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Artificial Intelligence in High School Tourism Education

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Abstract: This study examines the systemic feasibility of integrating Artificial Intelligence (AI) into high school tourism education in resource-constrained contexts, focusing on the uMgungundlovu District of KwaZulu-Natal, South Africa, as a qualitative case study. Drawing on open-ended responses from 15 purposively selected tourism educators, the study applies Rogers' Diffusion of Innovations (DOI) theory to examine how infrastructural readiness, curriculum alignment, professional capacity, and ethical governance shape educators' perceptions of AI adoption. Framed as a qualitative exploratory study, the study collected data via online open-ended questionnaires from educators in both urban and rural schools with varying resource levels. The findings indicate that AI adoption is highly contingent on basic infrastructure constraints. Although educators recognize AI's potential to improve student engagement and industry relevance, limitations in digital infrastructure, professional development, curriculum guidance within the CAPS framework, and ethical concerns hinder its implementation. The study argues that AI integration is not merely a pedagogical shift but a complex challenge of governance and systems readiness. By framing AI adoption through the lens of educational equity, the paper proposes a phased, context-sensitive policy framework. This approach aligns tourism education with Sustainable Development Goals 4 (Quality Education) and 8 (Decent Work and Economic Growth) in low-resource secondary environments.

Keywords: artificial intelligence (AI); educational equity; sustainable development goals; technology integration; tourism education

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Introduction

Artificial intelligence (AI) has become a transformative force in the tourism industry, reshaping destination marketing, customer relationship management, predictive analytics, and personalized service delivery. These developments necessitate new competencies among tourism professionals, including digital proficiency, data-informed decision-making, and engagement with automated systems (Altun et al., 2023; Skavronskaya et al., 2023). Consequently, tourism education faces growing pressure to align curricula and pedagogical practices with the realities of the technologically mediated industry. The existing literature largely addresses this transformation in higher education contexts, where institutional autonomy, technological infrastructure, and industry partnerships facilitate experimentation with AI-enabled learning tools, such as adaptive platforms

and simulation systems (Benuyenah, 2023). However, a clear gap remains in secondary education, especially in high school tourism curricula in low- and middle-income settings. High school curricula are usually guided by strict policy frameworks, limited by funding shortages, and marked by uneven digital infrastructure. These structural factors influence not only the practicality of technology adoption but also its integration into formal assessments and teaching methods. In South Africa, spatial and socioeconomic inequalities worsen these issues, creating significant disparities in connectivity, access to hardware, and educator training between urban and rural schools. While national policies increasingly promote digital growth and future-focused skills, many institutions still face connectivity issues, device shortages, and insufficient subject-specific training (Mhlanga, 2024). The Tourism Curriculum and Assessment Policy Statement (CAPS), the national curriculum framework governing the subject, encourages the use of digital tools. However, it offers little practical guidance on integrating advanced technologies, such as AI, into learning objectives, assessment standards, and classroom practices.

This study bridges these gaps by framing AI integration in high school tourism education as a matter of governance and system readiness, rather than simply as the provision of technology. It investigates the research question: How do institutional, curricular, and professional factors influence educators' perceptions of the feasibility and legitimacy of incorporating artificial intelligence into high school tourism programs?

Focusing on the uMgungundlovu District in KwaZulu-Natal, the study examines how systemic governance conditions shape educators' perceptions of AI's relative advantage, compatibility, complexity, trialability, and observability—the five core adoption attributes articulated in Rogers' (2003) Diffusion of Innovations (DOI) theory. By extending DOI analysis to the institutional rather than purely individual level, the study contributes a meso-level governance framework for understanding technology diffusion in a regulated, resource-constrained schooling system.

Literature review

Artificial Intelligence (AI), including Virtual Reality (VR), Augmented Reality (AR), and adaptive data analytics, offers great potential to bridge the gap between theory and practice in tourism education. By simulating real-world environments in hospitality, destination planning, and customer service, these tools promote experiential learning and digital literacy (Skavronskaya et al., 2023; Alyasiri et al., 2024). They provide learners with immersive, low-risk experiences that replicate professional realities. Additionally, AI-based adaptive systems personalize instruction by adjusting to performance metrics, engagement trends, and knowledge gaps (Alyasiri et al., 2024). Higher education research indicates that such systems enhance student motivation, digital skills, and industry relevance (Busulwa et al. 2024; Benuyenah, 2023), thereby supporting tourism workforce goals focused on technical skills and problem-solving in digital service settings. However, the transferability of these benefits to secondary school contexts remains empirically underexplored. Secondary tourism curricula operate under substantially different constraints: prescriptive national frameworks delimit learning objectives and assessment standards, resource scarcity limits access to immersive technologies, and assessment accountability structures discourage pedagogical experimentation. These conditions restrict AI's experiential and adaptive applications, rendering the optimistic findings from tertiary research of limited direct applicability to high school contexts.

The educational technology literature consistently identifies reliable infrastructure and robust educator competence as foundational prerequisites for meaningful digital innovation. International policy frameworks, including UNESCO (2021) and the World Economic Forum (2020), emphasise connectivity, device access, and institutional technical support as non-negotiable conditions for successful technology integration. In under-resourced schools, unreliable internet, limited devices, and insufficient support structures hinder even basic digital practices, making the adoption of advanced technologies more aspirational than practical. In South African high school tourism education, disparities in resource distribution reinforce spatial inequalities between urban and rural schools, shaping perceptions of feasibility and utility (Mamatzakis et al., 2023). Beyond infrastructure, professional capacity is an equally critical determinant of adoption. Educators' perceptions of technological complexity and institutional support influence their willingness to adopt new tools, particularly in applied disciplines that require integrating sector-specific knowledge with digital practice (Kimmons et al. 2020). Critically, professional development initiatives addressing AI integration remain concentrated in higher education, leaving secondary educators without structured subject-specific guidance and contributing to fragmented, uneven adoption trajectories.

Curriculum authority plays a crucial role in legitimizing pedagogical innovation. While broad national education policies in South Africa increasingly endorse technology-enhanced learning, they lack the specificity needed to

embed AI-related practices within accountability systems. The CAPS framework for tourism encourages the use of technology but articulates no AI-specific learning outcomes, approved pedagogical approaches, or assessment benchmarks. This lack of clarity shifts the responsibility for interpretation and implementation to individual educators and schools, leading to inconsistent practices. From a governance perspective, this gap reveals a broader tension between national digital transformation strategies and the operational realities of school systems. Without clear policy structures that connect curriculum development, educator training, and resource allocation, AI adoption risks remaining superficial rather than meaningful.

Generative AI presents multidimensional ethical challenges in educational settings, including threats to academic integrity, data privacy risks, and the potential erosion of critical thinking skills essential to cultural and service-oriented fields like tourism (Tanveer et al., 2020). Without formal institutional guidelines, educators face not only classroom management issues but also questions regarding professional authority and assessment credibility. Williamson's et al. 2020show that such ethical concerns can discourage the adoption of innovative teaching methods, even when AI tools clearly enhance access to learning. For high school educators, this challenge extends beyond classroom management to questions of professional authority and responsibility. The lack of formal ethical guidelines and institutional policies can lead to resistance to the adoption of AI-supported teaching methods and hinder experimentation.

AI in tourism education is advocated to advance the SDGs, particularly SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth). However, this link needs careful examination rather than blind acceptance. Although AI-powered systems can, in theory, support personalized learning and workforce-related skill development, their impact on these goals depends on governance, curriculum authority, and sufficient institutional capacity. For SDG 4, AI has the potential to create personalized learning environments, but its effectiveness depends on proper curriculum alignment and oversight; without these, its impact remains superficial (Opesemowo & Adekomaya, 2024). For SDG 8, AI facilitates access to digital platforms and analytics essential for modernizing the tourism workforce, but in under-resourced settings, uncoordinated implementation risks reinforcing inequalities rather than alleviating them (Boeren, 2019; Hanemann, 2019). Consequently, this study redefines AI as a governance-dependent innovation, whose developmental impact is more influenced by systemic readiness than by technological availability alone.

Theoretical framework

This study employs Rogers' (2003) Diffusion of Innovations (DOI) theory as its analytical framework, adapting its five adoption attributes for institutional rather than purely individual application. In its original formulation, DOI suggests that the adoption of innovations is driven by adopters' subjective assessments of: relative advantage (the perceived benefit over existing practice); compatibility (alignment with existing values, norms, and needs); complexity (perceived difficulty of understanding and use); trialability (the possibility of limited-scale experimentation); and observability (the visibility of outcomes to others).

This study extends DOI to the meso-level of educational governance, viewing schools as organisational actors situated within regulatory ecosystems rather than as collections of independent decision-makers. Within this institutional adaptation, each DOI attribute is defined as follows:

- Relative advantage is measured by AI's ability to enhance curriculum delivery quality and better align with industry standards within the constraints of CAPS. An innovation that clearly offers pedagogical and systemic benefits compared to current practices is more likely to gain institutional support.
- Compatibility is examined in terms of alignment between AI tools and existing teaching methods, assessment systems, and curriculum policy, rather than individual educator beliefs or preferences (Kimmons et al. 2020). Incompatibility is viewed as a governance construct arising from policy ambiguity rather than purely from technological mismatch.
- Complexity is understood both technically and professionally, including educators' AI literacy, available institutional support structures, and the clarity of regulatory expectations. High perceived complexity, especially when professional development and technical infrastructure are limited, is likely to hinder institutional adoption.
- Trialability refers to the ability to conduct pilot-scale experiments and formal tests within institutional settings, including access to approved platforms, supported trial designs, and moderated assessment pathways.

- Observability concerns the institutional visibility of AI integration outcomes, including peer-accessible success cases, diffusion-supporting guidance documents, and evidence shared through formal professional networks (Altun et al., 2023; Zawacki-Richter et al. 2019).

By shifting analytical focus from individual educator agency to the structural conditions that mediate adoption decisions, this framework acknowledges that in centralised, policy-driven schooling systems, diffusion is fundamentally a conditional process shaped by regulatory authority, resource allocation, and institutional legitimacy. This perspective is particularly consequential for analysing technological change in resource-constrained developing economy contexts, where standardised schooling systems face distinctive systemic pressures that conventional micro-level DOI analyses are ill-equipped to illuminate.

Methodology

This study employed an interpretive qualitative case study design to investigate the institutional factors shaping AI integration in high school tourism education in the uMgungundlovu District of KwaZulu-Natal, South Africa. The case study method was selected for its capacity to generate contextually grounded, in-depth analysis of how policy structures, infrastructural conditions, and professional practices interact to shape educators' experiences and perceptions (Yin, 2014). This approach enables the production of analytical insights that quantitative methods would obscure, particularly regarding the relational and governance dimensions of technology adoption in complex institutional environments.

A total of fifteen high school tourism educators were purposively selected from schools representing diverse geographic and socioeconomic contexts within the district. Participants were drawn from both urban (n = 8) and rural (n = 7) schools, with varying levels of access to digital infrastructure. Inclusion criteria required current teaching responsibility in tourism subjects and familiarity with digital technologies to ensure relevance to the discourse on AI integration. Sampling prioritized informational depth and contextual diversity rather than statistical representation (Patton 2015). Sample adequacy was assessed through thematic saturation rather than a numerical target (Guest et al. 2006).

Data were gathered through an open-ended qualitative online questionnaire distributed via email and messaging platforms, including WhatsApp and institutional email systems. This approach was chosen for its ability to generate reflective, detailed responses from participants across geographically separated schools. Online questionnaires support self-paced completion, increasing participant convenience and encouraging thoughtful input, which is especially useful in qualitative research seeking to capture in-depth perceptions (Braun et al. 2021). The questionnaire focused exclusively on educators' perceptions of AI integration feasibility and governance conditions; no student data or AI-generated learner content was collected. This deliberate scope minimised ethical risks associated with learner privacy and vulnerability, consistent with institutional ethics review guidelines and the principle of non-maleficence (Regmi et al. 2010).

Data were analysed using the six-phase thematic analysis framework developed by Braun and Clarke (2006). The analytical process was iterative, integrating inductive and deductive elements to ensure both empirical grounding and theoretical coherence:

- Phase 1: Familiarisation. All responses were read multiple times to develop a holistic understanding of educator perspectives. Analytical memos captured emerging patterns, contextual cues, and reflexive observations regarding researcher assumptions.
- Phase 2: Initial Coding. Open coding was conducted manually to identify meaning units grounded in participants' language, preserving contextual variation between urban and rural school settings.
- Phase 3: Code Refinement and Categorization. Codes were checked for redundancy and grouped into provisional categories through axial coding, with ongoing comparison across cases to identify shared and distinct patterns. Coding was done independently by the first author and then reviewed together to ensure consistency in interpretation.
- Phase 4: Theme Development. Categories were synthesised into broader themes reflecting systemic governance conditions influencing AI adoption. Themes were validated against the full dataset for internal coherence and external distinctiveness.
- Phase 5: Theoretical Integration. Rogers' (2003) DOI framework was applied deductively as an interpretive lens to examine how emergent themes mapped onto the five adoption attributes at the institutional level. The framework guided conceptual interpretation without foreclosing inductive category development.

- Phase 6: Validation and Trustworthiness. Credibility was enhanced through member checking with five participants and peer debriefing. A comprehensive audit trail documented all coding decisions and the steps in theme development. Thematic saturation was reached when no new conceptual categories emerged in the final three cases, confirming adequate data sufficiency.

This study does not aim for statistical generalizability; it offers analytical transferability to educational contexts with similar structural features, such as limited infrastructure, standardized curriculum governance, and constrained professional development systems (Lincoln and Guba 1985). Major limitations include a focus on a single district and reliance on self-reported data, which may introduce subjectivity and reporting bias. Nevertheless, the methodology is well-suited to generating context-specific insights into how systemic factors shape AI adoption in under-resourced educational settings. Consistent with qualitative case study methodology, the sample size was determined by reaching thematic saturation rather than by statistical representativeness. Redundancy in analysis across institutional types (urban and rural schools) was observed by the twelfth response and confirmed in the last three cases (Guest et al., 2006).

Findings

This section provides thematically integrated insights from the coding process, interpreted through Rogers' (2003) Diffusion of Innovations (DOI) framework within an institutional setting. Instead of viewing barriers as separate or additive, the findings show how infrastructure, curriculum governance, professional capacity, and ethical regulation work as interconnected diffusion factors that influence the perceived legitimacy and feasibility of artificial intelligence (AI) in standardized schooling systems.

Infrastructure governance and pedagogical feasibility

Educators consistently view digital infrastructure as the foundation of meaningful pedagogical innovation. They see it not just as a technical tool but as a governance mechanism that limits the range of possible experimentation. Ongoing challenges such as unreliable internet connections, shortages of shared devices, and equipment vulnerable to theft or damage are often cited as barriers to AI integration, particularly in rural schools where electricity remains unreliable. This highlights how a lack of infrastructure transforms AI from a practical resource into an ideal that's difficult to achieve. From a DOI perspective, these governance shortcomings directly hindered trialability, the capacity to experiment on a limited scale, and observability, as educators lacked consistent platforms to test AI-driven lessons or to showcase tangible results to colleagues. In urban schools with slightly better access (e.g., shared computer labs), initial trials were conducted, including the use of free AI chatbots for basic destination questions. However, even these efforts were constrained by bandwidth limitations, resulting in inconsistent implementation. Overall, the findings highlight that insufficient infrastructural oversight functions as a structural constraint that stifles the trialability of AI, creating a diffusion barrier across the district.

Professional capacity, complexity, and institutional support

Perceived complexity was driven more by gaps in subject-specific professional development than by technological difficulty. Participants noted the lack of AI training tailored to tourism, observing that generic digital workshops offered limited pedagogical relevance. One educator noted that, without guidance on integrating AI into CAPS topics, integration could disrupt mandated teaching schedules. This institutional gap led to a reliance on informal self-learning networks that lacked sustainability. In terms of DOI, complexity was heightened by fragmented support structures, leading to sporadic, isolated experimentation rather than integrated practice. Professional development capacity, therefore, served as a governance mechanism that shaped whether AI was viewed as an instructional opportunity or an accountability risk. These findings underscore that professional capacity functions as a governance tool: without formalized, subject-specific development pathways, educators view AI as a liability to their accountability, which discourages its integration into core assessment activities.

Curriculum governance, compatibility, and policy legitimacy

The absence of explicit AI-related learning outcomes or assessment guidance within CAPS significantly limited educators' willingness to incorporate AI into formal teaching and assessment. Participants indicated that this policy gap reduced AI activities to mere supplemental tools, detached from accountable learning objectives. Without official curriculum support, educators hesitated to include AI in assessment tasks, citing concerns about the credibility of moderators and potential accountability issues. This significantly reduced the perceived compatibility and advantage of AI integration: innovations without institutional recognition provided little

incentive for adoption in accountability-heavy schooling environments. Educators in both urban and rural settings reported this barrier, though their responses varied; some urban teachers cautiously experimented without disclosure, while others avoided AI altogether. These results highlight curriculum governance as a key structural gatekeeper whose policy legitimacy, or lack thereof, more strongly influences diffusion than the inherent pedagogical benefits.

Conditional relative advantage and industry alignment

Despite systemic constraints, educators widely recognized AI's potential to improve experiential learning and better align tourism education with evolving industry standards. Promising applications included chatbot-driven customer service simulations, demand forecasting exercises, and AI-supported itinerary planning. These tools were viewed as advancing workforce readiness and increasing student engagement with current industry practices. However, perceived relative advantage was consistently conditional rather than inherent. AI-enabled activities not linked to assessed curriculum outcomes were routinely deprioritized under instructional time pressure, regardless of their pedagogical merit. In under-resourced schools, infrastructural constraints further reduced perceived benefit. Relative advantage, therefore, appeared to be institutionally constructed, relying on governance alignment, assessment recognition, and operational practicality, rather than being an intrinsic property of the technology itself.

Ethical regulation, observability, and institutional risk

Ethical concerns extended beyond classroom management, covering issues of institutional responsibility and professional risk. Participants showed significant uncertainty about academic honesty, learner data privacy, and the cognitive dependency risks associated with generative AI, especially in the absence of formal policy guidelines from the Department of Basic Education (DBE). This regulatory ambiguity discouraged visible experimentation, substantially reducing the observability of AI integration across the district. Risk perceptions varied by context: some educators adopted transparency strategies, such as requiring learners to disclose their use of AI, while others avoided integration altogether pending formal policy clarification. This pattern shows how unresolved ethical governance reduces observability as a driver of diffusion: educators are hesitant to showcase potentially unauthorized innovations, breaking the peer visibility chain that DOI theory considers crucial for broader adoption.

Structural inequality and differential diffusion paths

Overall, the findings reveal stratified diffusion patterns that reflect and reproduce broader structural inequalities. Urban schools showed early-adopter qualities, supported by relatively greater resources, peer visibility, and professional social capital. In contrast, under-resourced rural schools faced increasing barriers that greatly limited experimentation and visibility. Instead of acting as an equalizing force, AI adoption risked widening existing inequalities by concentrating innovation capacity in already better-resourced settings. These patterns reveal that access to favourable DOI attributes, especially trialability and compatibility, is unevenly spread across different types of institutions and geographic areas. Diffusion in this context is non-linear, governance-dependent, and structurally varied, emphasizing the need for targeted, equity-focused systemic interventions to prevent AI from deepening the educational gaps it aims to address.

Discussion

This study advances understanding of AI integration in secondary tourism education by demonstrating that adoption primarily functions as a governance-mediated diffusion process rather than a technology-driven instructional choice. Interpreting findings through an institutional application of DOI theory shows that perceived relative advantage, compatibility, complexity, trialability, and observability are structurally influenced by curriculum authority, infrastructural support, professional development ecosystems, and ethical regulation. This perspective shifts focus from individual educators' readiness to systemic conditions that establish the legitimacy of innovation within standardized schooling environments.

The existing literature on AI in tourism education often highlights pedagogical benefits such as personalization, experiential learning through simulations, and better alignment with industry (Altun et al., 2023; Benuyenah, 2023; Skavronskaya et al., 2023). These advantages are well-established in higher education research. The present study, however, demonstrates that in regulated secondary systems, the adoption threshold is not technological capability but formal curriculum alignment and policy legitimacy. Educators assessed AI integration not

primarily on instructional effectiveness but on its coherence with curricular authority and assessment accountability structures. Without explicit CAPS endorsement, AI remains institutionally tolerated only marginally, at best, and actively discouraged at worst. This finding extends DOI theory by redefining compatibility as a regulatory construct within centralized governance systems, rather than as a function of individual user perceptions or technological features. Policy ambiguity leads to interpretive divergence across institutions, resulting in inconsistent adoption and exposing educators to unequal levels of institutional risk. Reconceptualizing compatibility in governance terms has direct implications for how innovation adoption is theorized and supported in policy-rich educational environments.

Traditional DOI interpretations view complexity as an inherent trait of the innovation itself (Rogers, 2003). The present findings challenge this assumption. Perceived complexity was not primarily a function of AI's technical difficulty. Still, it resulted from fragmented professional development pathways, the absence of guidance on tourism-specific integration, and unclear regulatory expectations regarding assessment validity and instructional accountability. Educators confronted complexity not as a technical challenge but as an institutional risk, the risk of accountability exposure arising from adopting practices unsupported by formal policy. This reframing aligns with broader scholarship that conceptualizes digital transformation in education as socially and structurally built rather than solely determined by technology. Therefore, addressing perceived complexity requires systemic governance interventions, such as developing structured, subject-specific professional development pathways, providing clear guidance on CAPS integration, and establishing formal accountability frameworks, rather than simply simplifying tools. Without such governance support, complexity remains a persistent barrier to diffusion, hindering trialability and observability, which are crucial for broader adoption.

Participants widely recognized AI's potential to improve experiential learning and industry relevance, strengthening the connection between tourism education and current labour market needs (Altun et al., 2023; Skavronskaya et al., 2023). However, the perceived advantage was consistently conditional: pedagogical benefits not reflected in assessed curriculum outcomes were routinely deprioritized due to instructional time limits and accountability pressures, regardless of their professional development value. This condition shows that institutional incentives influence diffusion decisions more strongly than the intrinsic instructional value. The findings reveal a disconnect between the speed of industry-driven technological change and the pace at which curriculum governance responds to it. This gap has serious implications not only for teaching quality but also for South African secondary tourism education's ability to prepare students with the digital skills needed in a rapidly changing industry, and thus support SDG 8 commitments.

The study challenges deterministic views of AI as a natural equalizer by showing that resource disparities influence diffusion pathways. Urban schools, with their superior infrastructure, social capital, and peer visibility networks, serve as early adopters. Rural and under-resourced schools, facing growing governance challenges, encounter obstacles that hinder significant experimentation. Without targeted, governance-led redistributive efforts, AI integration risks exacerbating educational and workforce inequalities instead of reducing them. These patterns challenge critiques of technocentric educational reform that see technology provision as enough for equitable change (Boeren, 2019). Equitable innovation must, at a minimum, address key social and institutional issues, connectivity, device access, professional development, and curriculum support before technology-specific interventions can achieve their intended benefits.

This study reconceptualises DOI at the meso-level, arguing that in centralised schooling systems, innovation attributes are institutionally constructed through governance structures rather than individually perceived. In this framework, innovation attributes are not inherent to a technology but are institutionally shaped through the interaction of curriculum authority, accountability systems, resource management, and professional development structures.

Compatibility was redefined as a function of policy-curriculum alignment rather than individual belief; complexity as arising from fragmented governance rather than technical difficulty; trialability as constrained by infrastructural governance; observability is constrained by ethical regulatory ambiguity; and relative advantage as contingent on formal assessment recognition. This institutional reconceptualization enhances DOI's explanatory power in centralized, resource-limited schooling systems where institutional directives significantly override individual agency in shaping adoption decisions.

Considering the study's framing of AI integration as a conditional, governance-driven process, successful implementation in high school tourism education requires coordinated actions across institutions rather than

isolated efforts by schools or educators. These implications include governance structures, curriculum development, professional capacity building, ethical oversight, and equity considerations. They directly address the interconnected barriers identified in the findings, such as infrastructure deficits, policy ambiguity, professional gaps, ethical risks, and structural inequalities, while leveraging attributes of DOI theory to promote sustainable and equitable adoption. Recommendations are prioritized for practical application in resource-constrained South African contexts and focus on collaboration among the Department of Basic Education (DBE), provincial education departments, educator unions, industry partners, and higher education institutions.

Governance-oriented implementation framework

The framework is intentionally phased and iterative, acknowledging that phases overlap and require ongoing feedback loops, pilot evaluations, and adaptive adjustments for sustainability. It draws directly on the empirical themes and institutional DOI analysis, establishing foundational readiness as essential before proceeding to operationalization and regulation. This sequential yet flexible approach reduces the risk of superficial adoption and promotes conditional innovation.

Phase 1: Foundational readiness

This phase establishes the minimum institutional conditions for AI integration to be pedagogically legitimate rather than merely symbolic.

- Infrastructure Standards: Require and fund district/provincial minimum benchmarks such as reliable broadband, device-to-student ratios for tourism classes, backup power via solar or UPS during load-shedding, and secure storage. Collaborate with organizations like Vodacom/MTN education programs or the DBE's Connected Schools initiative.
- Professional Capacity Benchmarks: Develop and enforce tourism-specific digital competency frameworks covering ethical AI use, data literacy, simulation tools, and CAPS-aligned applications. Require baseline certification for tourism educators.
- System-Level Training Pathways: Incorporate AI literacy into accredited Continuing Professional Educator Development (CPTD) programs through universities and provide subsidized, practical workshops with tourism industry guest facilitators.

Phase 2: Curriculum operationalization

This phase focuses on translating policy recognition into classroom legitimacy and assessment coherence.

- Curriculum Alignment: Revise the Tourism CAPS to clearly include AI-related learning outcomes mapped to specific topics and grade levels.
- Assessment Integration: Provide validated sample tasks, rubrics, and moderation guidelines (e.g., AI-supported itinerary design with mandatory ethical disclosure and critical reflection components).
- Departmental Guidance: Issue practical toolkits with exemplar lesson plans, risk-assessment templates, and alignment matrices for existing CAPS requirements. Launch approved pilot programs in selected districts with monitoring support.

Phase 3: Ethical and professional governance

This phase embeds safeguards to protect educators, learners, and system integrity.

- Responsible AI Policies: Develop school and district policies that prioritise academic integrity, data privacy, and cognitive autonomy when using generative and analytical AI tools.
- Review and Oversight Mechanisms: Establish AI ethics committees at circuit and district levels, institute mandatory moderation of AI-supported assessments, and require annual compliance audits.
- Learner Guidelines: Develop age-appropriate AI use frameworks promoting critical thinking, transparency, and responsible practice.

Policy dialogue, stakeholder engagement, and international relevance

An effective rollout requires multi-stakeholder dialogue among DBE, tourism organizations (such as SA Tourism and SATSA), educator unions, and the private sector technology partner (including tech companies that offer free or low-cost AI tools). Monitoring should involve annual diffusion audits using DOI metrics (like adoption rates

and perceived attributes) as well as equity impact assessments (covering urban/rural areas and income quintiles). The governance framework provides analytical transferability to other standardized, under-resourced systems in the Global South (such as Kenya, India, and Brazil) that share centralised curriculum governance, infrastructural inequalities, and limited subject-specific training. It challenges technology-first strategies by emphasizing governance coherence and contributes to international discussions on equitable digital transformation in tourism education.

Conclusion

This study has redefined the integration of artificial intelligence into South African high school tourism education as a form of conditional, governance-driven innovation rather than an inevitable technological advance. Using an institutional approach to Rogers' (2003) Diffusion of Innovations theory, this study shows that the five key attributes—relative advantage, compatibility, complexity, trialability, and observability —are significantly influenced by broader systemic factors: curriculum authority, infrastructural governance, professional development frameworks, and ethical regulation. In under-resourced, highly standardized school environments, AI's pedagogical potential remains hidden unless these governance conditions are addressed. Without intentional foundational investments and policy coordination, AI risks being a symbolic innovation rather than a meaningful one, potentially widening digital and skills disparities between well-resourced urban schools and under-resourced rural schools.

By emphasizing governance, equity, and curricular control, the research addresses the key question of how institutional, curricular, and professional factors influence educators' perceptions of AI's feasibility and legitimacy. Its main contributions include (1) an empirically based, mid-level extension of DOI theory tailored for regulated education systems; (2) a practical, phased governance model for conditional innovation; and (3) a connection between digital pedagogy debates and the broader objectives of equitable skill development, sustainable tourism workforce growth, and progress toward SDG 4 and SDG 8 in African contexts. Ultimately, successful AI integration and its educational and economic benefits depend less on the availability of advanced tools and more on the coherence, equity, and foresight of the institutional systems that authorize, support, and oversee their implementation.

Future research should broaden comparative studies across multiple provincial or international contexts to explore differences in diffusion under various governance conditions. Long-term studies that follow adoption patterns and learner outcomes can help clarify sustainability and impact. A mixed-methods approach that combines diffusion metrics with experiential insights could improve the understanding of institutional readiness. Simultaneously, action-oriented pilot projects testing governance frameworks could guide evidence-based policy improvements. These efforts would advance research on the equitable integration of technology within vocational secondary education systems.

Declarations

Interdisciplinary Scope: This manuscript is situated at the intersection of education policy studies, innovation and technology diffusion theory, and development studies. It integrates perspectives from educational governance, digital transformation, and inequality research to examine how AI adoption unfolds within differentiated secondary school contexts. By bridging curriculum studies, sociology of education, and public policy analysis, the study advances an interdisciplinary understanding of technology diffusion in unequal education systems.

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