidence, and a willingness to explore new technologies before expecting teachers to do the same:

"A school leader needs to be adventurous and curious about new technologies. Whenever I encounter something new, I believe I can learn it, understand how it works, and find ways to apply it in my school. Leaders cannot expect teachers to embrace AI if they are unwilling to explore and learn about it themselves. We need to model the positive attitude towards innovation that we expect from our staff."

A head of department explained that visionary leadership also involves motivating teachers to engage consistently with AI until they become confident and competent users:

"The more educators interact with AI, the more comfortable they become with integrating it into their lessons. Initially, many teachers may feel frustrated or uncertain, but with regular practice, they develop confidence, improve their digital skills, and begin to recognise the educational value of AI. School leaders should encourage teachers to persevere because our learners need innovative ways of thinking if they are to succeed in a rapidly changing world."

Another principal described visionary leadership as preparing learners for global citizenship by promoting AI-enabled learning opportunities that extend beyond the classroom:

"Visionary school leaders should ensure that learners are prepared for the future by providing opportunities to use AI responsibly and effectively. When learners have access to the internet and AI technologies, they become more independent because they can search for information, solve problems, and explore knowledge beyond their textbooks. AI also creates opportunities for learners to collaborate with their peers from different schools, provinces, and even other countries. For example, a Grade 5 learner in South Africa can engage in learning activities with a Grade 5 learner in Uganda, broadening their perspectives and preparing them to participate confidently in a globally connected society."

2. Strategic Advocacy

Participants identified strategic advocacy as a role of school leaders in advancing the integration of AI for ESD. They emphasised that school leaders should champion AI adoption by advocating for adequate resource allocation, building strategic partnerships, exposing educators to innovative technologies, and promoting the responsible and ethical use of AI. They argued that effective advocacy extends beyond acquiring digital tools to creating awareness, influencing stakeholders, and ensuring that AI implementation aligns with learners' educational needs and long-term sustainability goals. A principal emphasised that school leaders have a responsibility to advocate for the procurement of

appropriate technological resources by ensuring that AI implementation is prioritised in school budgeting and resource planning:

> *"School leaders should make sure that they purchase adequate resources for both learners and teachers so that the implementation of AI can be more effective. Without essential resources such as laptops, computers, reliable internet connectivity, and other digital technologies, AI cannot be implemented successfully. School leadership should therefore ensure that these resources are prioritised and included in the school budget because effective AI integration depends on having the necessary infrastructure in place."*

A deputy principal explained that school leaders should actively advocate for AI by exposing teachers and other stakeholders to practical demonstrations of emerging technologies. According to the participant, people are more likely to embrace innovation when they experience its benefits firsthand rather than merely hearing about it:

> *"We visited companies where they demonstrated how interactive whiteboards worked. When you are introducing a new idea, people are unlikely to support it if they only hear about it. You have to immerse them in what you are talking about. If you want teachers to accept AI and other digital technologies, you either bring the technology to the school or take them to places where they can see it being used successfully. That practical exposure builds confidence and encourages acceptance."*

A principal highlighted that strategic advocacy should also focus on promoting responsible and ethical AI use among learners. The participant noted that school leaders have an important role in educating learners about digital citizenship and online safety while encouraging them to use AI technologies productively:

> *"Most learners already have access to mobile phones and the internet. Our responsibility is to guide them so that what they search for and who they interact with online does not place them in danger. School leaders should advocate for responsible and ethical use of AI by teaching learners about digital safety, critical thinking, and responsible online behaviour so that these technologies support learning rather than exposing them to unnecessary risks."*

A head of department further explained that strategic advocacy involves building partnerships with external organisations that can strengthen schools' AI capabilities through funding, training, and access to emerging technologies:

> *"Schools cannot implement AI successfully on their own. School leaders should establish partnerships with universities, technology companies, and the Department of Education to access training opportunities, technical support, and digital resources. These collaborations can make AI implementation more sustainable and ensure that teachers are adequately prepared."*

Another head of department argued that advocacy should include creating a shared vision for AI integration by involving teachers, parents, and governing bodies in decision-making processes:

> *"School leaders should communicate the value of AI to teachers, parents, and the school governing body so that everyone understands why these technologies are important for teaching and learning. When stakeholders share the same vision, they are more willing to support funding decisions, participate in training, and encourage learners to use AI responsibly."*

3. AI-Enabled Experiential Learning for Sustainable Development

Participants indicated that AI has the potential to strengthen experiential learning by supporting authentic, hands-on educational activities that promote ESD. They explained that AI complements practical learning by assisting teachers to design learner-centred lessons, identify environmental challenges, generate teaching resources, and connect classroom learning with real-life sustainability practices. A principal explained how AI enhanced lesson planning for practical gardening activities by generating structured, engaging and curriculum-aligned learning experiences that integrated sustainability concepts across different learning activities. The participant remarked:

> *"We designed a lesson on gardening where learners identify gardening tools, different seeds and soil types, work together in groups, measure planting distances, and learn about seasonal crops. We used AI to generate a complete 60-minute lesson plan with clear learning objectives, practical activities, assessment tasks and realistic time allocations. The lesson became far more interactive and engaging because learners were actively involved in every stage of the learning process instead of simply listening to the teacher."*

A principal described the school garden as an important experiential learning environment where AI-supported learning resources and practical activities enable learners to connect classroom knowledge with sustainable living practices across different subjects. The participant stated:

> *"The garden is a centre for learning. We integrate it into Mathematics, Languages and Social Sciences. Learners identify vegetables in their mother tongue, calculate measurements, learn about healthy living and understand environmental conservation. AI also helps teachers develop activities that connect these subjects, allowing learners to experience what we teach instead of only hearing about it in the classroom. They remember the lessons much better because they learn by doing."*

A head of department reflected on the challenges associated with the utilisation of school-based learning resources, warning that the successful integration of AI depends on educators' willingness to embrace innovation and continuous professional learning. The participant commented:

> *"There are teachers who have never even visited the garden, yet we already have this valuable learning centre available. That concerns me because, even if schools receive AI technologies and other digital resources, they may remain unused if teachers are unwilling or unable to use them. Technology alone cannot transform education; people must also change. I believe change is a gradual process that requires leadership, training and continuous support."*

A deputy principal challenged traditional perceptions of school gardens by emphasising their educational value in fostering sustainability and experiential learning. The participant explained:

> *"Many people still see the school garden as a place where learners are sent for punishment, but our vision is completely different. The garden should become a place of enjoyment, discovery and meaningful learning where learners understand food production, environmental responsibility and sustainable living through practical experience. AI can help us make these learning experiences even more relevant and engaging."*

A deputy principal described how AI applications have strengthened practical environmental learning by providing immediate expert guidance for managing the school garden. The participant noted:

> *"Whenever I notice an insect or a disease affecting a plant, I simply scan it using an AI application on my phone. The AI identifies the disease, explains the possible causes and recommends environmentally friendly ways to treat it. It has significantly increased my knowledge of gardening and helps us maintain a healthier, more sustainable garden while also providing valuable learning opportunities for both teachers and learners. Learners count the number of seedlings, record the harvest, calculate income from selling vegetables and monitor the growth of different crops. They are developing numeracy, record-keeping and entrepreneurial skills while learning about sustainable agriculture. AI can also help us analyse production records and improve planning, making the learning experience even more relevant to real-life situations."*

Another head of department emphasised that AI can reinforce sustainable development by helping learners understand affordable and environmentally responsible agricultural practices that can be implemented within their own communities:

> *"Learners should understand that sustainable development does not always require expensive technology or large financial resources. AI can teach them simple, practical methods such as making compost, producing organic liquid fertilisers, improving soil fertility and growing healthy food using natural techniques. These are lifelong skills that empower learners to become responsible citizens who can contribute to sustainable communities."*

4. Equalising Global Competitiveness and Information Access

Participants perceived that the integration of AI has the potential to reduce educational inequalities by providing learners with equitable access to high-quality learning resources, irrespective of their geographical location or socio-economic background. Participants argued that AI can expose learners to the same educational content accessed by learners in other provinces and countries, thereby promoting global competitiveness and supporting ESD. A principal explained that AI has the potential to position South African learners alongside their international counterparts by broadening learning opportunities beyond conventional classroom instruction. According to the participant, AI enables learners to access diverse learning environments and experiences that prepare them to compete in an increasingly globalised world:

> *"AI is helping our learners to compete with learners from other countries, such as China. In many countries, learning does not only happen inside the classroom for eight hours a day. Learners may spend only a few hours in class and continue learning independently outside the classroom through digital technologies. AI provides opportunities for learners to experience different learning environments and develop knowledge beyond what is taught during normal school hours."*

A deputy principal highlighted that AI promotes learner autonomy by allowing learners to access information independently, investigate problems, and generate solutions without relying solely on teacher-centred instruction:

> *"Learners will increasingly be able to learn independently without depending entirely on the teacher. As long as they have access to the internet and AI platforms, they can search for information, explore different ideas, ask questions, and generate solutions on their own. This encourages independent learning, critical thinking, and lifelong learning skills."*

Another principal also believed that AI has the capacity to bridge educational disparities by connecting learners across schools, provinces, and countries, thereby creating comparable learning opportunities irrespective of location:

> *"Our learners will be able to interact with learners from other schools, other provinces, and even other countries. AI creates opportunities for learners to access similar educational content regardless of where they live. A Grade 5 learner in South Africa can learn alongside a Grade 5 learner in Uganda or another country because they have access to similar learning resources and can progress at a similar pace."*

Expanding on this perspective, a departmental head explained that AI democratises access to knowledge by enabling learners to utilise the same digital learning resources available globally, thereby reducing inequalities associated with geographical location:

> *"With AI, it becomes less important where a learner comes from because everyone can access similar information. Whether a learner is in Limpopo, Gauteng, or another country, they can use the same AI tools and access the same educational resources. For example, if a learner watches a lesson developed in the United States on YouTube or another AI-supported platform, they receive the same*

quality of information as learners in that country. This helps to equalise educational opportunities across different contexts."

When asked to clarify whether AI could contribute to educational equity, the participant reaffirmed that its greatest contribution lies in providing equal access to learning opportunities for all learners: *"Yes, AI can equalise opportunities for our learners because it gives them equal access to information, learning resources, and educational opportunities regardless of where they come from."*

5. Optimising Teacher Efficiency through Automated Planning and Assessment

Participants strongly emphasised AI as a valuable tool for reducing teachers' administrative workload while improving the efficiency of lesson planning, assessment, and instructional delivery. Participants highlighted that AI has the potential to automate routine teaching tasks, enabling teachers to devote more time to learner engagement, personalised support, and improving learning outcomes. A principal explained that AI significantly reduces teachers' workload by assisting with lesson preparation while simultaneously providing learners with additional learning resources to support classroom activities and independent research:

> *"It will really offload the workload that teachers have when preparing their daily work in schools. It also assists learners to access more information based on whatever research or activities they are given. Teachers can spend less time preparing routine materials and more time supporting learners during the teaching process."*

A deputy principal emphasised that AI simplifies lesson planning by generating structured lesson plans together with learner-centred classroom activities, making planning more efficient, particularly for teachers who require additional instructional support: *"Teachers should design lessons using artificial intelligence because it also gives the activities that learners can do. That is the simplest and easiest way to design a lesson plan, especially when teachers need ideas that are aligned with the topic they are teaching."* Another principal highlighted AI's usefulness in curriculum planning, particularly when teachers are required to teach unfamiliar subjects or prepare assessments within a limited timeframe. According to the participant, AI enables teachers to quickly generate lesson plans and assessment questions while still allowing them to adapt the materials to suit their learners' needs: *"If I'm allocated a new subject, I can tell ChatGPT to develop a lesson plan for me. I can also give ChatGPT a topic and ask it to formulate questions. It saves time because the teacher already has a starting point that can still be adapted for the classroom."*

A departmental head also noted that AI supports assessment design by automatically generating marking rubrics and scoring criteria, thereby reducing the time teachers spend developing assessment instruments while promoting greater consistency in marking: *"You are able to ask AI to give you a rubric. You simply provide the activity, and it automatically generates the rubric, including the assessment criteria and scoring guidelines for that particular task."* Similarly, another principal explained that AI-powered assessment technologies can automate the marking process, particularly for objective

assessments such as multiple-choice tests. This enables teachers to obtain learners' results almost immediately and use the time saved to provide feedback and academic support: "*I can mark learners' scripts using my phone. I give them multiple-choice questions, and, once they are finished, I simply scan their papers. Everything is marked within seconds, which saves a great deal of time and allows teachers to focus on helping learners who need support."*

A deputy principal described how AI and digital technologies could provide learners with continuous access to instructional content beyond the physical classroom. Recorded lessons, according to the participant, could reduce instructional disruptions and create opportunities for learners to revisit difficult concepts at their own pace: *"Teachers have less work than before because computers already have recorded lessons. If learners do not want to read, they can simply put on their headphones and listen to a teacher explaining the lesson. They can replay the lesson whenever they need additional understanding."* Building on this idea, a principal suggested that schools could develop digital repositories of teachers' recorded lessons to ensure continuity of teaching during teacher absences while maintaining curriculum coverage: *"We are also thinking that next year teachers should have their own lessons recorded so that if a teacher is absent, we can simply play the recorded lesson. Learners will continue learning without unnecessary interruptions, and teaching time will not be lost."*

6. Promoting Entrepreneurial Agency to Disrupt the "Dependency Syndrome"

Participants posited that integrating AI into ESD should extend beyond improving academic performance to cultivating entrepreneurial agency, self-reliance, and sustainable livelihoods. Participants viewed AI as a catalyst for shifting learners away from a "dependency syndrome" mindset towards becoming innovative problem-solvers capable of identifying opportunities within their communities. They argued that school leaders have a responsibility to nurture entrepreneurial thinking from an early age, equipping learners with practical skills that enable them to create employment opportunities rather than relying solely on formal employment. A principal highlighted the importance of developing learners' capacity for self-sustainability through entrepreneurship. The participant argued that AI-supported learning should encourage learners to recognise opportunities within their immediate environment and develop solutions that generate sustainable livelihoods:

> *"I think it is very important for the learners that we have because they must learn how to sustain themselves. South Africa has a problem of dependency syndrome, where many people always expect to receive rather than create opportunities. We need to take learners out of that mindset. Through initiatives such as gardening, entrepreneurship and AI-supported innovation, learners can learn to generate income and become self-reliant instead of always being on the receiving end. We must help them to see the bigger picture and realise that they can become job creators rather than job seekers."*

A deputy principal explained how AI was incorporated into entrepreneurial learning by encouraging learners to investigate successful business ideas, analyse existing markets and identify viable products and services before launching their own ventures:

> *"I asked learners to search for products that they could sell. They researched different products and presented their ideas to me, and I approved those that were practical. I also encouraged them to search for previous market days organised by other schools so that they could study successful business ideas, compare them and improve on them. AI makes this process easier because learners can quickly gather information, analyse trends and develop more innovative business concepts."*

A head of department argued that schools should expose learners to different forms of entrepreneurship, including service-based enterprises that require little financial capital but encourage creativity, initiative and problem-solving:

> *"Entrepreneurship is not only about selling products. Learners must also understand service businesses where there is very little financial risk because they do not need to buy stock. I even encourage them to think creatively by offering simple services, such as washing teachers' shoes during break or after school, or identifying other services that people in the school community may need. AI can help them identify customer needs and improve the way they market these services."*

Expanding on this perspective, a deputy principal stressed that entrepreneurial education should begin during the earliest years of schooling so that learners develop an entrepreneurial mindset before entering adulthood:

> *"Learners must start learning about business from Grade R. If entrepreneurial thinking becomes part of their education from an early age, they will grow up understanding how to create opportunities for themselves. Even if some learners do not complete Grade 12, they should still possess practical skills that enable them to establish small businesses, generate income and support themselves with dignity."*

A deputy principal explained that schools should encourage practical entrepreneurial activities connected to learners' home and community environments:

> *"We must teach learners as early as possible to start their own small businesses, establish backyard gardens or small farms, and become involved in family businesses where possible. AI can provide ideas, improve production methods, assist with marketing and help learners identify opportunities that they may not have considered before. These practical experiences prepare them for lifelong self-employment and sustainable living."*

Another head of department reinforced the need for entrepreneurship education by noting that many learners would not progress to higher education or secure formal employment. Hence, schools should prioritise practical skills that enable learners to become economically independent.

> *"Not every learner will go to university, and some may even leave school before completing Grade 12. Even among graduates, many struggle to find employment.*

That is why schools must equip learners with practical entrepreneurial skills that enable them to earn a living, support their families and contribute positively to their communities. AI should be used as a tool that strengthens these skills rather than creating dependence on technology."

7. Advocating for Structural and Financial Infrastructure Readiness

The data indicate that school leaders perceive visionary leadership as a critical driver of AI integration for ESD, requiring leaders to anticipate future educational demands, inspire innovation, and cultivate a culture of continuous professional learning. Rather than viewing AI merely as a technological advancement, participants regarded it as a strategic tool for transforming teaching, learning, and learners' preparedness for an increasingly digital and interconnected society. Their perspectives suggest that visionary leadership extends beyond introducing AI technologies to fostering an organisational culture where teachers are empowered to experiment with innovative pedagogies, continuously develop their digital competencies, and embrace educational change with confidence. This finding aligns with transformational leadership theory, which posits that effective leaders articulate a compelling vision, inspire followers towards shared goals, stimulate intellectual growth, and support individual development (Agazu et al., 2025; Bass & Riggio, 2006). From this perspective, school leaders serve as change agents who motivate teachers to adopt AI not through compliance but by cultivating a shared commitment to educational innovation and sustainable development. The findings therefore demonstrate that visionary leadership is not confined to administrative oversight but encompasses strategic foresight, capacity building, and the creation of conditions that enable meaningful AI integration.

The findings further suggest that visionary leadership is closely associated with preparing schools and learners for the demands of the Fourth Industrial Revolution and the achievement of sustainable development goals through responsible AI adoption. Participants perceived school leaders as instrumental in modelling lifelong learning, encouraging digital experimentation, and expanding learning opportunities beyond traditional classroom boundaries to promote collaboration and global citizenship. These findings corroborate previous studies which found that visionary school leadership significantly influences teachers' willingness to adopt emerging technologies by establishing a clear strategic direction, promoting innovation, and supporting continuous professional development (Karakose & Tulubas, 2025; Ahmad & Mohebi, 2025). They are also consistent with recent studies indicating that effective AI integration requires leaders who possess a future-oriented vision, foster organisational learning, and create supportive environments that encourage teachers to develop AI-related competencies (Ahmad & Mohebi, 2025; Ghosh & Taylor, 2026). Furthermore, the findings extend existing literature by demonstrating that school leaders perceive AI leadership not only as a means of improving instructional practices but also as a vehicle for advancing ESD through digital inclusion, global collaboration, and the development of learners' future-ready competencies. This interpretation reinforces the argument that visionary leadership represents a foundational condition for embedding AI within sustainable educational transformation, where technological innovation is intentionally aligned with broader educational, social, and sustainability objectives.

Participants opined that the successful integration of AI for ESD depends on the availability of adequate structural and financial infrastructure. Participants argued that while there is enthusiasm among teachers and school leaders to embrace AI, its implementation remains constrained by inadequate funding, poor digital infrastructure, unreliable internet connectivity, insufficient technological devices, and unfavourable school environments. A principal stressed that financial planning should deliberately prioritise AI implementation by ensuring the school's budget for the technological resources required to support digital teaching and learning. The participant further noted that many schools still lack basic devices for both teachers and learners, making AI integration unrealistic:

> *"Not all schools have learners where each learner has a laptop in the classroom. In some schools, teachers do not even have laptops. In my department, three teachers sometimes have to share one laptop. When schools draw up their budgets, they should deliberately budget for AI because AI requires reliable Wi-Fi, data, laptops, and even smart devices where possible. These resources are essential if AI is to function effectively in teaching and learning."*

Similarly, a departmental head argued that financial investment must extend beyond purchasing equipment to providing sustainable digital infrastructure, particularly reliable internet connectivity. The participant likened AI implementation without adequate resources to possessing skills without the necessary tools to apply them.

> *"If we could have a budget that allows us to purchase the equipment needed in the media centre, it would also help us secure reliable Wi-Fi because, without internet connectivity, learners and teachers cannot search for information or use AI tools effectively. The most important thing is implementation. If I do not have the necessary resources, it is like having a driving licence but not having a car."*

A deputy principal highlighted that inadequate funding remains one of the greatest barriers to AI adoption. The participant explained that although many educators are willing to embrace innovation, persistent shortages of resources, poor school infrastructure, and security challenges undermine these efforts:

> *"Resources are the biggest limiting factor. My school lacks the resources needed, and that makes it extremely difficult to promote and implement AI effectively. There are teachers who are eager to bring about change, but the shortage of resources prevents meaningful progress. We also experience burglaries because members of the community sometimes view schools as places where they can steal devices to sell. Computers and other equipment that we depend on have been stolen. Furthermore, our classrooms are containers (mobile classrooms), which makes it difficult to invest in permanent technological infrastructure. If our school could become a fully smart school, we would be in a much stronger position to integrate AI into teaching and learning."*

Another deputy principal emphasised that infrastructural inequalities across communities continue to widen the digital divide. The participant argued that government and

municipalities should ensure universal access to electricity, internet connectivity, and digital infrastructure if AI is to benefit all learners equitably:

> *"As long as the schools are still around informal settlements without electricity, it will remain difficult for schools in those communities to adopt AI. Every school should have access to reliable internet twenty-four hours a day, computer laboratories that are always available, and municipalities or government departments should provide free Wi-Fi. Without these basic services, equitable AI integration will remain impossible."*

A head of department focused on the importance of creating dedicated technological learning spaces that enable learners to engage with AI-supported research and independent learning. The participant viewed technology laboratories as essential infrastructure for developing learners' digital competencies:

> *"My dream is for the school to have a fully equipped technology laboratory where learners can access computers whenever they need them. Such a facility would enable them to access information, conduct research, download learning materials, and use AI-powered tools because most of the projects they complete require extensive research and digital engagement."*

Discussion

Participants' accounts indicate that strategic advocacy is perceived as a multidimensional leadership responsibility that extends beyond securing technological resources to mobilising stakeholders, shaping institutional vision, fostering collaborative partnerships, and promoting the ethical use of AI for ESD. Participants viewed school leaders as strategic agents who influence decision-making, advocate for sustainable investment in digital infrastructure, facilitate exposure to innovative technologies, and cultivate stakeholder commitment towards AI integration. This suggests that successful AI implementation is not solely dependent on technological availability but also on leaders' capacity to inspire collective ownership, build strategic networks, and create an enabling environment for educational innovation. These findings align with transformational leadership theory, which posits that effective leaders articulate a compelling vision, inspire commitment to change, and stimulate innovation through collaborative engagement. The participants' emphasis on communicating a shared vision, motivating stakeholders, and advocating for long-term investment reflects the dimensions of inspirational motivation and idealised influence, demonstrating that transformational school leaders play a pivotal role in driving sustainable educational reform through AI integration. The findings corroborate studies which argue that transformational leadership is fundamental to successful digital transformation because leaders create organisational readiness, inspire innovation, and encourage stakeholder commitment to technology-enhanced learning (Assefa & Mujtaba, 2025; Yang & Xu, 2026).

Furthermore, the participants' emphasis on ethical AI use, experiential learning opportunities, and partnerships with external organisations demonstrates that strategic advocacy encompasses both internal capacity building and external collaboration to achieve sustainable educational outcomes. This finding extends existing literature by

illustrating that advocacy for AI in schools is not limited to lobbying for resources but also involves promoting responsible digital citizenship, strengthening teachers' confidence through authentic exposure to AI technologies, and leveraging partnerships to address resource and expertise gaps. These perspectives support recent studies which contend that effective AI integration requires cross-sector collaboration, continuous professional learning, and governance structures that ensure AI is implemented responsibly and equitably within schools (Oyetade & Zuva, 2025; Daher, 2025). From an interpretive perspective, the findings suggest that school leaders perceive strategic advocacy as a catalyst for creating an ecosystem in which policy support, stakeholder engagement, ethical governance, and institutional partnerships collectively enhance schools' readiness to integrate AI for ESD. Therefore, strategic advocacy emerges not merely as an administrative responsibility but as a transformative leadership practice that strengthens institutional capacity, promotes shared responsibility, and advances the sustainable adoption of AI within educational settings.

Participants reported that school leaders perceive AI not merely as a technological innovation but as an enabler of experiential learning that strengthens ESD by connecting classroom instruction with authentic, real-world sustainability challenges. Participants viewed AI as a pedagogical tool that enhances inquiry-based learning, supports interdisciplinary teaching, and enables learners to develop practical competencies such as critical thinking, collaboration, environmental stewardship, entrepreneurship, and problem-solving through meaningful engagement with their local contexts. Rather than replacing hands-on learning, AI was perceived as enriching experiential learning by assisting teachers to design authentic learning activities, generate contextualised instructional resources, and provide timely information that enhances decision-making during practical tasks. These findings confirm previous studies that argue AI has the capacity to personalise learning, facilitate authentic problem-solving, and promote learner-centred pedagogies that prepare learners with the competencies required to achieve the Sustainable Development Goals (SDGs) (Fortuna et al., 2025; Alkhawaja et al., 2025). The findings further extend existing literature by illustrating how school leaders envision AI supporting sustainability education through locally relevant experiential activities, such as school gardening and environmental conservation, thereby demonstrating that AI can strengthen place-based learning rather than divert attention from authentic educational experiences.

From the perspective of transformational leadership theory, the findings highlight the pivotal role of school leaders in fostering a shared vision that encourages innovation, continuous learning, and the effective integration of AI into experiential ESD practices. School leaders recognised that successful AI implementation depends not only on technological availability but also on cultivating teachers' willingness to embrace pedagogical change through professional learning, guidance, and ongoing support. This reflects the dimensions of inspirational motivation and intellectual stimulation, whereby transformational leaders encourage educators to rethink traditional teaching practices, experiment with innovative approaches, and collaboratively develop sustainable learning environments (Assefa & Mujtaba, 2025). The findings therefore reinforce evidence that leadership remains a critical determinant of successful educational technology integration because leaders influence organisational culture, teacher confidence, and innovation

readiness (Ahmad & Mohebi, 2025; Ghosh & Taylor, 2026). Furthermore, the results extend the current discourse on AI in education by suggesting that the transformative potential of AI for ESD lies not primarily in the technology itself, but in visionary leadership that intentionally aligns AI-enabled experiential learning with sustainability values, community relevance, and the holistic development of learners as active contributors to sustainable societies.

Participants argued that school leaders perceive AI as a transformative mechanism for reducing educational inequalities by expanding learners' access to knowledge, fostering independent learning, and enhancing global competitiveness. Rather than viewing AI merely as a technological innovation, participants conceptualised it as an enabler of equitable educational opportunities that transcends geographical and socio-economic boundaries. Their perspectives suggest that AI can democratise access to quality learning resources, allowing learners to participate in knowledge networks and educational experiences that were previously inaccessible because of contextual limitations. From the perspective of transformational leadership theory, these findings reflect the dimension of inspirational motivation, whereby school leaders articulate a future-oriented vision that inspires teachers and learners to embrace innovation in pursuit of educational transformation. By promoting AI as a vehicle for equitable access, lifelong learning, and international competitiveness, school leaders demonstrate transformational leadership through their commitment to preparing learners for the demands of an increasingly interconnected and knowledge-driven society. This interpretation suggests that the leaders' vision extends beyond improving academic performance to positioning AI as a strategic resource for achieving the broader objectives of ESD through inclusive, accessible, and future-focused learning environments.

These findings corroborate previous research which argues that AI has the capacity to promote educational equity by personalising learning, widening access to high-quality educational content, and supporting learner autonomy irrespective of learners' socio-economic or geographical circumstances (Kotikalapudi & Gayatri, 2026; Khlaif et al., 2025). The participants' emphasis on learners accessing globally available educational resources and engaging in self-directed learning is also consistent with literature that identifies AI as an important catalyst for developing twenty-first-century competencies, including critical thinking, collaboration, digital literacy, and lifelong learning, all of which are central to ESD (Assefa, 2025; Zenda & Dewa, 2025). However, the findings extend existing scholarship by highlighting school leaders' belief that AI can narrow disparities not only between learners within South Africa but also between learners across different countries by providing comparable learning opportunities through shared digital platforms. This broader interpretation positions AI as an instrument for advancing global educational inclusion rather than merely improving classroom instruction. Nevertheless, the findings should be interpreted cautiously, as the aspiration for equal access to AI-enabled learning remains contingent upon addressing persistent inequalities in digital infrastructure, internet connectivity, and access to technological devices, which continue to characterise many resource-constrained educational contexts (Chigbu & Makapela, 2025; Zenda & Dewa, 2025). As a result, while school leaders perceive AI as a powerful equaliser, the realisation of this vision depends on complementary investments in digital infrastructure and policy support that ensure equitable access for all learners.

Participants' opinions indicate that school leaders perceive AI as a strategic resource for improving teacher efficiency by automating routine administrative and instructional tasks, thereby enabling teachers to devote greater attention to pedagogical interactions and learner support. Rather than viewing AI as a substitute for professional expertise, participants regarded it as a complementary tool that enhances lesson preparation, assessment practices, and curriculum delivery. This perspective reflects an understanding of sustainable education in which technology is used to optimise teachers' time, improve instructional quality, and strengthen learner-centred practices. The findings align with recent studies demonstrating that generative AI can significantly reduce teachers' workload through automated lesson planning, content generation, assessment design, and feedback processes, allowing educators to focus on higher-order teaching responsibilities and differentiated learner support (Mulyani et al., 2025; Brunton et al., 2025). The participants' emphasis on AI-assisted planning and assessment also extends existing literature by highlighting how school leaders perceive these technologies as practical mechanisms for sustaining teacher effectiveness in resource-constrained educational environments, where increasing administrative demands often limit opportunities for meaningful learner engagement.

From the perspective of transformational leadership theory, these findings illustrate the role of school leaders in fostering innovation by encouraging teachers to embrace AI-enabled instructional practices that improve teaching efficiency and educational quality. The theory's dimension of intellectual stimulation is evident in leaders' support for adopting new technological approaches that challenge conventional planning and assessment practices, while individualised consideration is reflected in their recognition that AI can provide practical support for teachers with varying levels of experience and workload. Furthermore, participants' advocacy for recorded lessons and digital learning repositories demonstrates a forward-looking leadership orientation that seeks to strengthen instructional continuity and equitable access to learning resources beyond the traditional classroom. This finding corroborates evidence that transformational leaders play a critical role in creating school cultures that encourage technological innovation, continuous professional learning, and collaborative problem-solving, all of which are essential for successful AI integration in education (Ali et al., 2025; Atasoy & Ozkul, 2026). At the same time, the findings extend previous research by suggesting that school leaders increasingly perceive AI not merely as an instructional technology but as a strategic leadership resource capable of improving organisational efficiency, supporting teacher wellbeing, and advancing the broader objectives of ESD through more responsive and sustainable teaching practices.

The findings demonstrate that school leaders perceive AI integration for ESD as extending beyond technological competence to fostering entrepreneurial agency, self-reliance, and sustainable livelihoods. Participants envisioned AI as an enabler of opportunity recognition, innovation, and practical problem-solving that equips learners to respond proactively to socio-economic challenges, particularly unemployment and poverty. Their perspectives suggest that AI should be embedded within authentic learning experiences that encourage learners to identify community needs, generate business ideas, and develop locally relevant solutions. This interpretation indicates that school leaders view AI not merely as a digital tool for improving teaching and learning but as a

transformative resource for cultivating an entrepreneurial mindset that empowers learners to become active contributors to sustainable development rather than passive recipients of economic support. These findings resonate with the aspirations of ESD, which advocates the development of competencies such as creativity, critical thinking, collaboration, and responsible action to enable learners to address complex societal challenges sustainably (Xiao et al., 2025). Furthermore, the findings confirm studies suggesting that AI can enhance entrepreneurial learning by supporting idea generation, market analysis, innovation, and informed decision-making, thereby strengthening learners' capacity to create sustainable economic opportunities (Mumi et al., 2025; Bell & Bell, 2026).

Viewed through the lens of transformational leadership theory, the findings illustrate how school leaders perceive their role as inspiring a shared vision that prepares learners to become innovative, adaptable, and economically independent citizens. The emphasis on nurturing entrepreneurial thinking from the early years of schooling reflects the transformational leadership dimensions of inspirational motivation and intellectual stimulation, whereby leaders encourage learners and teachers to challenge conventional assumptions, embrace innovation, and develop creative solutions to real-world problems. Rather than limiting educational success to academic achievement or progression to higher education, participants advocated a broader conception of education that develops learners' capacity to generate livelihoods and contribute to community resilience. This finding extends existing leadership literature by demonstrating that school leaders increasingly conceptualise AI leadership within a sustainable development agenda that integrates digital innovation with entrepreneurship, social responsibility, and economic empowerment. Recent scholarship similarly argues that educational leaders play a critical role in creating learning environments where AI supports learner agency, innovation, and future-ready competencies essential for sustainable societies (Karakose & Tulubas, 2025; Kim & Wargo, 2025). Therefore, the findings suggest that effective AI leadership should prioritise the development of entrepreneurial ecosystems within schools, enabling learners to apply AI ethically and creatively to address local challenges while contributing to inclusive and sustainable socio-economic development.

Participants' responses show that school leaders perceive advocating for structural and financial infrastructure readiness as a fundamental leadership responsibility in facilitating the integration of AI for ESD. Rather than viewing AI adoption solely as a technological initiative, participants recognised that its successful implementation depends on strategic investment in digital infrastructure, including reliable internet connectivity, adequate technological devices, sustainable funding, secure learning environments, and purpose-built technology facilities. These findings suggest that school leaders see themselves as advocates who must influence resource allocation and mobilise support from school governing bodies, education departments, municipalities, and other stakeholders to create enabling conditions for AI integration. This interpretation extends beyond the operational acquisition of technology by demonstrating that school leaders perceive infrastructure readiness as a prerequisite for achieving equitable and sustainable AI-enabled education. The findings corroborate existing studies which argue that inadequate infrastructure, limited funding, poor internet connectivity, and unequal access to digital technologies remain among the greatest barriers to AI implementation in schools,

particularly within developing contexts (Saal et al., 2025; Mokoena & Seeletse, 2025). Furthermore, the participants' concerns regarding unequal access between schools reinforce the argument that without deliberate investment in digital infrastructure, AI risks exacerbating existing educational inequalities rather than advancing the inclusive aspirations of ESD (Liu & Zhang, 2025).

From the perspective of transformational leadership theory, these findings demonstrate that school leaders perceive their role as extending beyond school administration to becoming visionary change agents who advocate for the organisational conditions necessary to support educational innovation. The emphasis on strategic budgeting, infrastructure development, and long-term investment reflects the transformational leadership dimensions of inspirational motivation and idealised influence, whereby leaders articulate a shared vision for digitally enabled education while mobilising resources to realise that vision. Rather than merely encouraging teachers to adopt AI, participants recognised that meaningful transformation requires structural readiness that empowers educators to implement innovative pedagogical practices confidently and sustainably. This interpretation aligns with research suggesting that transformational leaders play a critical role in securing organisational support, building innovation capacity, and creating environments that foster technology-enabled teaching and learning (Assefa & Mujtaba, 2025; Ali et al., 2025). However, the present findings extend previous scholarship by highlighting contextual realities that are particularly pronounced in resource-constrained South African schools, including inadequate school infrastructure, community security challenges, unreliable electricity supply, and persistent digital inequalities. These contextual factors illustrate that transformational leadership alone cannot guarantee successful AI integration unless it is complemented by sustained governmental investment and systemic policy support. Consequently, the findings underscore that effective leadership for AI-enabled ESD requires both visionary leadership and structural preparedness to ensure equitable access to emerging technologies across diverse educational contexts.

Contributions of the Study

This study contributes to the growing body of knowledge on AI integration for ESD by demonstrating that school leaders perceive AI implementation as a multidimensional leadership process rather than a purely technological initiative. The findings reveal that effective AI integration depends on the interaction of visionary leadership, strategic advocacy, AI-enabled experiential learning, equitable access to information, teacher empowerment through automation, entrepreneurial agency, and structural and financial readiness. These interconnected dimensions highlight that successful AI implementation requires a systems-orientated leadership approach in which leadership vision, organisational capacity, pedagogy, technological innovation, sustainability, and social equity reinforce one another to promote meaningful educational transformation.

The study also makes a significant theoretical contribution by extending the application of transformational leadership theory to AI-enabled ESD in resource-constrained educational contexts. While the theory traditionally emphasises vision, motivation, intellectual stimulation, and individualised support, the findings demonstrate that effective

AI leadership also requires strategic advocacy, digital governance, entrepreneurial development, and resource mobilisation. Furthermore, the study argues that structural readiness and digital equity should be recognised as foundational dimensions of transformational leadership, particularly in contexts characterised by inadequate infrastructure, unreliable electricity, limited internet connectivity, and financial constraints. This refinement enhances the explanatory power of the theory by recognising that leadership effectiveness is shaped by both leaders' behaviours and the structural environments within which they operate.

From a policy and practice perspective, the study highlights the need for comprehensive AI strategies that extend beyond technology acquisition to encompass infrastructure development, ethical AI governance, equitable resource allocation, professional development, and cross-sector partnerships. The findings provide school leaders with practical guidance for implementing AI responsibly by promoting a shared vision, strengthening teacher capacity, fostering collaborative partnerships, encouraging ethical AI use, and creating authentic learning experiences linked to sustainability challenges. Finally, the study advances the broader discourse on AI in education by positioning school leadership as the central mechanism through which technological innovation can drive sustainable educational transformation. By integrating transformational leadership with ESD principles, the study offers a contextually grounded framework that is relevant to South African schools while providing valuable insights for other resource-constrained educational settings and future research on AI-enabled educational leadership.

Conclusion

The study demonstrates that school leaders perceive themselves as pivotal agents in integrating AI for ESD through visionary leadership, strategic advocacy, AI-enabled experiential learning, promoting equitable access to information, enhancing teacher efficiency, fostering entrepreneurial agency, and advocating for structural and financial infrastructure readiness. Collectively, these roles illustrate that successful AI integration extends beyond the adoption of technological tools to encompass strategic leadership, institutional capacity building, ethical governance, collaborative partnerships, and sustained investment in human and material resources. Guided by transformational leadership theory, the findings further reveal that school leaders recognise the importance of articulating a shared vision, inspiring innovation, empowering teachers, and creating enabling environments that support sustainable educational transformation. At the same time, the study highlights that persistent inequalities in infrastructure, funding, connectivity, and access to digital technologies continue to constrain the realisation of AI's transformative potential, particularly within resource-constrained educational contexts.

The study concludes that the successful integration of AI for ESD requires a coordinated effort involving school leaders, policymakers, education departments, higher education institutions, technology providers, communities, and the private sector. AI should not be regarded merely as an emerging technology but as a strategic enabler for advancing equitable, inclusive, and sustainable education that prepares learners for the demands of the twenty-first century. There is therefore an urgent need for stakeholders at all levels to

move beyond policy aspirations towards deliberate action by investing in digital infrastructure, strengthening leadership capacity, supporting teacher professional development, and embedding AI within sustainable educational practices. Such collective commitment will ensure that AI serves as a catalyst for educational transformation and contributes meaningfully to achieving sustainable development goals within and beyond the South African education system.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Strengthen visionary leadership and strategic advocacy for AI integration: Since school leaders perceived visionary leadership and strategic advocacy as central to successful AI integration, the Department of Basic Education and Provincial Departments of Education should strengthen leadership development programmes that equip school leaders with competencies to develop AI implementation strategies, promote ethical AI use, mobilise stakeholders, and establish collaborative partnerships that support ESD.

2. Improve structural and financial readiness for AI implementation: The findings revealed that inadequate infrastructure, unreliable internet connectivity, insufficient technological devices, and limited financial resources remain significant barriers to AI integration. Consequently, government and relevant stakeholders should prioritise sustained investment in digital infrastructure, school connectivity, technological resources, and secure learning environments to enable equitable AI implementation across schools.

3. Promote continuous professional development for teachers and school leaders: As participants highlighted the importance of teacher confidence and digital competence, ongoing professional development should be provided to strengthen AI literacy, pedagogical integration, ethical AI practices, and the effective use of AI for teaching, assessment, and school leadership.

4. Integrate AI to support learner-centred, experiential, and entrepreneurial learning: The findings demonstrated that school leaders perceive AI as a valuable tool for enhancing experiential learning, improving teacher efficiency, expanding learners' access to information, and fostering entrepreneurial agency. Schools should therefore integrate AI into curriculum delivery through authentic sustainability projects, inquiry-based learning, and entrepreneurship initiatives that develop learners' critical thinking, creativity, problem-solving, and lifelong learning competencies.

References

Agazu, B. G., Kero, C. A., & Debela, K. L. (2025). Transformational leadership and firm performance: A systematic literature review. *Journal of Innovation and Entrepreneurship, 14*(1), 1–29. https://doi.org/10.1186/s13731-025-00476-x

Ahmad, D., & Mohebi, L. (2025). Visionary leadership and AI in educational technology: Theoretical and practical perspectives. In A. ElSayary (Ed.), *Prompt engineering and*

generative AI applications for teaching and learning (pp. 15–30). IGI Global. https://doi.org/10.4018/979-8-3693-7332-3.ch002

Ali, M. M., Ubaidillah, Khomsinnudin, & Ismawati. (2025). Transformational leadership as a catalyst for innovation and quality in education: A literature review. *Journal of Innovative and Creativity, 5*(2), 92–105. https://doi.org/10.31004/joecy.v5i2.148

Alkhawaja, L., Idris, M., Al-Sayyed, S. I., & Al Jaber, A. M. (2025). Exploring the impact of artificial intelligence on students' skills for sustainable development in education. *Frontiers in Education, 10*, 1–12. https://doi.org/10.3389/feduc.2025.1691148

Assefa, E. A. (2026). AI and the digital divide in ensuring educational access and multicultural inclusivity. *Journal of Information, Communication and Ethics in Society, 24*(2), 298–316. https://doi.org/10.1108/JICES-05-2025-0125

Assefa, E. A., & Mujtaba, B. G. (2025). Exploring transformational leadership in education by leveraging diversity and technology for inclusive practices. *International Journal of Public Leadership, 21*(4), 356–375. https://doi.org/10.1108/IJPL-10-2024-0112

Atasoy, R., & Ozkul, R. (2026). Navigating organizational change: The interplay of transformational leadership, instructional strategy self-efficacy, professional learning, and AI anxiety. *Journal of Organizational Change Management, 39*(3), 764–785. https://doi.org/10.1108/JOCM-04-2025-0302

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership*. Psychology Press.

Bell, H., & Bell, R. (2026). Extending the about–for–through tradition for AI-enabled entrepreneurship education: The AI-enabled entrepreneurial learning progression framework. *Entrepreneurship Education*, 1–25. https://doi.org/10.1007/s41959-026-00184-x

Brockwell, A. J., Mochizuki, Y., & Sprague, T. (2024). Designing indicators and assessment tools for SDG Target 4.7: A critique of the current approach and a proposal for an 'inside-out' strategy. *Compare: A Journal of Comparative and International Education, 54*(5), 731–749. https://doi.org/10.1080/03057925.2022.2129957

Brunton, R. J., Rhazzafe, S., Moodley, R., Kuhn, S., Caraffini, F., Wilford, S., Higginbottom, R., Colreavy-Donnelly, S., & Gongora, M. (2025). Using generative artificial intelligence to enhance the performance of disadvantaged students in secondary education. *Social Sciences & Humanities Open, 12*, Article 102110, 1–12. https://doi.org/10.1016/j.ssaho.2025.102110

Cambeses-Franco, C., & Cambeses-Franco, P. (2026). A country-level preparedness index for digital education: Infrastructure, teacher scientific-technology competence, and socioeconomic context. *Education and Information Technologies*, 1–28. https://doi.org/10.1007/s10639-026-14042-9

Chigbu, B. I., & Makapela, S. L. (2025). AI in education, sustainability, and the future of work: An integrative review of Industry 5.0, Education 5.0, and Work 5.0. *Journal of Open Innovation: Technology, Market, and Complexity, 11*(4), 100645, 1–15. https://doi.org/10.1016/j.joitmc.2025.100645

Daher, R. (2025). Integrating AI literacy into teacher education: A critical perspective paper. *Discover Artificial Intelligence, 5*(1), Article 217, 1–20. https://doi.org/10.1007/s44163-025-00475-7

Fortuna, A., Prasetya, F., Samala, A. D., Rawas, S., Criollo-C, S., Kaya, D., Raihan, M., Andriani, W., Safitri, D., & Nabawi, R. A. (2025). Artificial intelligence in personalized learning: A global systematic review of current advancements and shaping future opportunities. *Social Sciences & Humanities Open, 12*, Article 102114. https://doi.org/10.1016/j.ssaho.2025.102114

Ghosh, U. K., & Taylor, W. (2026). Visionary leadership in the age of AI: Harnessing emerging technologies to drive organizational excellence and innovation. In M. Paradiso-Testa (Ed.), *The value of vision in leadership* (pp. 217–252). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3373-2392-3.ch008

Karakose, T., & Tulubas, T. (2025). The role of educational leaders in the age of artificial intelligence (AI). *Educational Process: International Journal, 16*, Article e2025267, 1–22. https://doi.org/10.22521/edupij.2025.16.267

Khalil, S. A., Mahmood, M., Ali, Z., & Alam, I. (2026). AI for personalized learning experiences: Adaptive course content and intelligent tutoring systems. In R. M. S. Abdelaal & M. Kayyali (Eds.), *AI education strategies for future-proofing curriculum design* (pp. 223–242). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3373-2752-5.ch010

Khlaif, Z. N., Alshakhshir, R., Hamamra, B., & Joma, A. (2025). *Reimagining inclusive education: The assistive power of generative AI in promoting accessibility and equity. British Journal of Visual Impairment*. Advance online publication. https://doi.org/10.1177/02646196251382469

Kim, J., & Wargo, E. (2025). Empowering educational leaders for AI integration in rural STEM education: Challenges and strategies. *Frontiers in Education, 10*, 1–13. https://doi.org/10.3389/feduc.2025.1567698

Kotikalapudi, K. B., & Gayatri, S. N. (2026). Artificial intelligence in education: An educational perspective on personalization, equity, and ethics. *Discover Education, 5*(1), Article 187, 1–11. https://doi.org/10.1007/s44217-026-01226-1

Liu, Y., & Zhang, Y. (2025). Revisiting techno-optimism: Multidimensional inequalities in AI education across urban, suburban, and rural primary schools in China. *Education as Change, 29*, 1–25. https://doi.org/10.25159/1947-9417/18869

Mamba, S., & Beharry-Ramraj, A. (2026). Transforming teaching and learning into South Africa's FET phase through a dual-user AI-powered entrepreneurial sandbox. *International Journal of Studies in Inclusive Education, 1*(si1), 82–90. https://doi.org/10.4314/ijsie.v1i1.12s

Mienye, I. D., Sun, Y., & Ileberi, E. (2024). Artificial intelligence and sustainable development in Africa: A comprehensive review. *Machine Learning with Applications, 18*, Article 100591, 1–14. https://doi.org/10.1016/j.mlwa.2024.100591

Mokoena, O. P., & Seeletse, S. M. (2025). AI in rural classrooms: Challenges and perspectives from South African educators. *International Journal of Current Educational Studies, 4*(2), 30–52. https://doi.org/10.46328/ijces.199

Mulyani, H., Istiaq, M. A., Shauki, E. R., Kurniati, F., & Arlinda, H. (2025). Transforming education: Exploring the influence of generative AI on teaching performance. *Cogent Education, 12*(1), Article 2448066, 1–17. https://doi.org/10.1080/2331186X.2024.2448066

Mumi, A., Ngammoh, N., & Suwanpakdee, A. (2025). The nexus of artificial intelligence and entrepreneurship research: Bibliometric analysis. *Sustainable Futures, 9*, Article 100688, 1–13. https://doi.org/10.1016/j.sftr.2025.100688

Okoye, K., Campos, E., Das, A., Chakraborty, V., Ghosh, M., Chakrabarti, A., & Hosseini, S. (2025). Impact of digitalized education upon sustainable education and practice: A systematic review and meta-analysis of literature based on pre-, intra-, and post-pandemic and rural education development. *Sustainable Futures, 10*, Article 100851, 1–24. https://doi.org/10.1016/j.sftr.2025.100851

Oyetade, K., & Zuva, T. (2025). Rethinking education for a more inclusive and future-ready AI era. *African Journal of Inter/Multidisciplinary Studies, 7*(2), 1–13. https://doi.org/10.51415/ajims.v7i2.2707

Saal, P. E., Chetty, K., Ntshayintshayi, N., Moosa, T., & Masuku, N. (2025). A scoping review of the integration of artificial intelligence in primary and secondary schools from 2020 to 2024: Policy implications for South Africa. *Journal of Education (University of KwaZulu-Natal)*, (98), 62–85. https://doi.org/10.17159/2520-9868/i98a04

Xiao, L., Gill-Simmen, L., & Mehta, A. (2025). The quantum shift: Achieving education for sustainability development through a transformative teaching and learning approach. *World Development Sustainability, 7*, Article 100236, 1–10. https://doi.org/10.1016/j.wds.2025.100236

Yang, C., & Xu, Z. (2026). Principal visionary leadership and teacher instructional innovation: Mediating roles of teacher workplace well-being and collaboration. *Frontiers in Psychology, 17*, Article 1701099, 1–12. https://doi.org/10.3389/fpsyg.2026.1701099

Zenda, R., & Dewa, A. (2025). Artificial intelligence for enhanced student engagement in South African open distance learning: A systematic review. *Progressio, 46*, 1–25. https://doi.org/10.25159/2663-5895/17443