

A theoretical framework for integrating AI into health professions education

Author: Michael Rowe ([ORCID](#))

Affiliation: University of Lincoln (mrowe@lincoln.ac.uk)

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Abstract

Health professions education faces a significant challenge: graduates are simultaneously overwhelmed with information yet under-prepared for complex practice environments. Meanwhile, artificial intelligence (AI) tools are being rapidly adopted by students, revealing fundamental gaps in traditional educational approaches. This paper introduces the ACADEMIC framework, a theoretically grounded approach to integrating AI into health professions education (HPE) that shifts focus from assessing outputs to supporting learning processes. Drawing on social constructivism, critical pedagogy, complexity theory, and connectivism, I analysed learning interactions across six dimensions: power dynamics, knowledge representation, agency, contextual influence, identity formation, and temporality. From this comparative analysis emerged seven principles—Augmented dialogue, Critical consciousness, Adaptive expertise development, Dynamic contexts, Emergent curriculum design, Metacognitive development, and Interprofessional Community knowledge building—that guide the integration of AI into HPE. Rather than viewing AI as a tool for efficient content delivery or a threat to academic integrity, the ACADEMIC framework positions AI as a partner in learning that can address longstanding challenges. The framework emphasises that most students are not natural autodidacts and need guidance in learning with AI rather than simply using it to produce better outputs. By reframing the relationship between students and AI, educators can create learning environments that more authentically prepare professionals for the complexity, uncertainty, and collaborative demands of contemporary healthcare practice.

Introduction

Health professions education stands at a crossroads. Despite decades of innovation and reform, our education systems introduce a troubling tension: graduates who are simultaneously overwhelmed with information yet under-prepared for the complexity of modern practice.^(1,2) Typical approaches to learning and teaching, characterised by content overload, decontextualised knowledge, and assessment practices that reward recall over reasoning, are increasingly at odds with the realities of healthcare delivery.^(1,3)

Artificial intelligence has entered this landscape not as a solution to these challenges, nor merely as another technology to integrate, but as a catalyst that prompts educators and students to reexamine fundamental assumptions about learning itself. Students are already widely using AI tools—with surveys showing adoption rates of 80-90%—as they explore concepts, practice reasoning, and prepare for assessments, regardless of whether educators have sanctioned or even acknowledged this use.

This paper proposes that addressing these questions requires us to examine four interrelated dimensions of learning in health professions education, through the lens of multiple theoretical perspectives: the how, why, where, and what of learning. By integrating these theoretical perspectives, we can position students as active agents who learn to communicate effectively with AI tools as part of their learning, moving beyond viewing AI as either a threat to be resisted or a panacea to be embraced.

The integration of AI into our educational practices offers an opportunity to pursue these aspirations in new ways—not by automating traditional approaches, but by enabling shifts from assessing products to observing learning behaviours and processes that better prepare practitioners for contemporary healthcare.

Theoretical foundations

This approach to integrating AI in health professions education draws on four complementary theoretical perspectives. Each addresses a different dimension of learning and, taken together, provide a robust foundation for reimagining health professions education.

Social constructivism in health professions education

Social constructivism represents a fundamental shift away from the notion that knowledge exists independently of the knower. Rather than viewing knowledge as objective "truth" that can be transferred from teacher to student, social constructivism posits that knowledge is actively constructed through social interaction and is personally meaningful to the learner.⁽⁴⁾ In health professions education, this perspective challenges the dominant paradigm of content delivery and procedural training that has characterised much of our educational practice. The foundational work of Vygotsky established that learning is inherently social, occurring first between people before being internalised by the individual. The zone of proximal development—another key Vygotskian concept—describes the space between what a learner can do independently and what they can achieve with guidance from a more knowledgeable other. This concept has important implications

for clinical education, where students work alongside experienced clinicians who provide scaffolding that gradually fades as students develop competence.

The implications for AI integration are significant. If knowledge is constructed through social processes rather than transmitted through content delivery, we should consider how AI might serve as a dialogical partner rather than merely a generator of content, supporting the social processes of meaning-making that are central to effective learning.(5)

Critical pedagogy and liberatory education

Paulo Freire's critical pedagogy(6) provides a theoretical frame to explore the why of learning. Critical pedagogy emerged from a critique of what Freire called the "banking model" of education—a model that remains pervasive in health professions education where educators "deposit" knowledge into passive students who are expected to receive, memorise, and repeat this information.(6,7) Critical pedagogy offers an alternative vision centred on conscientization—the development of critical consciousness through which learners come to recognise systems of oppression and their own capacity to transform these systems. For health professions students, conscientization might involve recognising how education systems perpetuate inequities, how professional hierarchies limit collaborative practice, or how institutional structures themselves constrain learning.

The implications for AI integration extend beyond just having AI produce outputs that students passively consume. The presence of AI tools raises questions about authority and power in educational settings: Who determines what constitutes valid knowledge? Critical pedagogy encourages us to design interactions with AI that develop critical consciousness rather than uncritical acceptance.

Complexity theory and healthcare systems

The disjunction between how we educate health professionals and how healthcare actually works reflects a fundamental misalignment. Health professions education has traditionally been structured around linear, reductionist models of learning and practice,(8) while contemporary healthcare operates as a complex adaptive system characterised by nonlinearity, emergence, self-organisation, and unpredictability.(9,10) Complexity theory offers a framework for understanding these systems and their implications for education. Traditional approaches that emphasise memorisation of procedures inadequately prepare practitioners for complex environments. Complexity theory suggests educational approaches that develop adaptive expertise—the ability to apply knowledge flexibly in novel situations and to navigate uncertainty with confidence. These capabilities are essential in healthcare environments where practitioners must constantly adapt their knowledge to unique patient presentations and evolving system conditions.(10)

AI systems, properly designed, might help bridge this gap by creating dynamic, responsive learning experiences that mirror the complexity of actual practice settings, supporting the development of adaptive responses to unpredictable situations.

Connectivism and networked knowledge

Connectivism acknowledges that knowledge no longer resides primarily in individuals or static repositories but is distributed across networks of connections.⁽¹¹⁾ Learning involves creating and navigating these networks rather than merely acquiring content. This perspective challenges conventional notions of curriculum as a predetermined body of knowledge to be transferred to students. From a connectivist perspective, what students should learn shifts from static content to the connections between areas of knowledge, the patterns that link seemingly disparate domains, and the meta-learning skills that enable effective navigation of knowledge networks. This networked approach to knowledge becomes increasingly important as healthcare specialisation deepens, requiring practitioners to collaborate across disciplinary boundaries.⁽¹²⁾

In an AI-enabled learning environment, connectivism takes on new dimensions. AI systems can help make visible connections between knowledge domains that might otherwise remain obscure, suggest novel patterns that human cognition might miss, and personalise learning networks based on individual interests and needs.

Integration and implications for AI-supported learning

These four theoretical perspectives—social constructivism, critical pedagogy, complexity theory, and connectivism—offer complementary insights into how learning occurs, why it matters, where it happens, and what constitutes knowledge in the digital age. While each emerged independently, they share remarkable convergences: all reject simplistic transmission models of education; all emphasise the social, contextual nature of learning; all value adaptability over rigid standardisation; and all challenge traditional power structures in educational settings.

Together, they suggest that effective learning in HPE requires environments that foster social knowledge construction, develop critical consciousness, prepare students for complex adaptive systems, and support navigation of distributed knowledge networks. Traditional educational approaches have struggled to create such environments due to constraints of time, resources, and organisational structures. However, AI offers potential pathways to address these constraints not by simply making existing practices more efficient, but by enabling fundamentally different approaches to learning and teaching.

Core to the resulting framework is the recognition that students won't naturally become autodidacts when given access to AI tools. Simply providing AI chatbots can actually undermine education by creating an illusion of learning while merely providing answers. The principles that emerge from these theoretical foundations provide a framework to help educators create learning environments supporting students to learn how to learn with AI, focusing on changes in learning behaviours rather than merely improving outputs.

Methods: From theoretical foundation to design principles

Moving from the four theoretical foundations to a set of principles for AI integration in HPE requires a methodological approach that maintains theoretical integrity. I conducted a thematic synthesis across the four theories using "learning

interactions" as the unit of analysis—the points of engagement between learners and other elements of the educational ecosystem.(13,14) To structure this analysis, I examined how each theory conceptualises six key dimensions of learning interactions:

1. **Power dynamics:** How authority and decision-making are distributed
2. **Knowledge representation:** How knowledge is structured and engaged with
3. **Agency:** How learner autonomy is supported or constrained
4. **Contextual influence:** How broader contexts shape learning
5. **Identity formation:** How professional identity develops
6. **Temporality:** How learning unfolds over time

Rather than analysing each theory individually across these dimensions (which would involve 24 separate analyses), I created a comparative matrix to directly identify patterns, convergences, and tensions across the four perspectives. This comparative approach allowed for more efficient identification of cross-cutting themes that could inform principles for AI integration.

Comparative theory analysis

This matrix visualisation helps identify patterns across theories and dimensions.(15) We see how each theory addresses similar concerns but with different emphases and conceptualisations. For example, all theories challenge traditional power dynamics but do so in different ways—from social constructivism's graduated transfer of authority to connectivism's distributed network authority. In the matrix below we begin to see the emergence of colour-coded themes that will form the foundation of a set of principles to support the integration of AI into an education framework that aims to address some of the pedagogical challenges highlighted earlier.(16)

Analytical Dimension	Social constructivism	Critical pedagogy	Complexity theory	Connectivism
Power dynamics	Gradual transfer of authority from expert to learner through fading scaffolding; "more knowledgeable other" provides initial structure	Explicit critique of power hierarchies; redistribution of power through dialogue; teachers and learners both teach and learn	Challenges hierarchical control; emphasizes self-organization and distributed decision-making	Authority distributed across networks; power lies in ability to form, navigate, and influence connections; fluid and context-dependent authority
Knowledge representation	Personally meaningful constructions developed	Knowledge is never neutral; reflects interests and power	Emergent patterns rather than fixed facts; cannot	Exists in connections between information

Analytical Dimension	Social constructivism	Critical pedagogy	Complexity theory	Connectivism
	through social interaction; contextual, provisional, evolving through collaborative meaning-making	structures; values experiential knowledge alongside theoretical; socially constructed and contested	be reduced to component parts; provisional, contextual, evolving in response to new conditions	sources; distributed across networks; accessed not possessed; currency and accuracy depend on network quality
Agency	Learners as active constructors of knowledge; agency developed through testing ideas, receiving feedback, refining understanding; autonomous exploration within scaffolded boundaries	Central focus on conscientization; developing awareness of social realities and capacity to transform them; learners as subjects who act upon their world	Distributed across the system; capacity to influence complex systems through adaptive responses rather than controlling through predetermined actions	Ability to build, navigate, and reconfigure networks; evaluate information quality; recognize patterns; decision-making about what to learn as important as learning itself
Contextual influence	Learning inseparable from social and cultural context; communities of practice shape what counts as knowledge; authentic contexts essential for meaningful learning	Learning embedded in sociopolitical contexts; educational practices either reinforce or challenge existing social arrangements; addresses real-world problems	Context constitutive of learning, not just an influence; small changes in initial conditions lead to different outcomes; interdependent systems	Learning networks extend beyond formal educational contexts; quality depends on diversity and quality of network connections available
Identity formation	Becoming a member of a community, not just acquiring	Recognizing one's position within social systems;	Emerges from participation in complex adaptive	Develops through participation in knowledge

Analytical Dimension	Social constructivism	Critical pedagogy	Complexity theory	Connectivism
	knowledge; legitimate peripheral participation; knowledge construction and identity formation inseparable	developing capacity to transform those systems; reshaping self-understanding in relation to power structures	systems; involves developing comfort with uncertainty; capacity for adaptation in unpredictable environments	networks beyond traditional communities; more fluid; practitioners as nodes in evolving networks
Temporality	Developmental trajectories involving progressive participation; timing of support crucial; long-term trajectory of participation rather than discrete episodes	Cycles of action and reflection (praxis); conscientization as ongoing process; temporal horizon extends beyond immediate learning to future transformation	Non-linear progression; periods of stability punctuated by rapid change; complex relationship between immediate activities and long-term outcomes	Real-time learning through continuous engagement with evolving networks; compressed learning cycles; ongoing connection rather than one-time acquisition

Cross-cutting themes

1. Dialogic knowledge construction (augmented dialogue). All four theories emphasise that knowledge emerges through dialogue and interaction rather than transmission. Social constructivism highlights collaborative meaning-making; critical pedagogy centres dialogic exchange; complexity theory emphasises emergent understanding from interactions; and connectivism focuses on knowledge created through network connections. This suggests AI integration should support augmented dialogue rather than one-way information delivery.

2. Critical consciousness. While most explicitly articulated in critical pedagogy, elements of critical awareness appear across all theories. Social constructivism implies critical reflection on community practices; complexity theory requires critical awareness of system dynamics; and connectivism necessitates critical evaluation of information sources and network connections. This suggests AI integration should develop critical consciousness about both content and AI itself.

3. Adaptive expertise development. All theories challenge fixed notions of expertise. Social constructivism emphasises adaptation through scaffolded experiences; critical pedagogy focuses on adaptability in transforming circumstances; complexity theory centres adaptive responses to unpredictable conditions; and connectivism highlights adaptation to evolving knowledge networks. This suggests AI should support development of adaptive rather than routine expertise.

4. Dynamic contextual learning. All theories emphasise that learning is deeply embedded in authentic contexts. Social constructivism stresses situated learning; critical pedagogy emphasises real-world problem-solving; complexity theory highlights contextual embedded; and connectivism locates learning in diverse network contexts. This suggests AI should enhance rather than abstract from the dynamic contexts of healthcare practice.

5. Emergent curriculum design. Rather than fixed curricula, all theories suggest more fluid, emergent approaches to determining what should be learned. Social constructivism emphasises negotiated learning pathways; critical pedagogy rejects predetermined content; complexity theory highlights emergent learning outcomes; and connectivism emphasises dynamic knowledge flows. This suggests AI should support more adaptive, responsive curriculum structures.

6. Metacognitive development. All theories emphasise development of higher-order thinking about learning itself. Social constructivism highlights reflective practice; critical pedagogy centres critical reflection (praxis); complexity theory requires pattern recognition across systems; and connectivism emphasises meta-learning skills. This suggests AI should enhance metacognitive awareness and reflective practice.

7. Interprofessional community knowledge building. A theme appearing across theories is the importance of crossing traditional knowledge boundaries. Social constructivism's communities of practice can extend across professions; critical pedagogy challenges disciplinary silos as power structures; complexity theory emphasises interconnections across system components; and connectivism explicitly values diverse network connections. This suggests AI should facilitate knowledge building across traditional professional and disciplinary boundaries.

The cross-cutting themes do not map perfectly to single rows or columns - they emerge from patterns that cut across different dimensions and theories. Some cells contribute to multiple themes, and some themes draw from multiple dimensions. This reflects the complex, interconnected nature of these theoretical perspectives and the richness of insights they offer for AI integration in health professions education.

The ACADEMIC framework for AI-supported learning in health professions education

The seven cross-cutting themes translate into seven principles that form the ACADEMIC framework for AI integration in health professions education:

Augmented dialogue for knowledge co-construction

AI should be considered as a participant in dialogic learning processes rather than an authoritative source of knowledge. This principle emerges from the cross-cutting theme of dialogic knowledge construction, drawing particularly on social constructivism's emphasis on collaborative meaning-making and critical pedagogy's focus on dialogue as liberation. It directly challenges content-focused educational models that overwhelm students with information but provide insufficient opportunities for meaning-making.

Critical consciousness and power

AI implementation should support the development of critical consciousness while making transparent the limitations, biases, and assumptions embedded in AI systems. This principle emerges from the theme of critical consciousness, drawing particularly on critical pedagogy's emphasis on power dynamics and connectivism's model of distributed authority. It aims to challenge the persistent power dynamics in HPE that position students as passive recipients of information rather than active co-creators of personally meaningful knowledge.

Adaptive expertise development

AI integration should prioritize the development of adaptive expertise—the ability to apply knowledge flexibly in novel situations—over efficient information delivery. This principle emerges from the theme of adaptive expertise development, drawing on complexity theory's emphasis on adaptation in unpredictable environments and connectivism's focus on navigating evolving knowledge networks. It addresses the misalignment between structured educational systems and the complex, uncertain reality of healthcare practice.

Dynamic contexts for situated learning

AI should enhance rather than detract from the authentic contexts in which healthcare professionals practice. This principle emerges from the theme of dynamic contextual learning, drawing on social constructivism's emphasis on situated learning and complexity theory's recognition of contextual embeddedness. It addresses the decontextualization of knowledge in many health professions curricula, where students learn concepts without sufficient understanding of their application in complex practice environments.

Emergent curriculum design

AI integration should support more emergent, adaptive approaches to curriculum design and implementation. This principle emerges from the themes of knowledge as dynamic and contextual and non-linear learning trajectories, drawing on complexity theory's emphasis on emergence and connectivism's adaptive approach to curriculum. It addresses the rigidity of traditional curriculum structures that struggle to keep pace with rapidly evolving healthcare knowledge and practices.

Metacognitive development

AI integration should prioritise the development of metacognitive capabilities—the ability to monitor and regulate one's own thinking processes. This principle emerges from the theme of metacognitive development, drawing on social constructivism's emphasis on self-regulation and critical pedagogy's focus on reflection. It addresses the challenge that health professionals must not only possess knowledge but know how to apply it appropriately in complex situations.

Interprofessional Communities of learning

AI implementation should facilitate knowledge building across traditional boundaries—disciplinary, institutional, and geographical. This principle emerges from the theme of interprofessional knowledge integration, drawing on

connectivism's emphasis on networked knowledge and social constructivism's communities of practice. It addresses the fragmentation of HPE into discrete disciplines and subjects, which poorly prepares students for the collaborative, boundary-spanning work of contemporary healthcare.

These seven principles provide a theoretically grounded framework for AI integration in HPE that enhances rather than diminishes the human aspects of learning while addressing longstanding challenges in how we prepare clinical practitioners for complex healthcare environments. Rather than positioning AI as a replacement for human teachers or relationships, the framework views it as a potential partner that students must learn to communicate with effectively.

Conclusion

Health professions education faces a fundamental challenge: graduates are simultaneously overwhelmed with information yet under-prepared for complex practice. The rapid adoption of AI tools by students reveals gaps in traditional educational approaches that many institutions are responding to with attempts to exert control rather than embrace transformative integration.

This paper has presented the ACADEMIC framework for AI integration in health professions education, derived from a systematic analysis of social constructivism, critical pedagogy, complexity theory, and connectivism. The framework's seven principles—Augmented dialogue, Critical consciousness, Adaptive expertise development, Dynamic contexts, Emergent curriculum design, Metacognitive development, and Interprofessional Community knowledge building—provide a theoretically grounded middle path between viewing AI as either threat or panacea.

Perhaps most significantly, the framework recognises that students need guidance in learning with AI, focusing on processes rather than simply using AI to create better outputs. By reframing the relationship between students and AI, educators can create learning environments that more authentically prepare professionals for the complexity, uncertainty, and collaborative demands of contemporary healthcare practice. The framework thus positions AI not as a replacement for human educators but as a catalyst for addressing persistent challenges in preparing health professionals for contemporary healthcare environments.

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