The Crisis in Curriculum Studies and the Fourth Industrial Revolution: Reconceptualising Knowledge, Equity, and Competence for a New Era

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Abstract

This article discusses the crisis in curriculum studies, which has been aggravated by the Fourth Industrial Revolution (4IR). Young (2013) argues that prioritising learner-centred methods may neglect powerful knowledge, the specialised understanding needed for critical thinking beyond everyday knowledge. The 4IR, blending the physical, digital, and biological realms through AI and IoT, demands new skills and exposes inequalities such as the digital divide (Fomunyam, 2023). An effective curriculum should redefine literacy to include digital and data literacy, develop the 4 Cs (critical thinking, creativity, communication, collaboration), encourage interdisciplinary learning, and address ethical issues to counter AI biases. To prepare students for the supercomplexity of an unpredictable future, a pedagogy that merges ontology, epistemology, and praxis is recommended, enhancing resilience and adaptability through inquiry-based, agile learning. Solving the curriculum crisis requires combining powerful knowledge with 4IR skills within a decolonised, flexible curriculum focused on cognitive justice and equity.

Keywords: *Curriculum studies, Fourth Industrial Revolution, powerful knowledge, cognitive justice, educational equity, digital transformation, social justice.*

A Field in Crisis Amidst a World in Revolution

The Fourth Industrial Revolution (4IR), also known as Industry 4.0, signifies a fundamental change in the worldwide landscape. It introduces a new stage of human progress characterised by the swift, unprecedented fusion of the physical, digital, and biological realms (Fomunyam, 2023; Schwab, 2016). This revolution is fueled by disruptive technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), robotics, and big data analytics, which are profoundly altering societal functions, economic activities, and personal interactions.

Beyond its technological dimensions, Niazi (2023) contends that the 4IR significantly shapes society by speeding up the transition to a knowledge economy and heralding an Imagination Age where human creativity becomes the main source of economic value. In areas like design, for instance, AI fosters imagination, leading to quicker innovation and shifting value from routine or manual tasks to innovative ideas. As automation handles predictable tasks, the demand for uniquely human, higher-level cognitive skills—such as strategic decision-making, complex problem-solving, and advanced communication—grows rapidly, as these are skills machines cannot easily duplicate. During this period of rapid change, the curriculum acts as a crucial guide, identifying the knowledge areas most valuable for preparing individuals for an unpredictable future (Syomwene, 2017). The impact of the 4IR extends beyond changing teaching methods (the how of learning); it also requires a fundamental reassessment of what content should be

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learned (the what) (Al-Maskari et al., 2024).

This global revolution intersects with a longstanding crisis in curriculum studies. Historically, curriculum development has been marked by ongoing tension, with a pendulum swing between two ideological poles (Plate, 2014). One side features the traditional, subject-centred curriculum, which emphasises the rigorous transfer of established disciplinary knowledge. This approach has faced criticism for its rigidity, disconnection from modern life, and inability to prepare citizens for a dynamic, democratic society. In response, the opposing movement is the progressive, learner-centred curriculum. This approach advocates experiential, student-focused learning, arguing that education should adapt to the evolving needs of learners and society (Plate, 2014; Tanner & Tanner, 2007). This shift expanded the field's focus from simple curriculum development to more in-depth theorising (Pinar, 2008). An example from history is the early 20th-century shift toward project-based learning aimed at addressing real-world issues such as urbanisation.

Young (2013) highlights a fundamental tension in his influential critique, arguing that modern curriculum theory overemphasises the knower- namely, students and their everyday experiences- while neglecting the importance of the known, or objective, systematic knowledge that education should impart. He criticises curricula focused solely on practical experience, claiming they only replicate existing knowledge without providing students with essential conceptual tools to analyse, critique, and go beyond their immediate social environments. For example, a curriculum based only on local experiences cannot sufficiently prepare students to understand or evaluate global political or economic issues.

Young's (2013) alternative is the concept of "powerful knowledge," which is defined by three crucial characteristics:

1.   Distinct from Common Sense: It offers access to conceptual frameworks and ways of thinking that take students beyond their personal, everyday experiences.

2.   Systematic and Structured: Its concepts are coherently related within specific disciplines, enabling generalisation and broader application.

3.   Specialised and Validated: It is produced and authenticated by communities of expert practitioners (Young, 2014, 2015a).

Young (2013) emphasises that access to impactful knowledge should be seen as a matter of social justice rather than just an academic issue. Schools are the only institution capable of ensuring all students, no matter their backgrounds, gain this essential intellectual resource. Denying disadvantaged students this knowledge effectively withholds the tools needed for social mobility and critical influence, which have traditionally been limited to the privileged. A clear example of this is providing high-level STEM education to underprivileged students to prepare them for careers in technology.

The crisis arises from both poles being inadequate for the 4IR era. Traditional, static curricula are insufficient because their content cannot keep up with rapid technological advancements. On the other hand, experience-based curricula that focus on practical learning fail because they overlook the essential, systematic knowledge needed to fully understand, develop, or critique the complex digital and cyber-physical systems of the 4IR (Gwata, 2019; Motala & Dieltiens, 2021; Uleanya, 2023). An inflexible curriculum might teach outdated coding languages, while an experience-focused one might ignore the fundamental principles of AI. The solution is a synthesis: a knowledge-rich curriculum that remains adaptable to innovative technologies and societal changes.

The Imperatives and Inequities of the Fourth Industrial Revolution

Penprase (2018) argues that 4ir presents urgent and unavoidable challenges to curriculum development, fundamentally redefining the necessary skills, knowledge, and ethical attitudes for effective participation in modern society. These challenges require more than just adding technology to existing subjects; they call for a complete reimagining of learning in an increasingly convergent world. A key task is redefining literacy. Basic reading and writing are no longer enough. A contemporary curriculum must develop strong digital literacy skills, covering a wide range of competencies (Bonfield et al., 2020). This includes basic abilities like effective internet usage and file management, understanding online safety, privacy, and digital communication norms. More importantly, it involves advanced skills such as creating digital content, critically assessing sources to distinguish credible information from misinformation, and understanding the operation and ethical use of AI and automation tools like large language models (Concordia University Nebraska, 2024; Cornell University, 2024). For instance, a digitally literate student should not only know how to use a search engine but also understand how algorithms influence and filter search results.

According to Armstrong and Armstrong (2018), as AI and automation quickly take over routine and predictable tasks, the importance of uniquely human skills- those difficult for machines to mimic- grows significantly. This shift challenges traditional curricula that mainly focus on memorisation. Ruminar and Gayatri (2018) suggest that educational systems must shift toward emphasising higher-order thinking skills, often called the "4Cs": critical thinking, creativity, communication, and collaboration. For example, while AI can swiftly analyse large datasets to spot market trends, human input remains crucial for applying creative ideas to develop innovative strategies, using critical thinking to assess risks, and collaborating to carry out complex plans. These skills are best developed through active, project-based learning that encourages students to solve real-world, complex, and poorly defined problems.

Moreover, the convergence of technologies central to the 4IR makes traditional, isolated subject boundaries less relevant. Major global challenges like climate change, poverty, and pandemics are deeply interdisciplinary. This calls for a significant shift toward interdisciplinary and transdisciplinary approaches that prepare students to think broadly and integrate knowledge from various fields. For example, addressing food security involves using IoT sensors for soil monitoring (science and technology), big data analytics for yield forecasting (mathematics and computer science), and drone technology (engineering), all within a social and economic framework (social studies). In elementary education, a transdisciplinary project might have students collaboratively create a community garden to combat local food insecurity, applying biology, mathematics, social studies, and design principles.

Alongside these technical requirements, there is a crucial ethical and equity aspect. The use of AI and big data is not neutral; since these systems are trained on historical data, they can absorb, reinforce, or even magnify existing social biases (UNESCO, 2021). Therefore, a curriculum suited for the 4IR must include a strong ethical focus on data justice and algorithmic bias. A clear example is AI-based decision systems in education. For instance, if an AI screening thousands of university applications is trained on data from a decade where a particular institution favoured applicants from affluent schools, the algorithm may unintentionally link social privilege to success. This can result in systematically undervaluing applicants from under-resourced schools, regardless of their potential (Enrollify, 2024). Similarly, bias can appear in student support tools. An AI advising system might identify students as high risk of not graduating; if an audit shows Black students are flagged at four times the rate of White students with similar academic records,

it indicates the algorithm has learned to associate demographic factors with risk (Enrollify, 2024). Such biases can lead to stigmatisation and systematically divert capable students away from challenging, rewarding fields.

Sunganya (2017) highlights that the most critical challenge of the 4IR is its potential to worsen social and economic inequalities, especially deepening the digital divide. This issue is especially severe in countries with significant inequality, like South Africa. Despite technological progress, a sizeable portion of the population remains digitally excluded, lacking both connectivity and necessary digital skills (DataReportal, 2025; Mwansa, 2025). The COVID-19 pandemic exposed this divide starkly: urban schools with resources shifted to online learning, while many rural and township students faced complete disconnection due to lack of devices, high data costs, and unreliable electricity (Mhlanga & Moloi, 2020; Soudien et al., 2021). This illustrates that the digital divide reflects not just access issues but also deeper, historical, and structural inequalities. Another major obstacle is teacher preparedness. According to Seyama (2021), many educators, especially from older generations, feel uncertain and lack sufficient training to effectively incorporate modern technologies. They often feel disempowered within bureaucratic, top-down education systems that are slow to supply necessary resources and support. Therefore, any curriculum reform that solely relies on technology and overlooks these human and structural issues is likely to fail.

Reimagining Curriculum: A Pedagogy for Supercomplexity

To truly prepare students for a future that is not only complex but supercomplex (Barnett, 2000)- a state where even the basic frameworks used to understand the world are constantly challenged- a new curricular approach is needed. This approach should go beyond the narrow debate of skills versus knowledge and focus instead on developing the human traits essential for success in an inherently unpredictable future. A curriculum that only emphasises a fixed body of knowledge or a set of predefined skills cannot adequately prepare students for a world of ongoing uncertainty.

The path forward lies in a pedagogy for human being, which prioritises the development of essential human qualities, new ways of knowing, and the capacities for informed action that enable individuals to navigate unpredictable contexts (Barnett, 2004). A curriculum for supercomplexity is therefore an educational project that embraces three deeply interconnected domains: ontology (being), epistemology (knowing), and praxis (action) (Abegglen et al., 2020). This ontological perspective raises a key question: What kind of person should education aim to cultivate? It is not enough for students to simply acquire knowledge (epistemology) or complete tasks (praxis); they must also foster a powerful sense of self and develop the unique qualities, beliefs, and skills necessary to engage meaningfully with the world (ontology) (Abegglen et al., 2022). In an era dominated by AI and information overload, the main goal is to nurture a type of humanity capable of addressing the complex challenges of our time (Fataar et al., 2022). Such a curriculum would emphasise cultivating traits like resilience, adaptability, self-reliance, cognitive flexibility, carefulness, thoughtfulness, and courage. The focus is on developing individuals suited for complexity, providing students with the strength and motivation to navigate a world full of ongoing conflicts and new understandings without feeling overwhelmed. This ontological approach directly opposes the market-driven, utilitarian objectives of neoliberal educational models by grounding learning in values-based interactions centred on compassion, community, and flexibility (Khoza, 2022).

This conceptual shift mandates a fundamental change in teaching methods. The curriculum

should be reconceived not as a fixed document to be merely taught, but as a set of intentional, evolving strategies designed to shape specific Subjectivities in students (Abegglen et al., 2022). A key method involves actively involving students in research and inquiry, which boosts their ability to tackle twenty-first-century issues. By engaging with real-world problems without clear-cut solutions, students learn to navigate conflicting information and create their own interpretive frameworks. This approach encourages a creative and flexible understanding that goes beyond rote memorisation, highlighting the importance of recognising emerging meanings within an interconnected, complex world (Abegglen et al., 2022).

Practically implementing this approach involves designing learning experiences that are naturally open, adaptable, and inquiry-driven (Healey et al., 2022). Inquiry-Based Learning (IBL) serves as a central method. For instance, an interdisciplinary university course on "AI and Society" might challenge teams comprising students from computer science, law, and sociology to create an ethical framework for using facial recognition technology in a specific urban context. Their learning process would involve engaging with conflicting stakeholder perspectives (e.g., civil liberties groups versus municipal authorities) and addressing biased datasets. Instead of a traditional final exam, assessment would focus on a reflective portfolio where students document how their views have developed, the difficulties they faced with ambiguity, and how they handled team disagreements, thereby fostering qualities like resilience and critical thinking.

Another effective approach is to incorporate an Agile or Human-Centred Design (HCD) framework into the curriculum. For instance, a Sustainable Urban Development course could be organised into two-week sprints. During the first sprint, students could apply HCD principles by interviewing local community members about a specific waste management issue. The next sprint might involve brainstorming and prototyping a small intervention, like a community composting app. Following this, a subsequent sprint would focus on evaluating the prototype and collecting feedback for refinement. This structure makes the curriculum more responsive and iterative, emphasising collaborative problem-solving over content memorisation. Implementing this requires institutional flexibility, shifting from rigid, pre-approved syllabi to adaptable learning frameworks that respond quickly to real-world developments and student-driven inquiries.

A pedagogy centred on supercomplexity prepares students not for any specific, predictable career or future but for a variety of possible futures. It promotes deep interdisciplinary collaboration to help students develop connections and coalitions for change (Healey et al., 2022). Additionally, it emphasises a strong, relational approach to diversity and inclusion, using frameworks like intersectionality to understand how multiple social identities influence human experience in a globalised context (Bauer et al., 2021). This curriculum fosters essential human qualities that enable people to constantly reinvent and redefine themselves, making them resilient and capable of thriving amid continuous and profound uncertainty (Barnett, 2004).

Conclusion

The current crisis in curriculum studies, caught between outdated traditionalism and superficial progressivism, becomes especially urgent with the advent of the Fourth Industrial Revolution. The 4IR does not make knowledge obsolete; instead, it highlights the importance of access to systematic knowledge as the essential base for developing advanced skills such as critical thinking, ethical reasoning, and complex problem-solving. The answer is not to choose between knowledge and skills, but to integrate them deeply and meaningfully.

A curriculum suitable for the 4IR should be rich in knowledge but also grounded in a decolonial,

mobile perspective that appreciates a pluriverse of epistemologies. It must be deeply committed to social and cognitive justice. This involves integrating various knowledge systems, including Indigenous wisdom and scientific approaches, to develop innovative solutions, such as tackling climate change.

The urgency of these reforms cannot be emphasised enough. Educational systems are large and tend to resist change due to institutional inertia. Without deliberate and swift adaptation, we risk producing a generation of graduates who are unprepared for the future workforce and a society that struggles to manage the deep ethical, social, and political changes brought by the 4ir. The consequences of inaction are severe, including increased inequality, economic stagnation, and missed opportunities to direct our technological future toward fairness and justice.

A reimagined curriculum, based on the integration of powerful knowledge, critical 4IR skills, and decolonial ethics, has the potential to accomplish much more than simply preparing students for employment. It can enable them to become critical and creative architects of a more inclusive, equitable, and human-centred future. In an era of increasingly intelligent machines, the primary aim of education must be to nurture what is distinctly and permanently human: our ability for wisdom, compassion, creativity, and ethical judgment. The ultimate aim of a 4IR-aligned curriculum is not to serve technology, but to use technology to better serve the timeless pursuit of human flourishing.

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