CHAPTER FOUR

Artificial Intelligence and the PhD: Navigating Doctoralness in the Digital Age

Winter Sinkala[1]
Israel Kariyana[2]

AFFILIATIONS

[1]Department of Mathematical Sciences and Computing, Faculty of Natural Sciences, Walter Sisulu University, Mthatha, South Africa.
[2]Continuing Professional Teacher Development, Faculty of Education, Walter Sisulu University, Mthatha, South Africa.

CORRESPONDENCE

Email: wsinkala@wsu.ac.za

REFERENCE

Sinkala, W., & Kariyana, I. (2026). Artificial intelligence and the PhD: Navigating doctoralness in the digital age. In I. Kariyana & W. Sinkala (Eds.), *Artificial Intelligence and Postgraduate Supervision in Higher Education* (pp. 55–73). ERRCD Forum. https://doi.org/10.38140/obp4-2026-04

Abstract: The doctorate has long been regarded as the pinnacle of higher educational attainment, demanding originality, critical inquiry, and the capacity to generate new knowledge—qualities collectively referred to as doctoralness. In the early twenty-first century, doctoral education is undergoing transformation due to the increasing prevalence of artificial intelligence (AI) tools in research design, data analysis, academic writing, and supervisory practices. This chapter examines the intersection of AI with the nature and practice of doctoralness. We begin by clarifying the historical and conceptual foundations of doctoralness as an intellectual and identity-forming endeavour that extends beyond mere technical research skills. Subsequently, we explore the evolving landscape of the PhD as candidates, supervisors, and institutions adopt AI-enabled tools for literature synthesis, multilingual writing support, modelling, and personalised feedback. While these tools promise efficiency, inclusivity, and new modes of collaboration, they also pose risks—such as over-reliance, erosion of critical judgment, breaches of academic integrity, and the widening of inequities between well-resourced and under-resourced contexts. Drawing on global literature and examples from South Africa and the Global South, this chapter discusses strategies for safeguarding doctoralness through supervisor professional development, institutional AI literacy frameworks, and policies grounded in ethical and epistemic justice. We argue that the responsible integration of AI can enrich rather than diminish doctoral education when guided by human criticality and robust scholarly norms. The chapter concludes with recommendations for future directions in AI-infused doctoral training within a digitally mediated knowledge society.

Keywords: Artificial intelligence, doctoralness, ethics of AI, human–AI collaboration, postgraduate supervision, research integrity.

1. Introduction

Doctoral education has historically signified entry into a community of scholars whose core attributes include independence of thought, originality of contribution, and the capacity to interrogate and advance disciplinary knowledge (Trafford & Leshem, 2009; McKenna & van Schalkwyk, 2024). This distinctive constellation of qualities—often described as doctoralness—embodies a scholarly identity marked by intellectual autonomy, methodological rigour, ethical awareness, and reflexive judgement (Mowbray & Halse, 2010; Wisker, 2012). In recent decades, the meaning of doctoralness has been reframed in response to the massification of doctoral enrolments, demands for societal impact, and the diversification of doctoral career pathways

(Sarrico, 2022; Backhouse, 2009). Guerin et al. (2015) advocate for moving beyond the traditional apprenticeship model towards conceptions of doctoral learning as collaborative, situated practice that equips graduates for complex, digitally mediated knowledge work.

A defining feature of today's knowledge economy is the pervasive influence of artificial intelligence. AI-powered systems—ranging from machine-learning algorithms for data modelling to generative language models for writing support—are rapidly permeating the research workflow (Zawacki-Richter et al., 2019; Holmes et al., 2019). For doctoral researchers, this means that tools capable of summarising vast literatures, translating multilingual texts, suggesting analytical pipelines, or drafting prose are now readily accessible—often at little or no cost.

The growing ubiquity of such tools raises urgent questions about how doctoralness can be cultivated and recognised in an era where aspects of scholarly labour may be partially automated. Does reliance on AI diminish the candidate's demonstration of originality and critical thinking, or can it amplify these qualities by freeing cognitive resources for higher-order reasoning (Nguyen et al., 2024)? How should supervisors balance efficiency gains from AI with their responsibility to foster deep conceptual engagement, methodological understanding, and responsible research conduct (Wisker, 2012)? These questions are particularly salient in the Global South, where uneven access to advanced digital infrastructure risks exacerbating existing inequities in doctoral training (Akala, 2021; Dlamini & Ndzinisa, 2025). At the same time, well-implemented AI tools have the potential to reduce barriers to entry—for example, by supporting students who write in additional languages or by automating routine formatting and citation tasks, thereby enabling more equitable participation in global research dialogues (UNESCO, 2023).

This chapter situates the debate at the intersection of doctoral-level scholarly formation and the accelerating integration of AI into research practice. It traces the historical development of the concept of doctoralness, outlines the evolving technological landscape of the PhD, weighs the promises and perils of AI for doctoral training, and proposes strategies for safeguarding the epistemic integrity of the degree.

1.1 The nature of doctoralness

The term "doctoralness" encapsulates the distinctive characteristics of the doctorate: originality, intellectual autonomy, methodological rigour, ethical awareness, and the capacity to generate knowledge that withstands critical scrutiny (Trafford & Leshem, 2009; McKenna & van Schalkwyk, 2024). It reflects both the actions of doctoral candidates and their evolution into scholars who contribute new insights.

Historically, the doctorate has evolved from medieval teaching licences to the Humboldtian research model, which emphasises independent inquiry (Sarrico, 2022). Barnacle and Dall'Alba

(2014) assert that doctoral education is a practice that shapes the being and thinking of the scholar, rather than merely a form of technical training. Traditional apprenticeship-style supervision has been critiqued as inadequate for today's global, interdisciplinary, and digital environment (Blass et al., 2012). Guerin et al. (2015) propose a collaborative, situated model that fosters reflexivity, resilience, creativity, and ethical judgement—qualities that are essential in an AI-rich knowledge economy.

Key dimensions of doctoralness include originality, criticality and reflexivity, methodological sophistication, scholarly communication (Kamler & Thomson, 2014), ethics and integrity (UNESCO, 2023), and scholarly identity within disciplinary communities (Wisker, 2012). Doctoral programmes should facilitate knowledge creation (McKenna, 2025). Moreover, doctoral education should cultivate autonomous researchers who possess the attributes expected of individuals capable of contributing to knowledge—what can be termed the cultivation of the 'knower' (Boud & Lee, 2009). These dimensions are interwoven and mutually reinforcing. As subsequent sections will argue, while AI can support these processes, it cannot replace the essential human capacities; thus, sustaining doctoralness requires deliberate attention as digital tools proliferate.

1.2 The PhD in the era of AI

As computer power increases with technological advancements, AI becomes a viable tool, swiftly becoming an integral part of society (Haenlein & Kaplan, 2019). While Generative Artificial Intelligence (GenAI) presents new challenges for doctoral education, it also offers an opportunity to refocus doctoral programmes on their fundamental purposes: contributing to knowledge and developing critical researchers (McKenna, 2025). According to Calvino et al. (2025):

> *The rapid rise of generative AI has sparked discussions about its potentially transformative effects and whether the technology will bring significant benefits in the form of widespread productivity increases. Despite the early evidence, generative AI appears to exhibit the defining characteristics of general-purpose technologies (GPTs): i) pervasiveness, ii) continuous improvement over time, and iii) innovation spawning. While productivity gains may not materialise immediately, the evolution of earlier GPTs seems to provide encouraging signs that generative AI could lead to substantial improvements in productivity in the future, notably through the innovation-spawning channel. The full realisation of generative AI's productivity potential in the long term will depend on the implementation of relevant policies (p. 3).*

This citation places HEIs at the mercy of technological advancement. Kariyana et al. (2017) established that, beyond institutional mediation, the dispositions of the doctoral supervisor and the doctoral supervisee are the core determinants of the quality of a doctoral candidate.

AI technologies now pervade the PhD lifecycle. Discovery tools and generative search models accelerate literature mapping; coding assistants support data cleaning and analysis; LLM-based writing aids provide feedback on structure, clarity, and argumentation; and analytics dashboards promise personalised progress monitoring for supervisors and candidates (Zawacki-Richter et al., 2019; Holmes et al., 2019; OECD, 2024). In laboratories and fieldwork settings, computer vision and Natural Language Processing (NLP) systems unlock new forms of data, while translation models lower linguistic barriers to global scholarly participation.

Alongside these technical advances, new governance questions arise: attribution of authorship in AI-mediated writing, data protection and consent in training sets, and transparency of methods and provenance. Institutions are drafting policies and guidance to help candidates and supervisors navigate these questions (UNESCO, 2023; European University Association, 2023). Equity remains a core concern: access to capable hardware, paid tools, and reliable connectivity is uneven, particularly across the Global South (Dlamini & Ndzinisa, 2025). Nevertheless, clearly, concerns about 'catching' students who 'cheat' the system and the acknowledgement of the benefits of Generative AI are not the whole story. The implications of Generative AI for doctoral studies are extensive and multifaceted (McKenna, 2025, pp. 2-3). McKenna (2025) continues:

If grappled with fully, these implications raise fundamental questions about the nature of knowledge creation, the role of the researcher, and the meaning of original scholarship. If the doctorate is simply about producing a thesis good enough to pass muster in the examination process, and Generative AI can produce such a thesis almost instantly, one might ask whether doctoral programmes should simply focus on training students in prompt engineering and ensuring they know how to scrutinise outputs for hallucinations and inaccuracies. This approach would certainly be more efficient, aligning with current imperatives for streamlined, cost-effective education delivery.

However, this would of course fail to address the purposes of doctoral education. The doctorate is not about knowledge creation in the mechanical sense of reviewing the literature and implementing the data collection and analysis methods accepted in the field; it is also fundamentally about nurturing the independent, responsible researcher who undertakes the work of critically engaging with literature and grappling with data in order to make a contribution (p.3).

The same sentiments are shared by many authors; however, what remains is the feasibility of promoting the holistic development of a doctoral student who exhibits the uncompromising graduate attributes expected at this level of education.

1.3 Problem statement

Quality postgraduate supervision is at the heart of postgraduate student success. To enhance supervisory experiences, various models have been developed over time. Recently, Iatrellis et al. (2025) argue that universities should consider incorporating AI tools, such as ChatGPT, to support PhD supervision, particularly in providing structured feedback and guidance. Supervisors should explore AI-assisted mentoring to optimise time-intensive advisory tasks and enhance research productivity (Iatrellis et al., 2025). However, despite the uptake of AI tools in doctoral research and supervision, doctoral education often lacks clear, discipline-sensitive frameworks for distinguishing productive AI assistance from practices that may erode the essence of doctoral work, particularly in under-resourced Global South contexts. The existing fragmented literature on the utilisation of AI in postgraduate supervision presents inconsistencies concerning the potential adoption of AI in research and supervision within the higher education sector. This gap creates uncertainty regarding the acceptable use of AI, how to evidence originality and independent scholarly judgement, and how to ensure research integrity and equity in AI-mediated research workflows. As this impacts candidates, supervisors, and institutions, this study aims to design supervision and assessment practices that safeguard the essence of doctoral work while enabling responsible innovation.

1.3.1 Research objective

To develop a framework that mediates the conceptualisation of AI-enabled practices influencing doctoralness and strategies for safeguarding doctoral-level graduate attributes in the digital age.

2. Methodology

This chapter adopts a qualitative, conceptual research design. It employs an integrative review of scholarly and policy literature to synthesise how generative AI intersects with doctoralness and doctoral supervision.

2.1 Data sources and search strategy

Sources comprised (i) peer-reviewed journal articles and book chapters on doctoral education/supervision and AI/GenAI, and (ii) key policy and guidance texts that shape doctoral education and responsible AI use (e.g., CHE standards, national reports, UNESCO guidance, and sectoral position statements). Searches were conducted using academic databases (Scopus, ERIC, and Google Scholar) and discovery tools. Search strings combined terms such as "doctoralness" OR "doctorateness" OR "doctoral education" OR "PhD supervision" with "artificial intelligence" OR "generative AI" OR "large language model" OR "ChatGPT" OR "academic integrity" OR "provenance." Given the recency of GenAI, the search emphasised work published from 2019 to 2025 while also including earlier foundational scholarship on doctoral education and supervision for conceptual grounding. Reference lists of key sources were snowballed to locate additional relevant studies.

2.2 Inclusion and screening

Following the 2020 PRISMA flow diagram (Figure 1), records were screened for relevance to the chapter's objective through title/abstract review, followed by full-text screening. Items were included if they (a) addressed doctoral education, doctoral supervision, assessment of doctoral work, or doctoral graduate attributes, and (b) discussed AI/GenAI or closely related digital research tools with clear implications for doctoral formation and research practice. Literature with explicit relevance to South Africa or other Global South contexts was actively sought to support contextual sensitivity. Conceptual commentaries and policy statements were included selectively where they provided influential arguments or governance guidance directly relevant to the chapter. Ultimately, 31 papers were selected for this chapter.

2.3 Analysis and framework development

The retained sources were analysed using iterative qualitative content analysis. Extracted passages were coded for: (i) AI affordances across the doctoral lifecycle (literature mapping, analysis support, drafting, and revision), (ii) risks to doctoralness (integrity breaches, dependency, inequity, and opacity), and (iii) supervisory and assessment responses (disclosure, provenance records, feedback design, viva interrogation, and policy guidance). These themes were then mapped onto the CHE Knowledge and Skills graduate attributes (Table 1) to identify where AI can credibly support attribute development and where it threatens the evidencing of those attributes. The conceptual framework (Figure 2) was developed by iteratively refining the relationships between AI affordances and risks, mediating conditions, and doctoralness outcomes.

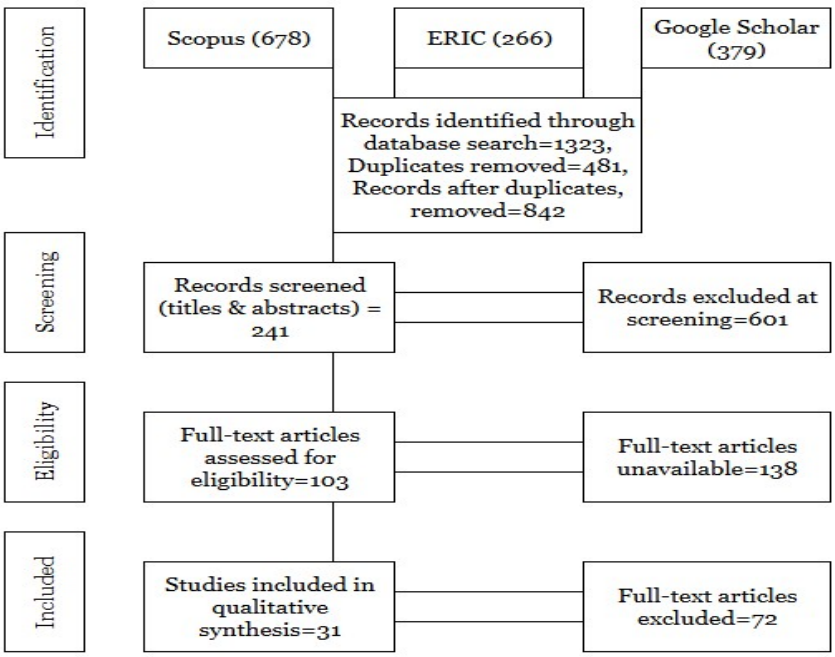

Figure 1: *PRISMA 2020 flow diagram for the paper*

3.4 Ethical considerations

This chapter is desk-based and did not involve human participants or identifiable personal data. Therefore, ethical considerations centred on responsible scholarship, including the accurate representation of sources, careful handling of claims regarding integrity and misconduct, and a clear distinction between evidence-based findings and interpretive arguments.

4. Merits, Pitfalls and Supervision Dynamics in the Age of AI

The arrival of AI has rendered gains and losses to doctoral training.

4.1 Merits of doctoral training in the era of AI

The robustness of higher education institutions (HEIs) is inextricably linked to the quality of high school graduates, and their proficiency is largely dictated by the teaching methods they encounter (Tachie & Kariyana, 2022). To extend this narrative, we acknowledge that the quality of doctoral education, the pinnacle of education, is fundamental in shaping society. In this context, supervision experiences become essential. With GenAI, Akbar (2025) notes that the increasing use of AI tools in higher education necessitates a clear understanding of how students—by demography and study discipline—employ these tools, for what purposes, and how their use is evaluated. This understanding will inform the development of future guidelines and training for staff and students (Akbar, 2025).

Effective doctoral supervision is heavily dependent on dialogic feedback (Jensen et al., 2025). When we position the development of responsible, independent, and critical researchers at the heart of doctoral education, this has significant implications for how we engage with Generative AI in doctoral programmes (McKenna, 2025). The benefits of utilising AI include aiding research—for example, assisting and improving coding/programming, proofreading, writing, and serving as an explanatory tool for rendering complex information accessible (Akbar, 2025). Oliinyk et al. (2024) summarise that the ability of AI to optimise the work of future scientists, scholars, and academics on the topics of their research can be considered the main advantage.

When used judiciously, AI can enhance doctoral learning. First, it can create time and cognitive bandwidth by automating repetitive tasks—such as formatting, preliminary coding, and reference matching—allowing candidates to invest more effort in theory building and interpretation (Kumar & Gunn, 2025). Second, AI can broaden access by assisting multilingual writers and neurodiverse learners, thereby supporting inclusive pedagogy and epistemic justice (UNESCO, 2023). Third, tools that surface diverse literatures can spur interdisciplinarity and creativity, while simulation and modelling expand methodological repertoires (Barrett & Pack, 2023). Finally, AI-enabled collaboration platforms and open-science workflows can connect dispersed teams and shorten the path from idea to impact.

These benefits depend on explicit human oversight and reflective practice: AI suggestions must be interrogated, triangulated with evidence, and situated within disciplinary norms—activities that themselves deepen the doctoral experience.

4.2 Pitfalls of doctoralness in the age of AI

The increasing prevalence of Artificial Intelligence (AI) in higher education underscores the necessity to explore its implications for ethical, social, and educational dynamics within the sector (Al-Zahrani & Alasmari, 2024). Risks cluster around integrity, dependency, inequity, and opacity. Generative systems challenge conventions of authorship and novelty, raising questions about what constitutes an original contribution (Thorp, 2023; Nguyen et al., 2024). Over-reliance can erode critical thinking and methodological understanding if candidates outsource judgment to opaque models (Yan et al., 2024). Biases embedded in training data may reproduce epistemic injustices, while uneven access to premium tools risks widening gaps between well-resourced and under-resourced institutions (Dlamini & Ndzinisa, 2025). Supervisors and examiners also face difficulties in verifying provenance and ensuring transparent reporting of AI involvement (Cotton et al., 2024; Kofinas et al., 2024).

The quality and validity of the information AI produces vary based on the AI product and the logistics of implementation (Mueller & Massaron, 2022). Factors affecting the quality of a doctoral graduate are embedded in the characteristics of universities and doctoral students (Kariyana et al., 2017). In confirmation, Ungadi's (2021) study found that multiple issues coalescing into challenges stemmed from PhD students' and PhD supervisors' past experiences, the structures in place to facilitate doctoral education, and the intersection between these structures, PhD supervisors, and the context of doctoral studies. Boyd and Harding (2025) highlight that the often-unacknowledged use of GenAI in doctoral research can confer undue agency on the technology, disrupting traditional relationships in an unacknowledged manner. The rapid but often unacknowledged uptake of GenAI within doctoral research occurs alongside a lack of consideration for the emotional support students attribute to the technology.

Potential problems include environmental costs, violations of intellectual property rights, the provision of misleading and/or inaccurate information, and risks of plagiarism and hindered creativity (Akbar, 2025). Opportunities to develop critical analytical skills are missed, which can threaten the integrity of research outputs (Harding & Boyd, 2023). Oliinyk et al. (2024) state that the challenge lies in the violation of ethics and academic integrity by graduate students (p. 302). Doctoral supervisors face numerous challenges in overseeing doctoral students. Such challenges include the structured nature of universities, which requires most experienced, skilled, and knowledgeable academic staff to engage in multiple administrative responsibilities, increasing their workload, and reducing the time available for PhD supervision. Additionally, contemporary doctoral candidates often require substantial support due to their weaker academic abilities (Ungadi, 2021).

4.3 Supervision dynamics in the age of AI

There is no doubt that the concept of supervision has evolved over time and will continue to do so. This evolution is evident in the transitions in postgraduate supervision models, which reflect a dissatisfaction with the quality of supervision over time and across different contexts, and a call for improvement. Throughout history, there has been no episode that has posed a sudden threat to supervisory roles, except for AI. For this reason, it is sensible to dedicate a section of this paper to positioning ourselves in relation to this reality. The Council on Higher Education (CHE) Qualification Standard for Doctoral Degrees (NQF Level 10) serves as the organising analytical lens.

It is inevitable that a balance must be struck between competitors if the market is to attain equilibrium. In this case, the long-held human supervision relationship seems to be disrupted by AI, which is the new kid on the block. Suddenly, it appears that supervisors have lost grip on their supervisees (Harding & Boyd, 2023). The advent and adoption of GenAI tools have pedagogical implications for researcher/supervisor dynamics. The rise of generative artificial intelligence chatbots raises the question of how interactions with a chatbot align with, or diverge from, authentic feedback practices with supervisors (Jensen et al., 2025).

ChatGPT can enhance PhD supervision by providing structured academic recommendations, reducing administrative burdens on supervisors, and contributing to the evolution of a "tripartite mentoring model" where AI, supervisors, and students collaborate to tackle complex research challenges (Iatrellis et al., 2025). The present study suggests that prospective students would benefit from being informed about the limitations of generative AI, as well as the risks it poses to accuracy, originality, creativity, and fostering dependence. It would also be prudent to outline the threat that training AI models poses to intellectual property rights, as under current trends, doctoral students' future work is likely to be utilised by such models without their consent (Akbar, 2025).

The supervisory role is evolving from sole gatekeeper to AI-literate mentor. Supervisors need fluency in the capabilities and limitations of current tools, as well as strategies for fostering students' reflective use of them (Caillaud & Skec, 2024; Wisker, 2012). Practical steps include co-creating AI-use agreements, requiring reflective memos that justify when and how AI was used, and designing assessments that privilege process, reasoning, and methodological justification over surface polish. Supervisors should model scholarly integrity by disclosing their own AI use and prioritising formative dialogue about argument quality and evidence.

Findings highlight that fear and suspicion surrounding the use of GenAI confer undue agency on the technology, which further conceals its use (Harding & Boyd, 2023).Chatbot feedback encounters highlighted the student's agency and focused on the task; supervisor feedback encounters were relational, contextual, and developmental (Jensen et al., 2025). AI-generated recommendations were most effective when structured around topic-specific concepts (Iatrellis

et al., 2025). The study established that the majority of PhD students have higher levels of research competence in terms of substantive and design components, and lower levels in terms of procedural, optional, and communicative components. The results of the study indicate that AI use is appropriate for increasing the research competence of future scientists, scholars, and academicians (Oliinyk et al., 2024).

5. Doctoralness in South Africa

5.1 Council on higher education graduate attributes for doctoral degrees

The Council on Higher Education's Qualification Standard for Doctoral Degrees defines 'doctoralness' through two interlinked sets of graduate attributes—Knowledge and Skills—that are used nationally as the threshold for awarding doctoral qualifications (National Qualifications Framework [NQF] Level 10) (Council on Higher Education, 2018; Boughey, 2023). In South Africa, the Higher Education Qualifications Sub-Framework describes this as making 'a significant and original academic contribution at the frontiers of a discipline or field' (CHE, 2013).

Knowledge attributes include: broad and current field knowledge; expert, in-depth knowledge in the specific research area; insight into connections with cognate fields; ethical awareness in research and professional conduct; and evidence of an original contribution that advances the field. Skills attributes require candidates to: evaluate, select and apply appropriate research approaches and methods; work with reflection and autonomy to reach defensible conclusions; communicate effectively (including information and digital literacy); and demonstrate critical and analytical thinking. These attributes provide the anchor points against which AI's role should be judged in this chapter.

5.2 Implications from the CHE doctoral degrees national report (2022)

The CHE's Doctoral Degrees National Report applies the same attribute framework to evaluate provision nationally. It highlights three implications relevant to AI-rich doctoral education: (1) Make attributes explicit and monitor progression throughout candidature (not only infer them at the thesis stage); (2) Strengthen supervision—ensure supervisors intentionally cultivate autonomy, ethical awareness, and critical judgement, including through AI-use agreements and provenance statements; (3) Balance disciplinary depth with cognate awareness—use AI to surface cross-field links while maintaining methodological fit and epistemic integrity (Leitch et al., 2022). In short, align institutional AI policies, supervision practices, and assessment rubrics directly with the CHE Knowledge and Skills attributes.

Table 1: Mapping CHE doctoral graduate attributes to AI-use guardrails

Attribute domain	CHE attribute (short label)	How AI can help	Risks to doctoralness	Concrete guardrails
Knowledge	Broad and current field knowledge	Landscape scans; topic overviews; rapid alerts	Uncritical summaries; superficial breadth	Annotated bibliographies; primary-source verification; log prompts & sources
Knowledge	Expert, in-depth knowledge in area	Corpus building; code/data assistance	Methodological shortcuts; dependency on models	Supervisor-approved methods or plan; reproducible notebooks; viva on design rationale
Knowledge	Interconnectedness with cognate fields	Cross-disciplinary retrieval; mapping related work	Hallucinated links; scope drift	Justify inclusion criteria; provenance records; scoped review protocol
Knowledge	Ethical awareness and conduct	Policy checks; consent templates; data-risk flags	Privacy/IP breaches; opaque model use	Provenance statements; data governance review; ethics sign-off including AI section
Knowledge	Original contribution	Gap analysis; simulation scaffolds	Plagiarism; derivative contributions	Originality statement; similarity checks; oral defense on novelty
Skills	Select and apply appropriate methods	Method comparison; diagnostics	Method mismatch; overfitting via automation	Methods-justification rubric; (pre)registration where applicable
Skills	Reflection and autonomy	Self-quiz; revision planners	Over-delegation to tools	Weekly reflection logs; supervisor attestation of independent work
Skills	Scholarly communication (including digital literacy)	Language polishing; visualisation assistance	Loss of authorial voice; hidden edits	Editing disclosure; keep tracked changes; retain pre-AI drafts
Skills	Critical and analytical thinking	Counterargument generation; error-finding	Shallow critique; confirmation bias	Structured critique templates; require manual replication/ablation where relevant

6. Safeguarding and enriching doctoralness, and looking beyond

Safeguarding doctoralness requires institutional frameworks that enable responsible innovation. Core elements include: (1) clear, discipline-sensitive policies for transparent AI use and provenance; (2) curricular AI literacy for candidates and supervisors; (3) assessment practices

that evaluate higher-order reasoning and originality; and (4) infrastructure and procurement choices that reduce inequities (UNESCO, 2023; European University Association, 2023; Leitch et al., 2022). In the Global South, partnerships that share computing resources and training, as well as the prioritisation of open-source tools, can help mitigate access gaps (Akala, 2021). Embedding reflexivity and epistemic justice perspectives ensures that AI augments, rather than distorts, disciplinary knowledge-making.

Throughout the doctoral journey, candidates are expected to display doctorateness in their thesis via the characteristics of high-quality scholarly research (Trafford & Leshem, 2009). Competencies expected of doctoral graduates include being autonomous researchers and knowledge producers (Kariyana et al., 2017). The presence of chatbots underlines, rather than replaces, the need for doctoral supervisors' engagement with feedback practices that lead to meaningful learning (Jensen et al., 2025). Unless both parties understand these implications, GenAI tools have the potential to disrupt the traditional balance of power and trust between Researcher and Supervisor, potentially impacting both the rigour of PhD training and research outcomes (Harding & Boyd, 2023). Perhaps most immediately, doctoral candidates need to engage in sustained reflection about what it means to work with AI and what it means to allow AI to perform significant portions of their scholarly work. Have they contributed to knowledge if AI has generated significant portions of the analysis or writing? What kind of critical researchers are they becoming through this process? These questions go to the heart of doctoral education's purposes (McKenna, 2025).

6.1 Future directions

Looking ahead, doctoral education is likely to incorporate artificial intelligence (AI) more profoundly into tailored learning pathways, project management, and collaborative knowledge creation. Scenario analysis indicates an increasing utilisation of intelligent research environments that monitor provenance, support reproducibility, and offer formative analytics to learners and supervisors (Oliinyk et al., 2024; OECD, 2024). Global policy frameworks (UNESCO, 2023; European University Association, 2023) will shape standards for disclosure, authorship, and data governance. Importantly, conceptions of originality may evolve from the production of text to the generation of defensible reasoning, designs, and contributions to open, machine-actionable knowledge bases.

The integration of Generative AI into doctoral education thus presents both challenges and opportunities. By confronting these challenges directly, through critical education regarding AI's capabilities and limitations, ongoing reflection on ethical implications, and a renewed emphasis on scholarly responsibility, we can leverage this moment to strengthen rather than undermine the fundamental purposes of doctoral education (McKenna, 2025). The study concludes that Generative AI tools should be more than a covert "third wheel" in the relationship. Instead, the

technology could be openly incorporated into supervision frameworks in a transparent and integrated manner (Harding & Boyd, 2023; Boyd & Harding, 2025).

7. Parting Shot

Artificial intelligence is not a surrogate for doctoralness; at best, it is a demanding collaborator. Throughout this chapter, we have treated the CHE Qualification Standard for Doctoral Degrees (2018) as the anchor for what counts at NQF Level 10, examining contemporary AI through that lens. The Standard's Knowledge and Skills attributes delineate the destination; AI is merely a set of vehicles that may speed or skew the journey. Our analysis shows that when institutions make those attributes explicit, teachable, assessable, and auditable, AI can be integrated without hollowing out the core of doctoral formation.McKenna (2025) concluded that:

> *In the South African context, where transformation remains a central imperative for higher education, refocusing on the substantive purposes of doctoral education—namely, knowledge creation that serves society and the development of ethically responsible scholars—directly addresses transformation goals. By foregrounding questions about whose knowledge counts, whom that knowledge serves, and what responsibilities accompany scholarly privilege, we create conditions for doctoral education that can genuinely contribute to social justice and decolonial knowledge production (p.5).*

7.1 Conceptual framework

In this regard, we propose a mediating conceptual framework. Figure 1 presents the proposed conceptual framework. The framework positions artificial intelligence (AI) as a set of research and supervision capabilities (affordances) that can either support or threaten doctoralness, depending on mediating conditions that function as guardrails. AI affordances (e.g., accelerated literature mapping, coding support, drafting/translation, and feedback/progress analytics) can enhance efficiency and access. As Iatrellis et al. (2025) found, ChatGPT demonstrated the capacity to refine research methodologies and improve knowledge discovery.

Conversely, AI risks (e.g., hallucinations, plagiarism/ghost authorship, bias, privacy/intellectual property breaches, and dependency) can undermine originality, critical judgement, and integrity. The net effect on doctoralness—anchored in the CHE NQF Level 10 Knowledge and Skills attributes—is mediated by (i) candidate AI literacy and reflexivity, (ii) supervisor AI pedagogy and feedback practices, (iii) institutional policy and ethics governance, (iv) access and infrastructure (equity), and (v) disciplinary norms and assessment design.

The framework, therefore, provides an analytical scaffold for connecting the literature reviewed in this chapter to actionable guidance for doctoral candidates, supervisors, and institutions.

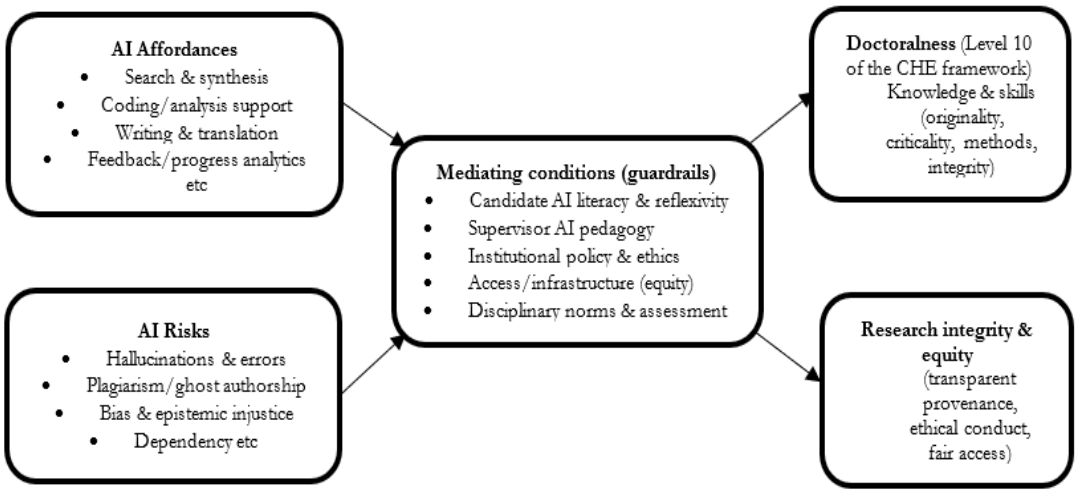

Figure 1: *Conceptual framework for AI-enabled doctoral education and doctoralness*

Throughout this discussion, we emphasise that maintaining the essence of doctoral scholarship in a digital age requires not the rejection of artificial intelligence, but its critical and ethical appropriation – accompanied by ongoing monitoring and reflection – as a collaborator rather than a replacement in advanced research learning. In this chapter, we acknowledge certain limitations, including the non-exhaustive nature of an integrative review, the rapid evolution of generative AI tools and guidance (which may outpace publication cycles), and the uneven availability of evidence from under-resourced contexts. Consequently, the analysis seeks to achieve conceptual clarity and practical implications rather than definitive claims of prevalence.

8. Conclusion and Recommendations

First, the thesis alone constitutes an insufficient proxy for the graduate attributes. The Doctoral Degrees National Report (2022) elucidates that many programmes still infer attributes retrospectively at the point of submission. In an AI-rich environment, such an approach becomes untenable. Provenance, methodological judgement, and independent reasoning must be cultivated and evidenced throughout the candidature, rather than reconstructed post hoc. The practical implication is to scaffold each CHE attribute with observable behaviours and artefacts, including research design defences, critical appraisal diaries, methods justifications, and ethics addenda that encompass tool use.

Second, supervision represents the decisive site of assurance. The potential of AI—namely, rapid literature mapping, coding assistance, and diagnostic checks—can only be realised when supervisors intentionally design tasks that reward critical thinking rather than mere surface refinement. Routine text-polishing may be permitted with appropriate disclosure; however, interpretation, critique, design choices, and argumentation must remain the candidate's work and be assessed as such. We recommend programme-wide supervision workshops that translate the CHE attributes into assessment prompts (for example, "defend your choice of estimator

against viable alternatives, including those suggested by an AI assistant") and oral examinations that explore tool-mediated processes.

Third, assessment regimes necessitate a modest but consequential redesign. In an environment where AI threatens to commodify superficial outputs, assessment must pivot towards process evidence: versioned research notebooks, preregistered design rationales (where appropriate), and viva voce components focusing on decisions that AI cannot credibly claim (such as assumption checks, trade-offs, and ethical reasoning). Assessment rubrics should explicitly allocate marks to original contributions, as demonstrated by novelty claims, triangulated gap analyses, and examiner-tested argument structures, rather than to textual fluency or diagrammatic presentation.

Fourth, provenance and ethics must be normalised as integral components of scholarly practice. A lightweight, programme-standard AI provenance statement—detailing tools, versions, prompts/workflows, and human verification steps—should be appended to chapters, articles, code, and datasets. Ethics review forms should similarly pose clear questions regarding data flows, privacy, intellectual property, and biases inherent in models and training sets. These practices are not bureaucratic add-ons; they are essential mechanisms through which integrity and accountability, as articulated within the CHE attributes, are rendered visible.

Fifth, equity and capability warrant sustained attention. Artificial Intelligence (AI) has the potential to both exacerbate and mitigate inequalities. Candidates with limited computational resources, connectivity, or institutional subscriptions may be directed towards inferior tools; conversely, an over-reliance on AI could undermine the very skills that the Standard mandates. Consequently, programmes should integrate access strategies (such as shared infrastructure and curated open-source pathways) with capability-building initiatives (including critical AI literacy, error identification, and methodological judgement). The aim is not universal adoption of AI but rather discerning utilisation that aligns with disciplinary norms and the expectations set forth in the Standard.

Sixth, institutions require cohesive policy that is succinct, enforceable, and pedagogically transparent: (1) what is permissible concerning disclosure; (2) what is prohibited; (3) what must always be evidenced; and (4) how breaches relate to existing misconduct frameworks. Importantly, policy should be co-created with examiners and supervisors to ensure that it translates seamlessly into tasks, rubrics, and viva protocols, thereby closing the loop between doctrine and practice.

Finally, we advocate for a targeted research and improvement agenda: (a) to develop validated instruments for measuring progression on each CHE attribute under conditions enriched by AI; (b) to trial viva formats that emphasise "explain-your-decision" questioning of tool-assisted steps; (c) to compare learning designs that differentially prioritise process artefacts versus final products; and (d) to investigate supervisor development models that most effectively enact

change in practice. Such endeavours should report not only on outcomes (completion rates, quality) but also on integrity metrics (such as provenance quality, success rates of replicating analysis pipelines, and examiner confidence in originality claims).

In summary, AI-enabled practices represent the 'affordances' aspect of the model and are examined in relation to the concept of doctoralness and the mediating frameworks. Preserving doctoralness in a digital age does not necessitate a ban on novel tools; rather, it calls for a re-centring of what the doctorate certifies and the back-designing of curricula, supervision, assessment, and policy to ensure that AI occupies its appropriate role: as a fallible assistant serving the candidate's judgement, creativity, and contribution. With the CHE Standard serving as the guiding principle and the lessons from the National Report functioning as practical benchmarks, South African programmes have the potential to leverage AI to enhance, rather than diminish, the significance of the PhD.

9. Declarations

Funding: This research did not receive any external funding.
Conflicts of Interest: The authors declare no conflict of interest.
Use of Artificial Intelligence: The current work was created with minimal assistance from artificial intelligence technologies, mainly Grammarly to refine language for clarity, and ChatGPT to conceptualise the development of Figure 1.

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