

Digital Transformation in Educational Institutions: Developing a Sustainable Educational Management Framework for the Artificial Intelligence Era

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ABSTRACT:

Digital transformation in educational institutions has become one of the most significant issues in educational management in the twenty-first century, particularly in the context of generative artificial intelligence (AI), which has fundamentally transformed teaching and learning, data management, policy decision-making, and human capital development within educational organizations. This article aims to develop a sustainable educational management framework for the artificial intelligence era by employing a conceptual synthesis approach based on the literature on digital transformation, digital leadership, AI governance, intelligent educational infrastructure, future competency development, and sustainable development. The synthesis resulted in the development of the Sustainable AI-Driven Educational Management Framework (SAIEM Framework), which consists of six interrelated dimensions: (1) Strategic Digital Leadership, (2) AI Governance, (3) Intelligent Educational Infrastructure, (4) Human-AI Collaboration, (5) Future Competency Development, and (6) Sustainable Educational Outcomes.

The findings suggest that successful digital transformation should not regard technology as the ultimate objective of organizational development. Rather, technology should be viewed as a strategic enabler governed by ethical principles, transparency, accountability, and human-centered development. Furthermore, the proposed framework aligns closely with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 9 (Industry, Innovation and Infrastructure), and SDG 16 (Peace, Justice and Strong Institutions). The SAIEM Framework therefore provides both theoretical and practical contributions for educational leaders, policymakers, and researchers seeking to design sustainable, intelligent, and human-centered educational systems in the era of artificial intelligence.

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1. Introduction

Digital transformation in educational institutions extends far beyond the mere adoption of information technologies. Rather, it represents a comprehensive organizational transformation encompassing strategic vision, leadership, organizational structures, institutional culture, data governance, and long-term value creation. Vial (2019) conceptualized digital transformation as a process through which digital technologies fundamentally reshape organizational structures, business models, and value creation mechanisms. Within the educational sector, this transformation is even more complex because educational institutions are responsible not only for improving learning quality but also for ensuring educational equity, protecting data privacy, and fostering human capability development.

The rapid emergence of generative artificial intelligence technologies—including ChatGPT, Gemini, Copilot, and Claude has accelerated educational digital transformation worldwide. Educational institutions are increasingly integrating AI into teaching and learning, assessment systems, student analytics, academic advising, administrative services, and strategic decision-making processes. Nevertheless, UNESCO emphasizes that the implementation of generative AI in education and research must be guided by human-centered policies that prioritize ethical principles, data protection, and the continuous professional development of teachers

and learners (UNESCO, 2023).

Similarly, the Organisation for Economic Co-operation and Development (OECD) has proposed the OECD Principles on Artificial Intelligence, highlighting that AI should promote innovation while simultaneously respecting human rights, democratic values, transparency, accountability, and organizational responsibility (OECD, 2019). These principles have profound implications for educational institutions because artificial intelligence is no longer merely a technological tool; it has become a strategic technology capable of influencing organizational decision-making, educational equity, governance practices, and the evolving roles of teachers, educational leaders, and learners.

Consequently, digital transformation in the AI era must move beyond a technology-centered transformation toward a human-centered and AI-governed transformation. This paradigm shift requires educational institutions to govern technological innovation through robust ethical standards, transparent governance mechanisms, organizational accountability, and sustainable development principles. Against this backdrop, this article proposes the Sustainable AI-Driven Educational Management Framework (SAIEM Framework) as an integrated conceptual framework for explaining and guiding educational management in the era of artificial intelligence.

Table 1. Differences Between Traditional Digital Transformation and AI-Driven Digital Transformation in Educational Institutions

Dimension	Traditional Digital Transformation	AI-Driven Digital Transformation
Primary Focus	Adoption of digital technologies and information systems	AI-enabled educational management, decision-making, and innovation
Role of Data	Descriptive reporting	Predictive analytics and intelligent decision support
Leadership Role	Digital management	AI-driven strategic leadership
Major Challenges	Technological readiness and digital skills	AI ethics, algorithmic bias, transparency, data privacy, and accountability
Strategic Goal	Organizational efficiency	Sustainable, equitable, ethical, and intelligent educational development

Dimension	Traditional Digital Transformation	AI-Driven Digital Transformation
Relationship with SDGs	Indirect contribution	Direct contribution to SDGs 4, 9, and 16

2. Research Gap

A review of the existing literature indicates that research on digital transformation in educational institutions continues to exhibit at least five major limitations.

First, a considerable body of research primarily focuses on the application of digital technologies to support teaching and learning processes, including online learning, learning management systems (LMSs), learning analytics, and various digital learning tools. However, comparatively limited attention has been given to organizational transformation, strategic leadership, institutional governance, and data governance as essential drivers of successful digital transformation (Bond et al., 2021; Vial, 2019).

Second, research on Artificial Intelligence in Education (AIED) has predominantly examined AI applications at the classroom level, such as intelligent tutoring systems, automated feedback, and adaptive learning. Relatively few studies have explored the strategic role of AI in institutional management, policy formulation, organizational decision-making, and enterprise risk management within educational organizations (Holmes et al., 2022; Zawacki-Richter et al., 2019).

Third, many existing conceptual frameworks for digital educational management were developed prior to the widespread emergence of Generative AI. Consequently, these frameworks are insufficient to explain several contemporary issues, including AI governance, algorithmic accountability, human–AI collaboration, AI literacy, and predictive educational management, all of which have become increasingly significant in the post-generative AI era.

Fourth, although sustainability has become a central agenda in educational development, the relationship between digital transformation, artificial intelligence, and the United Nations Sustainable Development Goals (SDGs) remains underexplored. In particular, limited research has

examined how AI can effectively contribute to SDG 4 (Quality Education) while simultaneously preventing unintended consequences such as digital inequality, algorithmic bias, and violations of learners' rights.

Fifth, the majority of existing studies concentrate on describing the current state of digital transformation rather than proposing future-oriented conceptual frameworks capable of guiding the strategic development of educational institutions toward the period 2030–2035, during which artificial intelligence is expected to become deeply embedded in educational governance and institutional operations.

In response to these research gaps, this article proposes the Sustainable AI-Driven Educational Management Framework (SAIEM Framework), which integrates six interrelated dimensions: Strategic Digital Leadership, AI Governance, Intelligent Educational Infrastructure, Human–AI Collaboration, Future Competency Development, and Sustainable Educational Outcomes. The proposed framework provides a comprehensive conceptual foundation for understanding and guiding the sustainable transformation of educational institutions in the era of artificial intelligence by integrating technological innovation, ethical governance, organizational capability, human-centered development, and long-term sustainability.

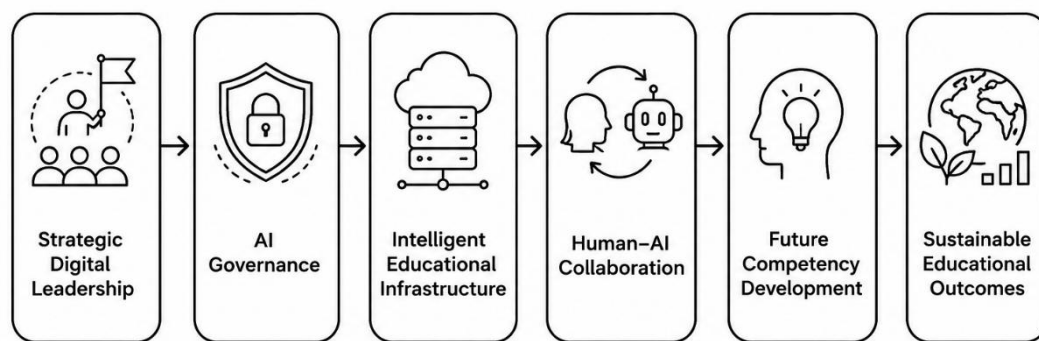


Figure 1. Preliminary Conceptual Framework of the SAIEM Framework

3. Literature Review

3.1 Digital Transformation in Educational Institutions

Digital transformation in educational institutions is a far more complex process

than simply adopting digital technologies or implementing online platforms. Rather, it represents a systemic organizational transformation that encompasses changes in the mindsets of educational leaders, teachers, staff, and students, as well as the redesign of institutional processes to support data-driven decision-making (Vial, 2019). At the institutional level, successful digital transformation should comprise four fundamental components: strategic digital vision, digital infrastructure, an innovation-oriented organizational culture, and continuous competency development for educational personnel.

Nevertheless, many digital transformation initiatives fail because technology is

often perceived as a procurement project rather than an organizational transformation process. Consequently, educational institutions should shift their focus from asking "What technologies should we adopt?" to asking "How can technology create educational value, and how can it be governed to minimize potential negative consequences?" This strategic shift emphasizes that digital transformation should be driven by institutional objectives rather than technological adoption alone.

3.2 Artificial Intelligence and Educational Management

Artificial intelligence (AI) has evolved from supporting classroom teaching and learning to playing an increasingly strategic role in institutional management. AI applications are now widely used for enrollment forecasting, student risk prediction, resource allocation, institutional performance evaluation, and executive decision support (Holmes et al., 2022). This evolution reflects a paradigm shift from "AI for Learning" toward "AI for Educational Management."

Despite its considerable potential, the integration of AI into educational

management also introduces significant challenges, including algorithmic opacity, bias arising from unrepresentative datasets, privacy violations, and excessive reliance on automated decision-making. UNESCO (2021, 2023) emphasizes that the development and deployment of AI in education should adhere to the principles of human rights, human dignity, transparency, fairness, and meaningful human oversight. Accordingly, educational institutions must ensure that AI complements rather than replaces human judgment in strategic and pedagogical decision-making.

3.3 Strategic Digital Leadership

Leadership is widely recognized as one of the most critical determinants of successful digital transformation. In the era of artificial intelligence, educational leaders are expected to possess at least five essential capabilities: establishing a strategic digital vision, managing organizational change, fostering a data-driven culture, promoting ethical

technology use, and continuously developing staff competencies (Westerman et al., 2014).

Therefore, contemporary educational leaders should not merely function as managers of digital technologies. Instead, they should become AI strategic leaders capable of integrating technological innovation with human values, ethical governance, and broader societal responsibilities. Such leaders must balance technological advancement with educational equity, institutional resilience, and sustainable organizational development. The findings of this study are consistent with the review by Qiumeng et al. (2025), which suggests that organizational success in the digital era does not stem from technology investment alone, but rather from collaborative leadership capable of creating a shared vision, connecting stakeholders, and developing a governance system that fosters collective learning and innovation. These findings support the concept of the SGD Framework, which views digital leadership and stakeholder participation as key foundations for digital governance and the sustainable development of educational institutions.

3.4 AI Governance

AI governance constitutes a fundamental prerequisite for the responsible adoption of artificial intelligence within educational institutions. It encompasses several key principles, including transparency, accountability, fairness, personal data protection, cybersecurity, and meaningful human oversight. According to the OECD (2019), trustworthy AI should respect human rights, democratic values, and the rule of law, while promoting innovation in a responsible and sustainable manner.

Within educational contexts, AI governance should operate across four interconnected levels: policy governance, data governance, teaching and learning governance, and assessment governance. These governance mechanisms are essential to ensuring that AI implementation enhances educational quality without exacerbating digital inequality or undermining the trust of educators, students, and other stakeholders.

3.5 Sustainable Development and the Sustainable Development Goals (SDGs)

Educational management in the artificial intelligence era should be closely

aligned with the United Nations Sustainable Development Goals (SDGs). In particular, SDG 4 (Quality Education) advocates equitable, inclusive, and high-quality education for all; SDG 9 (Industry, Innovation and Infrastructure) emphasizes technological innovation and resilient infrastructure; and SDG 16 (Peace, Justice and Strong Institutions) promotes transparent, accountable, and effective institutions. Furthermore, Huang, Chuangprakhon, and Santaveesuk (2024) found that organizational sustainability does not arise from the use of technology alone, but requires a transparent governance system, responsible data management, and stakeholder participation alongside the utilization of digital technologies. This helps strengthen trust, support knowledge transmission, and co-create sustainable value for society. These findings reflect that governance and participation are key mechanisms for sustainable organizational development and can be applied to educational organizations as well (Huang et al., 2024). This aligns with Wang, Chuangprakhon, Liu, Jian, and Santaveesuk (2024), who found that fostering collaboration among stakeholders and transparent governance are crucial factors for sustainable development, which is consistent with the concepts of Participatory Digital Ecosystem and Sustainable Educational Value within the SGD Framework.

Artificial intelligence has considerable potential to advance SDG 4 through

personalized learning, early-warning systems for identifying at-risk students, intelligent academic support, and expanded educational access. However, without appropriate governance mechanisms, AI may also contribute to digital divides, algorithmic bias, and data injustice. Consequently, sustainable educational development in the AI era must simultaneously address educational quality, equity, ethical governance, social responsibility, and institutional accountability.

Ultimately, sustainability in AI-driven education

should not be evaluated solely by technological advancement or operational efficiency. Rather, it should be assessed according to the extent to which AI contributes to human-centered

development, educational equity, ethical governance, and the long-term resilience of educational institutions.

Table 2. Alignment of the SAIEM Framework with the Sustainable Development Goals (SDGs)

Dimension of the Alignment with SAIEM Framework the SDGs		Examples of Practical Applications
Strategic Leadership	Digital SDG 4, SDG 16	Develop transparent, participatory, and strategic institutional AI policies and educational transformation plans.
AI Governance	SDG 16	Establish AI governance committees and implement institutional policies for data protection, ethical AI use, and accountability.
Intelligent Infrastructure	Educational SDG 9	Develop Big Data platforms, cloud computing, cybersecurity systems, and learning analytics infrastructure.
Human-AI Collaboration	SDG 4	Employ AI as a teaching and learning assistant to augment, rather than replace, educators.
Future Development	Competency SDG 4	Strengthen AI literacy, digital literacy, critical thinking, creativity, and lifelong learning competencies.
Sustainable Outcomes	Educational SDG 4, SDG 9, SDG 16	Promote educational quality, equity, organizational resilience, innovation, and sustainable institutional development.

4. Methodology

This article adopts a conceptual research approach based on conceptual synthesis of scholarly literature, policy reports, and previous studies related to digital transformation, artificial intelligence in education (AI in Education), educational leadership, AI governance, and sustainable educational management. The objective of the conceptual synthesis is to integrate existing theoretical perspectives into a comprehensive framework for sustainable educational management in the era of artificial intelligence.

The conceptual synthesis was conducted through the following four sequential stages:

1. Identification of key literature related to digital transformation and artificial intelligence in education
2. Classification of major conceptual domains and theoretical perspectives
3. Synthesis of common constructs and interrelationships across the identified literature; and
4. Development of the Sustainable AI-Driven Educational Management Framework (SAIEM Framework) and explanation of the relationships among its constituent dimensions.

Table 3. Conceptual Synthesis Matrix for the Development of the SAIEM Framework

Knowledge Domain	Key Concepts	Synthesized Components	SAIEM Dimension
Digital Transformation	Organizational transformation through digital technologies	Digital vision, organizational change management	Strategic Digital Leadership
Digital Leadership	Strategic leadership	Strategic direction, organizational culture, innovation leadership	Strategic Digital Leadership
AI Ethics / Responsible AI	Transparency, accountability, fairness	AI governance principles, ethical oversight	AI Governance
AI in Education	Learning analytics, adaptive learning, generative AI	Human–AI collaboration, AI-assisted educational practices	Human–AI Collaboration
Digital Infrastructure	Big Data, cloud computing, cybersecurity	Intelligent educational support systems, digital infrastructure	Intelligent Educational Infrastructure
Future Skills	AI literacy, critical thinking, creativity	Future competencies for educational personnel	Future Competency Development
Sustainability	Quality, equity, organizational resilience	Sustainable educational outcomes	Sustainable Educational Outcomes

5. Results of the Conceptual Synthesis: The SAIEM Framework

The conceptual synthesis resulted in the development of the Sustainable AI-Driven Educational Management Framework (SAIEM Framework), which provides an integrated conceptual model for managing educational institutions in the era of artificial intelligence. The framework comprises six interrelated dimensions, each representing a critical component of sustainable educational transformation.

5.1 Strategic Digital Leadership

Strategic Digital Leadership serves as the foundation for digital transformation

within educational institutions. Educational leaders must be capable of establishing a clear digital vision, fostering a learning-oriented organizational culture, and formulating policies

that support the ethical and responsible adoption of artificial intelligence. Beyond technological competence, strategic digital leaders are expected to guide institutional transformation, promote innovation, and cultivate organizational resilience in response to rapidly evolving technological environments.

5.2 AI Governance

AI Governance provides the institutional mechanisms necessary to ensure that artificial intelligence is implemented in a transparent, accountable, equitable, and ethically responsible manner while safeguarding the rights of learners, educators, and institutional stakeholders. This dimension encompasses data privacy policies, institutional guidelines for AI utilization, AI risk assessment, algorithmic auditing, regulatory compliance, and mechanisms for continuous monitoring and human oversight. Effective AI

governance establishes trust in AI-assisted educational processes and promotes responsible innovation across educational institutions. Furthermore, Zhou, Chuangprakhon, Santaveesuk, and Han (2024) found that the application of digital technology enhances the efficiency of data storage, knowledge dissemination, and accessibility for learners and the general public. However, the researchers indicated that the use of technology will yield sustainable benefits only when accompanied by an appropriate data governance system, intellectual property protection, data accuracy preservation, and the establishment of shared digital data management standards. These findings support the concept of Data and AI Governance within the SGD Framework, which focuses on governing data and technology with governance principles to co-create sustainable educational value.

5.3 Intelligent Educational Infrastructure

Intelligent Educational Infrastructure refers to the technological ecosystem that enables AI-driven educational management. This infrastructure includes Big Data platforms, cloud computing, learning analytics, cybersecurity systems, and AI-enabled digital platforms that integrate teaching and learning, institutional administration, quality assurance, and strategic decision-making. Such infrastructure provides educational institutions with real-time information, predictive insights, and intelligent services that enhance operational effectiveness and institutional adaptability.

5.4 Human–AI Collaboration

Educational institutions should not regard artificial intelligence as a substitute for teachers, administrators, or educational professionals. Instead, AI should function as a strategic partner that augments human capabilities and supports professional decision-making. Examples include AI teaching assistants, AI academic advisors, AI-

powered learning support systems, and AI-based decision-support systems for educational management. Human–AI collaboration emphasizes complementarity rather than replacement, ensuring that human judgment, ethical reasoning, and educational values remain central to institutional decision-making.

5.5 Future Competency Development

Sustainable digital transformation can only be achieved when educational personnel and learners possess the competencies required for the AI era. These competencies include AI literacy, data literacy, digital ethics, critical thinking, creativity, collaboration, problem-solving, adaptability, and lifelong learning. Educational institutions should therefore redesign curricula, professional development programs, and organizational learning strategies to equip individuals with the knowledge and skills necessary to thrive in increasingly intelligent and technology-rich educational environments.

5.6 Sustainable Educational Outcomes

The ultimate objective of the SAIEM Framework is to establish an educational system that is high-quality, equitable, resilient, transparent, and sustainable. Within this framework, technology is viewed as an enabler of human development rather than an end in itself. Sustainable educational outcomes are reflected not only in improved institutional performance and learning achievement but also in educational equity, organizational resilience, ethical governance, and the long-term capacity of educational institutions to respond effectively to technological and societal change. Ultimately, the SAIEM Framework advocates a human-centered approach to AI, ensuring that technological advancement strengthens rather than diminishes human values, educational integrity, and sustainable development.

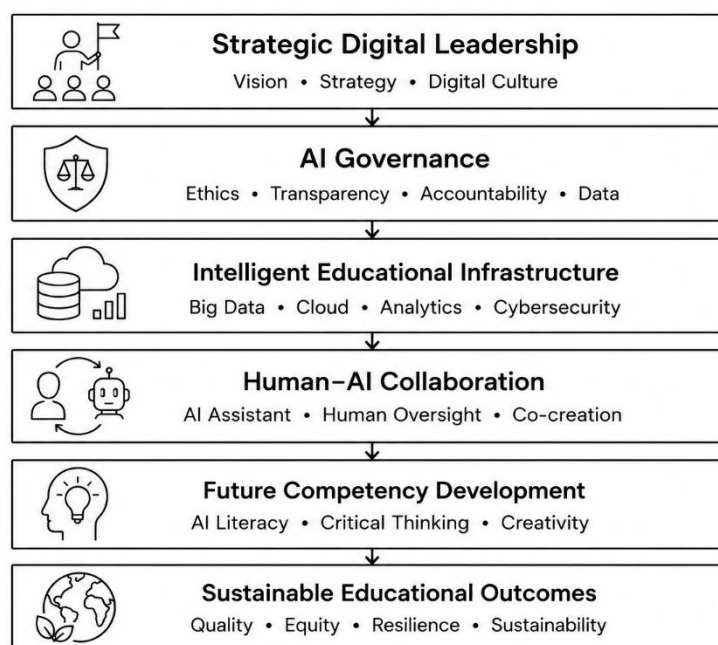


Figure 2. The Sustainable AI-Driven Educational Management Framework (SAIEM Framework)

6. Discussion

The proposed Sustainable AI-Driven Educational Management Framework (SAIEM Framework) demonstrates that successful digital transformation in educational institutions cannot be achieved solely through investments in digital technologies. Instead, sustainable transformation requires the integration of strategic digital leadership, effective AI governance, intelligent educational infrastructure, human capital development, and sustainability-oriented institutional goals.

A key finding of this study is that educational management is evolving from the concept of the "Digital Institution" toward that of the "Sustainable Intelligent Institution." In this emerging paradigm, educational institutions are expected to leverage data and artificial intelligence to enhance teaching quality, learning effectiveness, and organizational decision-making while simultaneously preserving human values, educational equity, ethical responsibility, and social accountability. The study by Alias, Yusof, Rasli, Ismail, Nordin, Ishak, Prestianawati, Abas, and Jamaludin (2023) supports these findings,

revealing that the strength of university governance plays a vital role in enhancing the integrity, accountability, and credibility of academic personnel. A transparent governance system, ethical leadership, and clear risk management mechanisms are key factors that elevate the performance of higher education institutions and build trust among stakeholders.

From a theoretical perspective, the SAIEM Framework extends the traditional concept of digital transformation by incorporating two increasingly important dimensions in the era of Generative AI: AI governance and sustainability. Unlike conventional digital transformation models, which primarily emphasize technological adoption, the SAIEM Framework integrates technological innovation with ethical governance, organizational resilience, and sustainable educational development.

From a practical perspective, the framework provides educational leaders and policymakers with a comprehensive guideline for assessing institutional readiness, formulating AI strategies, strengthening digital governance, and developing policies related to data management, AI ethics,

and responsible technology adoption. Consequently, the framework serves not only as a theoretical contribution but also as a practical management tool for educational institutions navigating digital transformation in the age of artificial intelligence.

7. Policy Implications

Based on the findings of this study, the following policy recommendations are proposed to support sustainable educational transformation in the era of artificial intelligence:

1. Educational institutions should formulate institution-wide AI strategies that align

technological innovation with educational goals and long-term organizational development.

2. Dedicated AI Governance Committees should be established to oversee AI

implementation, ethical compliance, risk management, and institutional accountability.

3. AI literacy should be systematically developed among educational leaders, teachers,

staff, and students to strengthen digital competencies and responsible AI utilization.

4. Educational institutions should invest in secure, resilient, and inclusive digital

infrastructure, including cloud computing, cybersecurity, learning analytics, and intelligent information systems.

5. AI implementation should be aligned with the United Nations Sustainable

Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 9 (Industry, Innovation and Infrastructure), and SDG 16 (Peace, Justice and Strong Institutions).

6. Comprehensive evaluation mechanisms should be established to assess the impact of

AI on educational quality, equity, transparency,

accountability, and ethical governance, ensuring that technological advancement contributes to sustainable educational development.

8. Conclusion

This article proposes the Sustainable AI-Driven Educational Management Framework (SAIEM Framework) as a comprehensive conceptual framework for understanding and guiding sustainable educational management in the era of artificial intelligence. The framework comprises six interrelated dimensions: Strategic Digital Leadership, AI Governance, Intelligent Educational Infrastructure, Human-AI Collaboration, Future Competency Development, and Sustainable Educational Outcomes.

The principal contribution of this study is the recognition that digital transformation in the AI era should not focus solely on technological efficiency or digital adoption. Instead, educational transformation should pursue the development of high-quality, equitable, transparent, resilient, and sustainable educational systems in which artificial intelligence serves as a strategic enabler of human development rather than a replacement for human judgment.

By integrating digital transformation, responsible AI governance, institutional leadership, future competencies, and sustainable development into a unified conceptual framework, the SAIEM Framework offers both a theoretical foundation and a practical roadmap for educational institutions seeking to navigate the challenges and opportunities of artificial intelligence. Furthermore, the framework provides valuable guidance for future research, policy formulation, and institutional practice aimed at building human-centered, intelligent, and sustainable educational organizations capable of responding effectively to the rapidly evolving digital landscape.

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