

BEYOND DATA AND TECHNOLOGY: A PHILOSOPHICAL INQUIRY INTO DIGITAL AND DATA-DRIVEN EDUCATIONAL MANAGEMENT

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ABSTRACT

The growing reliance on digital technologies and data analytics has transformed educational management practices worldwide, positioning data-driven decision-making as a dominant managerial paradigm. While these approaches promise efficiency, transparency, and accountability, they are often grounded in technocratic and positivistic assumptions that treat data as objective, value-neutral representations of educational reality. This study aims to critically examine digital and data-driven educational management through the lens of the philosophy of science, moving beyond instrumental perspectives toward a more reflective and humanistic understanding. Employing a qualitative conceptual research design, this study conducts a critical literature analysis using an integrative philosophical framework encompassing epistemological, ontological, and axiological dimensions. The analysis reveals three key findings. First, data-driven educational management is predominantly shaped by positivistic epistemologies that privilege quantifiable indicators over contextual and professional knowledge. Second, digital management systems actively reconfigure educational reality by shaping institutional practices, governance structures, and definitions of success. Third, efficiency-oriented rationalities often overshadow ethical considerations, raising concerns about justice, responsibility, and educational values. The study contributes a novel integrative framework that positions philosophy of science as a foundational lens for understanding and guiding digital educational management. By reframing data and technology as reflective tools rather than authoritative ends, the study offers a conceptual basis for developing digital and data-driven educational management that is efficient yet ethically grounded, context-sensitive, and aligned with the broader purposes of Education.

Keywords: Philosophy; Digital Educational, Data-Driven Education; Educational Governance

INTRODUCTION

The rapid expansion of digital technologies and data analytics has profoundly reshaped the global landscape of educational management. Educational institutions increasingly rely on digital platforms, management information systems, and data-driven decision-making tools to support planning, evaluation, and organisational governance. Concepts such as *data-driven educational management*, *learning analytics*, and *digital governance* have become central to contemporary educational reform discourses, promising greater efficiency, transparency, and accountability in managing complex educational systems (Teräs, 2022; Rosário & Dias, 2022). In this context, data and technology are often portrayed as neutral tools that objectively represent educational realities and optimise managerial decisions (Samira et al., 2026).

However, the growing dominance of digital and data-driven approaches has also raised critical questions about the underlying assumptions that guide their adoption. Much of the existing literature on digital educational management is grounded in technocratic and instrumental rationalities, in which quantifiable indicators, system performance, and efficiency gains primarily measure success. While such approaches offer practical benefits, they risk reducing Education to a set of measurable outputs and administrative processes, overlooking its inherently social, ethical, and value-laden nature. As educational management is increasingly shaped by algorithms, dashboards, and performance metrics, concerns emerge about the marginalisation of pedagogical judgment, contextual knowledge, and human experience in decision-making.

Recent international scholarship has begun to problematize the phenomenon of *datafication* in Education, highlighting how data practices actively construct, rather than merely represent, educational realities. Digital systems do not simply collect information; they shape what is visible, measurable, and valued within educational organisations. As Williamson and colleagues argue, data infrastructures embed particular epistemological assumptions about what counts as valid knowledge and how educational quality should be understood. Consequently, data-driven educational management is not a purely technical endeavour but a deeply normative practice with significant implications for power relations, professional autonomy, and educational equity.

Despite these growing critiques, philosophical reflection remains underrepresented in mainstream discussions of digital educational management. Most studies focus on implementation strategies, system effectiveness, or organisational outcomes, offering limited engagement with fundamental questions concerning the nature of educational data, the validity of data-based knowledge, and the ethical purposes of educational governance. This gap is particularly evident in contexts where digital transformation is pursued as a policy imperative, often framed as an inevitable response to globalisation and technological advancement. In such contexts, the absence of a philosophical lens risks normalising managerial practices that prioritise efficiency over meaning, control over care, and standardisation over contextual sensitivity.

The urgency of this issue lies in the transformative power of digital and data-driven management to redefine not only how Education is administered, but also how educational success, accountability, and responsibility are conceptualised. Without critical reflection, data-driven systems may reinforce existing inequalities, intensify surveillance, and promote a narrow conception of educational quality aligned with performance metrics rather than holistic development. Therefore, there is a pressing need to move beyond instrumental debates and examine the philosophical foundations that underpin digital educational management.

Several recent studies offer important entry points for this discussion, but also reveal significant limitations. First, Teräs (2022) offers a critical overview of education–technology debates, emphasising the socio-political dimensions of digital transformation. While the study highlights tensions between innovation and equity, it does not systematically engage with the philosophy of science as an analytical framework, leaving epistemological and ontological assumptions largely implicit. Second, Rosário and Dias (2022) examine learning management systems and digital management practices, focusing on organisational challenges and opportunities. Their work contributes valuable insights into digital infrastructures but remains primarily managerial, offering limited reflection on the nature of knowledge and values embedded in data-driven systems. Third, recent critical research on educational technology has problematized data governance and algorithmic decision-making, yet often treats philosophical inquiry as a background concern rather than a central analytical lens.

Taken together, these studies demonstrate a growing awareness of the limitations of purely technical approaches to digital educational management. However, they also reveal a clear research gap: the lack of an integrated philosophical framework that explicitly addresses the epistemological, ontological, and axiological dimensions of data-driven educational management. Existing research often critiques outcomes or impacts without sufficiently interrogating the foundational assumptions that shape how data are produced, interpreted, and used in managerial decision-making. As a result, philosophical questions about what educational data *are*, how data-based knowledge *comes to be regarded as valid*, and *for what purposes* digital management systems should ultimately serve remain insufficiently explored.

This gap points to the novelty and significance of the present study. Rather than treating philosophy as a supplementary perspective, this article positions philosophy of science as a central analytical framework for understanding digital and data-driven educational management. By integrating epistemology, ontology, and axiology, the study moves beyond fragmented

critiques and offers a coherent lens for examining how data and technology shape educational management practices. Epistemologically, the study challenges positivistic assumptions that portray data as objective and value-free, emphasising instead their socially constructed and interpretive character. Ontologically, it reconceptualises digital educational management as both a technical system and a social reality that actively reconfigures relationships, practices, and meanings within Education. Axiologically, it foregrounds ethical considerations, questioning how data-driven management aligns with values such as justice, responsibility, and the humanistic purposes of Education.

The novelty of this study lies in its integrative philosophical approach to digital educational management, which has been largely absent from both educational management and digital Education literatures. By systematically articulating the role of philosophy of science, this research contributes a reflective framework that guides both theoretical inquiry and practical decision-making. Rather than rejecting data and technology, the study seeks to reposition them as tools that support, rather than replace, professional judgment, contextual understanding, and ethical responsibility.

Accordingly, the purpose of this study is to critically examine the role of philosophy of science in shaping digital and data-driven educational management. Through a conceptual and qualitative analysis of contemporary literature, the article aims to (1) clarify the epistemological assumptions underlying data-driven management practices, (2) explore the ontological implications of digital systems for educational realities, and (3) articulate the axiological foundations necessary for ethically and humanistically grounded educational management. By doing so, this study seeks to contribute to the development of a more reflective, value-conscious, and socially responsible approach to digital educational management in an increasingly datafied educational landscape.

METHODOLOGY

This study adopts a qualitative, conceptually grounded design rooted in philosophical inquiry and critical analysis of the literature. Rather than testing hypotheses, it seeks to examine and synthesise theoretical perspectives on digital and data-driven educational management through a philosophy-of-science lens. The focus is on uncovering the epistemological, ontological, and axiological assumptions embedded in contemporary data-driven practices. Conceptual inquiry enables systematic interrogation of how digital management is framed as technical or neutral, while revealing its underlying knowledge claims, constructions of reality, and normative commitments.

The analytical framework integrates three interrelated dimensions. Epistemologically, the study examines how educational data are produced, interpreted, and legitimised as authoritative knowledge in decision-making. Ontologically, it explores how digital systems, algorithms, and performance metrics reshape educational realities, governance structures, and professional relationships. Axiologically, it interrogates the ethical values embedded in data-driven management, including justice, accountability, and humanistic educational purposes.

Data consist of peer-reviewed journal articles and scholarly books (2020–2025) indexed in Scopus, Web of Science, and Google Scholar. Only theoretically or critically engaged works were included, while technical reports and non-scholarly sources were excluded.

Table 1. Literature Selection Criteria

Criterion	Description
Publication period	2020–2025
Type of source	Peer-reviewed journals and academic books
Focus area	Digital education management, data-driven governance, and philosophy of science
Perspective	Conceptual, theoretical, or critical
Language	English

Literature was collected through a systematic, keyword-based search that captured contemporary debates on digital and data-driven educational management, using terms such as digital educational management, data-driven education, educational data governance, philosophy of science in education, and datafication and education, across major academic databases. Titles and abstracts were screened for conceptual and philosophical relevance, followed by a full-text review to retain works that addressed theoretical assumptions, conceptual frameworks, or normative implications. Data analysis employed a thematic–conceptual approach combining inductive interpretation and deductive philosophical reasoning. Texts were closely read to identify core arguments and tensions, then coded by theme into data, governance, ethics, and management. These themes were mapped onto epistemological, ontological, and axiological dimensions, enabling structured philosophical interpretation—conceptual synthesis integrated insights into a coherent framework, emphasising depth and critical engagement rather than quantification. Trustworthiness was ensured through analytical transparency, theoretical triangulation across education, management, and philosophy, and interpretive reflexivity. As a literature-based study, no ethical clearance was required, but academic integrity and accurate representation of sources were strictly maintained throughout.

RESULT AND DISCUSSION

The analysis of the selected literature reveals four interrelated findings that collectively illustrate how philosophy of science provides a critical and integrative foundation for understanding digital and data-driven educational management. These findings demonstrate that current managerial practices are shaped by implicit philosophical assumptions that influence how data are conceptualised, how educational realities are constructed, and how values are negotiated within digital governance systems.

Epistemological Dominance of Positivist Data Rationality

The first major finding indicates that digital and data-driven educational management is predominantly grounded in a positivist epistemology, in which data are treated as objective, neutral, and authoritative representations of educational reality. Across the reviewed literature, educational data—such as performance indicators, dashboards, and analytics outputs—are frequently positioned as the primary basis for managerial decision-making. This epistemological stance assumes that quantitative data can comprehensively and value-free capture educational quality. The analysis shows that such an approach tends to privilege measurable outcomes over contextual and experiential knowledge. Professional judgment, pedagogical expertise, and a localised understanding of educational processes are often subordinated to standardised indicators generated by digital systems. As a result, data-driven management practices increasingly equate “evidence” with numerical data, marginalising qualitative insights and interpretive forms of knowledge. This finding suggests that epistemological assumptions play a decisive role in shaping how data are legitimised and mobilised within educational management.

Table 2. Epistemological Assumptions in Digital Educational Management

Epistemological Orientation	Key Characteristics	Implications for Management
Positivist	Data is viewed as objective and neutral	Decisions rely heavily on metrics and indicators
Instrumental	Knowledge valued for efficiency	Pedagogical judgment becomes secondary
Reflective (emerging)	Data seen as interpretive	Encourages contextual and professional reasoning

Ontological Reconfiguration of Educational Reality Through Digital Systems

The second finding reveals that digital and data-driven management does not merely support existing educational structures but actively **reconfigures the ontological nature of educational reality**. Digital platforms, management information systems, and analytics tools

function as socio-technical actors that shape organisational practices, institutional priorities, and definitions of success. The analysis indicates that educational institutions increasingly operate within digitally mediated environments where visibility, accountability, and performance are defined by what systems can record and display. Consequently, educational reality aligns with system logics, such as standardisation, comparability, and real-time monitoring. Practices that are not easily captured by data—such as relational work, emotional labour, and contextual adaptation—risk being rendered invisible or undervalued. This ontological shift suggests that digital management systems help construct educational reality rather than merely reflect it. Educational management, therefore, emerges as a hybrid space where technical infrastructures and social practices co-produce institutional meanings and governance norms.

Table 3. Ontological Shifts in Digital and Data-Driven Educational Management

Ontological Perspective	Traditional Management	Digital Data-Driven Management
Nature of education	Social and relational practice	Socio-technical system
Basis of visibility	Human interaction and context	Data traces and indicators
Definition of success	Contextual and negotiated	System-defined performance

Axiological Tensions: Efficiency Versus Educational Values

The third finding concerns the axiological dimension of digital educational management, revealing persistent tensions between efficiency-oriented rationalities and the normative goals of Education. The literature consistently indicates that claims of optimisation, accountability, and performance improvement often justify digital transformation initiatives. While these aims are not inherently problematic, the analysis shows that they often overshadow ethical considerations and humanistic values. Issues such as data privacy, surveillance, equity, and professional autonomy are significant concerns in data-driven management environments. The reliance on data-intensive systems can intensify monitoring practices and reinforce asymmetrical power relations between managers, educators, and learners. Moreover, unequal access to digital infrastructure and data literacy exacerbates existing inequalities, raising questions about fairness and social justice. This finding demonstrates that digital educational management is inherently value-laden. Decisions about what data to collect, how to analyse it, and how to act on it are inseparable from ethical judgments and normative priorities. Philosophy of science, particularly through its axiological lens, exposes these value commitments and underscores the need for ethically grounded management practices.

Philosophy of Science Framework

The final finding synthesises the epistemological, ontological, and axiological analyses, demonstrating that philosophy of science provides an integrative framework that addresses the limitations of technocratic, data-driven management. The literature indicates that when philosophical reflection is incorporated, data and technology are repositioned as tools that support, rather than dominate, educational decision-making. An integrative philosophical approach enables educational managers to critically assess the assumptions embedded in digital systems, recognise the constructed nature of educational realities, and foreground ethical responsibility. Rather than rejecting data and technology, this framework advocates for reflective use that balances efficiency with meaning, accountability with trust, and innovation with educational values.

Table 3. Integrative Role of Philosophy of Science in Digital Educational Management

Philosophical Dimension	Critical Function	Managerial Implication
Epistemology	Questions about data objectivity	Promotes reflective data use
Ontology	Reveals constructed realities	Encourages holistic governance
Axiology	Clarifies ethical priorities	Supports humanistic management

Overall, the results indicate that digital and data-driven educational management is deeply shaped by implicit philosophical assumptions that influence how knowledge is produced, how

educational realities are constructed, and how values are enacted. The findings demonstrate that without philosophical reflection, data-driven practices risk becoming reductive and technocratic. Conversely, integrating epistemological, ontological, and axiological perspectives enables a more reflective, ethical, and context-sensitive approach to educational management.

DISCUSSION

This study set out to critically examine digital and data-driven educational management through a philosophy-of-science lens, integrating epistemological, ontological, and axiological dimensions. The findings demonstrate that contemporary educational management practices are not merely technical or operational phenomena, but are deeply shaped by philosophical assumptions that influence how data are legitimised, how educational realities are constructed, and how values are enacted in managerial decision-making. This discussion situates these findings within global scholarly debates and articulates the study's theoretical novelty.

The epistemological dominance of positivistic data rationality identified in this study aligns with international critiques of *datafication* in Education. Global research has shown that data-driven approaches often privilege quantifiable indicators as the primary form of evidence, marginalising professional judgment and contextual understanding (Knafllic & Hargreaves, 2021; Prinsloo & Slade, 2022). Similar to findings in critical data studies, this research confirms that educational data are often treated as objective and value-neutral, even though they are socially produced and institutionally mediated.

However, this study extends existing literature by explicitly grounding this critique in philosophy of science, rather than treating epistemological issues as secondary concerns. While prior studies have highlighted the limitations of data-centric decision-making, they often stop short of systematically interrogating the ways knowledge claims are constructed and legitimised. By foregrounding epistemology, this research demonstrates that the problem is not data itself, but the uncritical acceptance of data as epistemic authority. This reframing represents a conceptual advancement by positioning epistemological reflection as a prerequisite for responsible data-driven educational management (Samira et al., 2026).

The findings related to ontological reconfiguration resonate strongly with international scholarship on digital governance and algorithmic management in Education. Studies on platformization and algorithmic governance suggest that digital systems actively shape organisational behaviour, institutional priorities, and educational subjectivities (Pangrazio & Sefton-Green, 2021; Komljenovic & Robertson, 2023). This study reinforces these insights by showing that digital management systems function as socio-technical actors that redefine what counts as educational reality.

What distinguishes this research is its explicit articulation of ontology as a central analytical concern. Rather than viewing digital tools as external supports for management, this study conceptualises digital educational management as a hybrid reality in which technological infrastructures and social practices co-constitute meaning and governance. This ontological perspective challenges managerial discourses that frame digitalisation as a neutral form of modernisation, highlighting its role in reshaping institutional norms, visibility, and power relations instead. In doing so, the study contributes to a more nuanced understanding of how digital management transforms not only practices but also the very nature of educational organisations.

The axiological tensions identified in this study reflect a growing international concern with the ethical implications of data-intensive educational management. Global research has documented risks associated with surveillance, erosion of privacy, and inequitable outcomes arising from data-driven systems (Ifenthaler & Schumacher, 2023; Tsai et al., 2020). This study corroborates these concerns, demonstrating that efficiency-oriented rationalities often overshadow ethical reflection and humanistic educational values.

Importantly, this research advances the discussion by framing these ethical issues within an axiological dimension of philosophy of science. Rather than treating ethics as an add-on or compliance issue, the study positions values as integral to the design and use of digital management systems. Decisions about data collection, analysis, and use are shown to be inherently normative, reflecting implicit priorities about what Education is for and whom it serves. This axiological framing offers a stronger conceptual foundation for addressing ethical challenges than approaches that rely solely on technical safeguards or policy regulations.

The central novelty of this study lies in its integrative philosophical framework, which brings together epistemology, ontology, and axiology to provide a holistic understanding of digital and data-driven educational management. While existing literature often addresses these dimensions separately—focusing on knowledge, technology, or ethics in isolation—this research demonstrates that they are deeply interconnected and mutually reinforcing.

By integrating these dimensions, the study moves beyond fragmented critiques and offers a coherent framework that can guide both theoretical inquiry and managerial practice. This integrative approach responds directly to calls in international literature for more reflective and critical perspectives on digital transformation in Education (Knox, 2020; Decuyper et al., 2021). Unlike purely critical accounts that emphasise risks and limitations, this study does not reject data or technology outright. Instead, it repositions them within a reflective, value-conscious, and humanistic model of educational management.

From a theoretical standpoint, this study contributes to global scholarship by embedding digital educational management within the philosophy of science, thereby strengthening the field's conceptual foundations. It demonstrates that philosophical inquiry is not peripheral but essential for understanding the implications of data-driven governance. From a practical perspective, the findings suggest that educational leaders and policymakers should adopt reflective data practices that balance analytical insights with professional judgment, contextual knowledge, and ethical responsibility.

By articulating a philosophy-of-science-based framework, this study opens new avenues for future research, including empirical investigations into how epistemological awareness, ontological sensitivity, and axiological commitments shape digital management practices across different educational contexts. In this sense, the study not only addresses a critical gap in the literature but also provides a conceptual platform for more responsible and sustainable approaches to digital educational management.

CONCLUSION

This study argues that digital and data-driven educational management is not merely a technical practice but a philosophically grounded endeavour shaped by assumptions about knowledge, reality, and values. The analysis shows that many data-driven systems rest on positivistic epistemologies, socio-technical constructions of educational reality, and efficiency-oriented value frameworks that may marginalise professional judgment and ethical reflection. When unexamined, such assumptions risk reducing education to measurable performance and instrumental control. By positioning philosophy of science as an integrative framework encompassing epistemology, ontology, and axiology, the study offers a coherent foundation for rethinking digital management beyond technocratic rationality. It calls for the reflective and ethically informed use of data, aligned with humanistic and socially responsible educational purposes. Theoretically, the study contributes an integrative framework linking knowledge claims, constructions of reality, and value commitments in digital governance, reframing educational management as an epistemic and moral practice. Practically, it encourages leaders to use digital systems as decision-support tools grounded in equity, responsibility, and care. Although limited to conceptual analysis, the study invites empirical research to examine further how philosophical awareness shapes digital management practices across contexts.

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