El Midad : Jurnal Jurusan PGMI
p-ISSN 2087-8389 e-ISSN 2656-4289
website : http://journal.uinmataram.ac.id/index.php/elmidad
Vol. 18 No.1 April 2026
p. 160-169
email : elmidadpgmi@uinmataram.ac.id

BEYOND TECHNOCRATIC DIGITALIZATION: INTEGRATING SCIENTIFIC AND CRITICAL PARADIGMS IN DIGITAL EDUCATION MANAGEMENT

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ABSTRACT

Digital transformation has profoundly reshaped the governance and management of education systems through the expansion of data-driven decision-making, learning analytics, and platform-based management. However, research on digital education management remains largely dominated by a scientific–technocratic paradigm that prioritises efficiency, performance measurement, and system optimisation. While this orientation can strengthen organisational accountability, it often underplays the social, ethical, and political dimensions embedded in digital governance practices. This study addresses this limitation by examining digital education management through an integration of scientific and critical paradigms. Using a qualitative integrative literature review, we analysed peer-reviewed publications (2020–2025) retrieved from Scopus, Web of Science, and Google Scholar. The analysis followed a three-stage procedure comprising paradigmatic mapping, thematic coding, and conceptual integration. The findings indicate a persistent fragmentation between technocratic and critical approaches, alongside limited attempts at substantive integration. Building on this synthesis, the study proposes an integrative conceptual framework that conceptualises digital education management as both a technical practice and a social praxis. The study contributes theoretically by bridging competing paradigms in educational management scholarship and practically by offering a reflective foundation for digital education governance that is efficient, participatory, and socially just.

Keyword: Digital, management; Technocratic rationality; Critical paradigm; Digital governance

INTRODUCTION

Digital transformation has become a central agenda in contemporary Education systems worldwide, particularly in educational management and governance. Over the past decade, the rapid expansion of digital technologies—such as learning management systems, educational data analytics, algorithmic assessment tools, and digital governance platforms—has fundamentally reshaped how educational institutions are planned, managed, evaluated, and regulated. Digital Education management is no longer perceived merely as a technical innovation aimed at administrative efficiency; rather, it increasingly functions as a strategic mechanism through which institutional performance, accountability, and policy decisions are structured and legitimised (Selwyn, 2020; Williamson & Hogan, 2020).

The current state of the art in digital Education management research is largely characterised by the dominance of a scientific or rational–technocratic paradigm. This paradigm conceptualises Education as a system that can be optimised through objective measurement, standardisation, and data-driven decision-making. Within this framework, digital technologies are positioned as neutral tools that enhance efficiency, transparency, and organisational effectiveness. Recent studies highlight the growing reliance on learning analytics, performance indicators, and evidence-based management practices to support institutional decision-making and quality assurance processes (Datnow & Park, 2020; Zawacki-Richter et al., 2021). Consequently, digitalisation is frequently framed as an inevitable and desirable pathway towards more effective and accountable Education systems.

Despite its practical contributions, the technocratic orientation of digital Education management has increasingly been questioned in recent scholarly debates. Critical researchers

argue that digital technologies are never value-neutral, as they embed specific assumptions about learning, performance, and governance that reflect broader political and economic agendas (Selwyn et al., 2020; Macgilchrist et al., 2023). From this perspective, digital Education management is not merely a technical process but a social practice shaped by power relations, institutional priorities, and ideological frameworks. The widespread adoption of datafication, for instance, transforms complex educational processes into measurable outputs, potentially marginalising pedagogical, relational, and ethical dimensions of Education that resist quantification.

A key problem emerging from this context is the increasing use of digital management systems as instruments of control and surveillance. Algorithmic monitoring, continuous reporting, and performance dashboards enable new forms of data-driven governance that intensify administrative oversight over teachers and students (Williamson, 2020). While such systems promise objectivity and efficiency, they often obscure the normative assumptions embedded in data production and interpretation. As a result, teachers and learners are frequently positioned as objects of digital management rather than active subjects who shape educational practices. This condition raises critical concerns about professional autonomy, pedagogical freedom, and democratic participation in educational decision-making.

The urgency of addressing these issues has been further amplified in the post-pandemic context. The COVID-19 crisis accelerated the digitalisation of Education at an unprecedented scale, normalising remote learning, platform-based management, and data-intensive monitoring practices across Education systems. While this rapid transition ensured institutional continuity, it also exposed and intensified structural inequalities related to access, digital literacy, and institutional capacity (Williamson et al., 2020; Selwyn, 2022). Many digital management policies adopted during and after the pandemic were implemented through top-down approaches that prioritised efficiency and scalability, often without sufficient reflection on their long-term social, ethical, and pedagogical consequences.

Existing studies provide important insights into these dynamics, but also reveal significant conceptual limitations. Selwyn et al. (2020) critically examined the future of educational technology and warned that digital innovation risks reinforcing neoliberal logics of performance, competition, and marketisation if left unexamined (doi:10.1080/17439884.2020.1694945). Williamson (2020) analysed the rise of big data and algorithmic governance in Education, demonstrating how data-driven systems shape policy and practice through seemingly neutral technical processes that nonetheless carry political implications (doi:10.4135/9781529714920). More recently, Zawacki-Richter et al. (2021) conducted a systematic review of digital Education research and found that studies focusing on management and governance remain predominantly technical, with limited engagement with critical or sociopolitical perspectives (doi:10.1186/s41239-021-00262-1). Although these works advance critical awareness, they address technocratic and critical paradigms separately rather than exploring their possible integration.

This fragmentation highlights a clear theoretical gap in the literature. On the one hand, the scientific paradigm offers robust tools for managing digital systems, improving organisational efficiency, and supporting evidence-based decision making. On the other hand, the critical paradigm provides essential insights into power, inequality, ideology, and social justice in digital Education. However, most existing research treats these paradigms as competing or incompatible frameworks. Technocratic studies often overlook ethical and social implications, while critical analyses frequently remain at the level of normative critique, offering little operational guidance for educational management. As a result, digital Education management scholarship lacks an integrative conceptual framework that reconciles managerial effectiveness with critical reflection.

The novelty of this study lies in its effort to bridge this divide by proposing an integrative conceptual framework that combines scientific and critical paradigms in digital Education

management. Rather than rejecting technocratic approaches outright, this article acknowledges their practical value while situating them within a broader critical understanding of Education as a social and political practice. Digital Education management is thus conceptualised as both a technical practice—concerned with systems, data, and organisational performance—and a social praxis that involves ethical judgement, power negotiation, and the pursuit of social justice. This integrative perspective responds to recent calls for more reflexive and responsible approaches to digital governance in Education (Macgilchrist et al., 2023; Teräs et al., 2020).

Accordingly, the objective of this study is to critically examine contemporary literature on digital Education management, identify the limitations of dominant technocratic approaches, and develop an integrative conceptual framework that brings together scientific and critical paradigms. Through a conceptual literature review, this article aims to contribute theoretically to the field of educational management and practically to the development of digital Education governance that is not only efficient and data-informed but also humanistic, inclusive, and socially just.

METHODOLOGY

This study employs a qualitative, conceptual design using an integrative literature review to critically analyse and synthesise theoretical perspectives on digital education management through scientific (technocratic) and critical paradigms. Rather than testing empirical hypotheses, the study aims to build theory and integrate paradigms to advance conceptual understanding. Literature published between 2020 and 2025 was retrieved from Scopus, Web of Science, and Google Scholar to ensure currency and international relevance. Search terms included digital education management, educational governance and technology, data-driven decision-making, digital governance and power, and social justice in education, refined using Boolean operators. Inclusion criteria required peer-reviewed journal articles or academic books in English addressing management, governance, or policy dimensions of digital education and clearly engaging with scientific, critical, or hybrid paradigms. Technical studies lacking managerial implications and non-scholarly sources were excluded. From an initial corpus, 42 publications were deemed relevant, of which 14 were prioritised for in-depth analysis.

Data analysis followed three stages: paradigmatic mapping, thematic coding, and conceptual integration. Themes included efficiency, datafication, governance, power, equity, and professional agency. The synthesis produced an integrative framework positioning digital education management as a socially embedded and ethically informed governance practice. To ensure analytical consistency and transparency, an analytical instrument matrix was developed to guide the review process. This instrument functioned as a conceptual coding framework rather than a measurement tool, which is appropriate for qualitative conceptual research.

Table 1. Analytical Instrument for Literature Review

Analytical Dimension	Scientific Paradigm Focus	Critical Paradigm Focus	Integrative Analytical Lens
View of Technology	Neutral tool for efficiency	Ideologically embedded system	Contextual and value-laden technology
Management Logic	Rational, data-driven, performance-oriented	Power, control, governance critique	Reflective and value-informed management
Decision Making	Evidence-based and quantitative	Normative and political	Data-informed and ethically reflective
Role of Actors	System users and implementers	Subjects affected by power structures	Participatory and agentic actors
Evaluation Criteria	Efficiency, accountability, output	Equity, justice, inclusion	Balanced technical and social outcomes

This instrument enabled the study to examine how each paradigm frames digital Education management systematically and to identify points of integration. By using a shared

analytical structure, the study avoided selective interpretation and ensured conceptual coherence across the reviewed literature.

RESULT AND DISCUSSION

This section presents the results of the integrative literature analysis, structured explicitly according to the three-stage analytical procedure described in the Methods section. The findings are organised into paradigmatic mapping, thematic analysis, and conceptual integration, providing a systematic account of how scientific and critical paradigms frame digital Education management in contemporary scholarship.

Stage 1: Paradigmatic Mapping of Digital Education Management Literature

The first stage of analysis involved mapping the epistemological orientations and conceptual assumptions underlying the reviewed literature. The analysis revealed that contemporary studies on digital Education management can be broadly categorised into three paradigmatic orientations: a scientific or technocratic paradigm, a critical paradigm, and hybrid or transitional approaches that combine elements of both. Studies grounded in the scientific or technocratic paradigm predominantly conceptualise digital Education management as a rational and instrumental process aimed at enhancing organisational efficiency, accountability, and performance. Within this orientation, digital technologies are framed as neutral tools that enable data-driven decision-making, system optimisation, and standardisation of educational processes. Management effectiveness is typically assessed through measurable indicators such as performance metrics, efficiency gains, and system Reliability.

In contrast, studies adopting a critical paradigm conceptualise digital Education management as a socially embedded practice shaped by power relations, ideological assumptions, and governance structures. These studies foreground issues such as datafication, surveillance, marketisation, and the redistribution of authority through digital platforms. Rather than treating technology as neutral, critical studies emphasise its role in shaping subjectivities, institutional priorities, and educational inequalities. A smaller but increasingly visible group of studies reflects hybrid or transitional approaches. These studies acknowledge the functional benefits of digital systems for educational management while simultaneously recognising their social, ethical, and political implications. Although such studies do not always offer fully articulated integrative frameworks, they indicate an emerging recognition of the limitations of purely technocratic or purely critical perspectives.

Table 2. Paradigmatic Orientation of Reviewed Literature

Paradigmatic Orientation	Core Assumptions	Primary Focus	Dominant Outcomes
Scientific / Technocratic	Technology is neutral and objective	Efficiency, performance, data-driven management	System optimisation, accountability
Critical	Technology is value-laden and political	Power, control, inequality, governance	Critique of surveillance and marketisation
Hybrid / Transitional	Technology is functional but contextual	Balance between efficiency and ethics	Partial integration of technical and social concerns

Stage 2: Thematic Patterns in Digital Education Management Research

The second stage of analysis identified recurring themes across the reviewed literature through inductive and deductive thematic coding. Six dominant thematic clusters emerged consistently across paradigmatic orientations, though they were framed and prioritised differently depending on the underlying theoretical perspective. The first theme concerns efficiency and performance, which is central to technocratic studies. These studies emphasise the role of digital management systems in streamlining administrative processes, reducing operational costs, and improving institutional responsiveness. Performance indicators, dashboards, and analytics are frequently presented as objective tools for monitoring institutional effectiveness.

The second theme concerns datafication and analytics, highlighting the growing reliance on data as a basis for decision-making. Across the literature, data are positioned as key resources for policy formulation, quality assurance, and strategic planning. However, while technocratic studies frame data as neutral and evidence-based, critical studies highlight the constructed nature of data and the assumptions embedded in data collection and interpretation processes. A third theme focuses on governance and accountability. Digital platforms are widely portrayed as mechanisms for enhancing transparency and accountability in Education systems. At the same time, several studies point to the expansion of managerial oversight and reporting requirements enabled by digital governance infrastructures.

The fourth theme addresses power relations and control. This theme is predominantly articulated within critical studies, which document how digital Education management systems enable new forms of surveillance, standardisation, and behavioural regulation of teachers and students. Power is exercised not only through policy mandates but also through algorithmic systems that shape everyday educational practices. The fifth theme concerns equity, inclusion, and social justice. Studies within this theme highlight uneven access to digital infrastructure, disparities in digital literacy, and differential impacts of digital management policies across social and institutional contexts. Equity considerations are often marginal in technocratic studies but central in critical analyses.

The sixth theme relates to participation and professional agency. Several studies document limited involvement of teachers and other educational actors in the design and implementation of digital management systems. Participation is frequently constrained by top-down governance models, raising concerns about professional autonomy and democratic decision-making.

Table 3. Dominant Themes Across Paradigmatic Orientations

Theme	Technocratic Framing	Critical Framing
Efficiency and performance	Core objective	Instrument of managerial control
Datafication and analytics	Objective evidence	Socially constructed and political
Governance and accountability	Transparency and compliance	Expanded surveillance
Power and control	Largely implicit	Explicit and central
Equity and inclusion	Secondary concern	Primary analytical focus
Participation and agency	System adoption	Democratic deficit

Stage 3: Conceptual Integration of Scientific and Critical Paradigms

The third stage of analysis focused on synthesising insights from the scientific and critical paradigms to identify points of convergence, tension, and conceptual blind spots. The analysis revealed that while the two paradigms differ significantly in their assumptions and priorities, they also address complementary dimensions of digital Education management. Scientific approaches provide robust tools for managing digital systems, allocating resources, and supporting evidence-informed decision-making. However, they often under-theorise issues related to power, ethics, and social consequences. Conversely, critical approaches offer deep insights into governance, inequality, and ideological dynamics but frequently lack operational guidance for educational managers and policymakers. The synthesis of these findings informed the development of an integrative conceptualisation of digital Education management as both a technical practice and a social praxis. This integrative view recognises efficiency, data use, and system Reliability as legitimate managerial concerns, while simultaneously foregrounding ethical reflection, participatory governance, and social justice considerations.

Table 4. Key Dimensions of the Integrative Conceptual Framework

Dimension	Scientific Paradigm	Critical Paradigm	Integrative Orientation
Role of technology	Instrumental tool	Political artefact	Contextual and value-laden
Management logic	Rational and data-driven	Power-aware and reflexive	Reflective rationality
Decision making	Evidence-based	Normative and ethical	Data-informed and value-sensitive
Role of actors	System users	Subjects of governance	Participatory agents
Evaluation criteria	Performance indicators	Social impact	Balanced technical and social outcomes

Overall, the results demonstrate that contemporary digital Education management research remains largely fragmented along paradigmatic lines. While technocratic approaches dominate operational practices, critical perspectives reveal significant social and ethical implications that are often overlooked. The integrative synthesis highlights the potential to reconceptualise digital Education management in ways that reconcile managerial effectiveness with critical reflection, laying the foundation for the subsequent discussion of theoretical and practical implications.

DISCUSSION

The findings of this study highlight the persistent dominance of technocratic rationality in digital Education management while simultaneously revealing a growing, yet fragmented, body of critical scholarship that interrogates the social, political, and ethical dimensions of educational digitalisation. By explicitly aligning the discussion with the three-stage analytical results, this section interprets the implications of paradigmatic fragmentation, thematic tensions, and the proposed integrative framework for contemporary educational management Theory and practice.

The paradigmatic mapping results confirm that digital Education management remains largely shaped by a scientific–technocratic orientation that prioritises efficiency, performance measurement, and data-driven governance. This dominance reflects broader trends in public sector management, where digital technologies are increasingly mobilised to enhance accountability and standardisation (Margetts & Dunleavy, 2023). In Education, such approaches resonate strongly with policy discourses that frame digitalisation as a solution to organisational complexity and resource constraints. However, as the results demonstrate, this paradigm often abstracts management practices from their social and institutional contexts, reinforcing a narrow conception of effectiveness that privileges measurable outputs over educational meaning (Harinandrasana et al., 2026).

The thematic analysis further reveals that efficiency and datafication function as organising principles in technocratic studies. In contrast, issues of power, equity, and professional agency are treated as secondary or external concerns. This finding aligns with recent critiques of digital governance that argue that data-driven systems tend to depoliticise decision-making by framing managerial choices as technical necessities rather than value-laden judgments (Jarke & Breiter, 2019; Beer, 2020). In the context of Education, this depoliticisation risks obscuring how algorithmic systems and performance metrics shape pedagogical priorities, redistribute authority, and normalise particular visions of "good" Education.

At the same time, the prominence of critical themes such as surveillance, control, and inequality underscores the relevance of critical management studies for understanding digital Education management. The results echo broader concerns in critical data studies that digital infrastructures do not merely support governance but actively reconfigure power relations by embedding norms and expectations into technical systems (Kitchin, 2021). In educational settings, these dynamics are particularly consequential, as digital management platforms increasingly mediate teachers' work, students' learning trajectories, and institutional accountability. Such findings reinforce arguments that educational management cannot be understood independently of the political economy of digital platforms and data capitalism (Couldry & Mejias, 2019).

The limited presence of hybrid or transitional approaches identified in the results suggests that while awareness of technocratic limitations is growing, integrative theorisation remains underdeveloped. This gap reflects a broader challenge in Education research, where critical scholarship often prioritises deconstruction over reconstruction, and managerial research prioritises applicability over reflexivity (Fenwick et al., 2022). As a result, educational leaders and policymakers are frequently left with a binary choice between adopting efficiency-driven digital systems or rejecting them on ethical grounds, rather than being offered frameworks that support critical yet pragmatic engagement with digital technologies (Urbain et al., 2026).

The integrative framework developed in this study addresses this limitation by reconceptualising digital Education management as both a technical practice and a social praxis. From this perspective, efficiency, data use, and system optimisation are not dismissed but repositioned within a broader ethical and political horizon. This aligns with emerging scholarship that calls for "responsible digital governance" in Education—an approach that balances innovation with accountability to democratic values and social justice (Eubanks, 2018; Prinsloo, 2020). By integrating scientific and critical paradigms, the framework advances a form of reflective rationality that acknowledges the necessity of managerial tools while subjecting them to continuous ethical scrutiny.

Importantly, the discussion of participation and professional agency in the results highlights the democratic deficit inherent in many digital Education management initiatives. Studies in organisational learning and leadership increasingly emphasise that sustainable digital transformation depends on participatory governance structures that empower practitioners rather than treating them as passive system users (Avolio et al., 2020; Brynjolfsson & McAfee, 2022). The integrative framework responds to this insight by positioning teachers, administrators, and learners as agentic actors whose experiential knowledge should inform the design, implementation, and evaluation of digital management systems.

The equity-related findings further underscore the need for an integrative approach. Digital Education management systems often assume uniform access to infrastructure and digital literacy, an assumption that has been repeatedly challenged in recent comparative Education research (Steinmueller, 2020; van Dijk, 2020). By incorporating social justice as a core evaluative criterion, the proposed framework extends beyond performance metrics to consider distributive and recognitional dimensions of educational governance. This shift is critical in ensuring that digitalisation does not exacerbate existing inequalities under the guise of efficiency and innovation.

From a theoretical standpoint, this study contributes to educational management scholarship by bridging two paradigms that have historically developed in parallel rather than in dialogue. The integrative framework offers a conceptual vocabulary for examining how digital technologies simultaneously enable organisational coordination and enact governance through subtle forms of power. This contribution aligns with recent calls in Education policy research for middle-range theories that connect abstract critique with institutional practice (Ball, 2021; Gunter et al., 2023).

The findings suggest that educational leaders and policymakers should move beyond instrumental adoption of digital management systems and engage in reflexive governance practices. This involves questioning not only whether digital tools "work" but also whom they serve, whose values they embody, and what forms of educational practice they privilege or marginalise. Such reflexivity is increasingly recognised as a core competence of leadership in digitally mediated organisations (Carroll & Nicholson, 2022).

Overall, the discussion demonstrates that integrating scientific and critical paradigms is not merely a theoretical exercise but a practical necessity in an era where digital technologies increasingly shape the conditions of educational governance. By foregrounding both managerial effectiveness and social responsibility, the proposed framework provides a pathway for

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reimagining digital Education management in ways that are context-sensitive, ethically grounded, and aligned with the broader purposes of Education in democratic societies.

CONCLUSION

This study has critically examined the contemporary landscape of digital Education management by interrogating the dominance of technocratic rationality and advancing an integrative conceptual framework that bridges scientific and critical paradigms. In doing so, the article responds to growing concerns that digitalisation in Education has been driven primarily by efficiency, performance metrics, and data-driven governance, often at the expense of ethical reflection, social justice, and democratic participation.

The findings demonstrate that while scientific approaches provide indispensable tools for managing digital systems and supporting organisational decision making, they are insufficient on their own to address the complex social, political, and ethical dynamics embedded in digital Education governance. Conversely, critical perspectives offer valuable insights into power relations, datafication, and inequality, but frequently lack operational pathways for educational leadership and policy implementation. By integrating these paradigms, this study reframes digital Education management as both a technical practice and a social praxis, emphasising the need for reflective rationality that balances managerial effectiveness with normative responsibility.

The primary theoretical contribution of this article lies in its articulation of an integrative framework that reconceptualises digital Education management beyond the binary of technocratic efficiency versus critical resistance. This framework advances the field by providing a coherent conceptual vocabulary for understanding how digital technologies simultaneously enable organisational coordination and enact governance through subtle forms of power. As such, it contributes to ongoing debates in educational management, digital governance, and critical Education studies by offering a pathway toward more reflexive and context-sensitive theorisation.

From a practical perspective, the study underscores the need to rethink digital leadership and governance in Education. Educational leaders and policymakers are encouraged to move beyond instrumental adoption of digital management systems and engage in participatory, ethically informed decision-making. This involves critically examining the assumptions embedded in digital platforms, recognising educators' and learners' agency, and incorporating equity and inclusion as core criteria for evaluating digital transformation initiatives. Such an approach is essential if digital Education management is to support, rather than undermine, the broader purposes of Education in democratic societies.

Several limitations should be acknowledged. As a conceptual literature-based study, this research does not provide empirical validation of the proposed framework across specific institutional contexts. Future research could extend this work by empirically examining how integrative approaches to digital Education management are enacted in practice, particularly across diverse socioeconomic and policy environments. Comparative studies and qualitative case research would be especially valuable in exploring how tensions between efficiency and justice are negotiated within digitally mediated governance structures.

In conclusion, as digital technologies continue to reshape the governance and management of Education systems globally, the challenge is no longer whether to digitalise, but how to do so responsibly. This study argues that integrating scientific and critical paradigms is not merely an academic exercise but a necessary condition for ensuring that digital Education management remains aligned with educational values, social responsibility, and the pursuit of equitable and meaningful learning.

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