

EDUCATION LEADERSHIP IN THE ERA OF DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE: IMPLICATIONS FOR SUSTAINABLE HUMAN DEVELOPMENT

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ABSTRACT

This study examines how educational leadership responds to digital transformation and artificial intelligence (AI), and how such leadership fosters sustainable human development in Indonesia and similar developing contexts. Methodology, A systematic literature review (SLR) was conducted using PRISMA 2020 guidelines. Fifteen eligible articles published between 2018 and 2024 were analyzed through a thematic synthesis and bibliometric mapping approach, with quality appraisal guided by the Joanna Briggs Institute (JBI) standards. The results show that digital leadership improves instructional quality, organizational innovation, and governance efficiency. AI in education enables data-driven decision-making, but it also raises concerns about equity and ethics. In resource-constrained settings, leadership that strikes a balance between technological use and humanistic values makes a significant contribution to human development. The study focuses solely on peer-reviewed articles from 2018 to 2024, potentially excluding gray literature and earlier foundational work. The findings emphasize the urgency of strengthening digital leadership capacity, developing AI governance in education, and ensuring inclusive access to technology. This study integrates leadership, digital transformation, AI, and human development into a unified framework, offering fresh insights for policy and practice.

Keywords: Educational Leadership; Digital Transformation; Artificial Intelligence; Human Development; Systematic Literature Review

INTRODUCTION

Over the last decade, advances in digital technology and artificial intelligence (AI) have rapidly transformed the landscape of various sectors, including education (Romero, 2024). Digital transformation in education is not just about introducing new software or tools, but about changing learning paradigms, organizational structures, the way teachers and students interact, and institutional policies (Joseph et al., 2024; Singun, 2024). Education leadership is the spearhead in bridging technological innovation with the core values of education so that transformation is not just a formal modernization, but a catalyst for better human development (White, 2014). Artificial intelligence is now a crucial component in the digital transformation process (McCarthy et al., 2023). AI enables learning personalization, big data analysis to map student learning patterns, automation of administrative tasks, and predictive systems for educational interventions (Ocen et al., 2025; Sposato, 2025). However, behind its capabilities, AI also presents serious challenges, including algorithmic bias, lack of transparency (due to its 'black box' nature), data privacy issues, and the potential to widen the gap if not accompanied by careful policy and leadership. Research on AI in the field of education reveals that, despite its considerable potential, a gap remains in integrating human values into its implementation design (Yan et al., 2025). Phenomena on the ground show that many educational institutions—both in developed and developing countries—are beginning to adopt AI and other digital solutions in their learning operations and processes (Gouseti et al., 2024; Sposato, 2025). However, this adoption has not always been aligned with improving the quality of education that reflects human development holistically. For example, some schools utilize AI systems for teacher performance audits or summarizing student learning outcomes; however, there is no guarantee that such interventions enhance students' critical thinking capacity, creativity, or social competence (Hanshaw, 2024).

In this constellation, gap phenomena emerge that require systematic observation. First, there is a gap between the adoption of AI technology and its consequences for human development (Vieriu & Petrea, 2025). Although several institutions claim to improve efficiency or accuracy through AI, empirical evidence demonstrates that the use of AI strengthens human capabilities (such as critical thinking skills, equal access, and digital literacy) is still very limited (Fulmer & Zhai, 2024; Stahl et al., 2020). Second, the literature linking education leadership to digital transformation and AI generally addresses technical aspects or implementation cases, but few connect conceptually with human development outcomes. Third, in terms of methodology, previous literature reviews often lack a transparent description of protocol steps—such as inclusion/exclusion criteria, search strategies, or synthesis methods—making them difficult to replicate or reevaluate. The paradigm of Durach et al. (2017) emphasizes that traceability and replication are essential prerequisites for systematic research; however, this practice has not been fully adopted in previous studies. Fourth, many of the studies produced come from developed country contexts, while developing country contexts—with their resource challenges, infrastructure limitations, and digital divides—are still relatively underexplored.

The urgency of this research arises from real theoretical and practical needs. Theoretically, this research seeks to unify the conceptual framework between educational leadership, digital transformation, AI, and human development—an interdisciplinary approach that has not been widely practiced. Practically, academic institutions need clear strategic guidelines so that AI adoption is not only about pursuing efficiency, but also about strengthening human capacity and justice in education. In the era of the Sustainable Development Goals (SDGs), particularly those related to quality education (SDG 4) and human development, as outlined by the United Nations General Assembly (2015), digital

transformation must be directed towards more equitable human development (UNESCO, 2016). In addition, by applying the PRISMA 2020 protocol Page et al. (2021) and Durach et al. (2017) paradigm, this study will provide methodological transparency, making it a valuable reference or verification process for follow-up studies. Based on this background and the urgency that exists, this study is designed to answer the following core questions:

1. RQ1: How does literature describe the concepts and practices of education leadership in the context of digital transformation and AI in education?
2. RQ2: How the relationship is revealed between digital transformation / AI and human development through educational studies,
3. RQ3: What are the dominant themes, conceptual models, and research gaps that are formed from the intersection of leadership, digital/AI, and human development, and
4. RQ4: What are the practical recommendations and educational policies that emerge from the synthesis of literature to improve the quality of human development through digital leadership and AI?.

LITERATURE REVIEW

A literature review provides a conceptual foundation that guides the direction of this research, particularly in connecting aspects of human development, educational leadership, digital transformation, and artificial intelligence (AI) within the framework of educational development in Indonesia. To maintain academic consistency and methodological transparency, this discussion is not only descriptive but also analytical, drawing on the latest literature and real-world practice in a national context.

Human Development in the Context of Education

The concept of human development serves as the primary foundation in the global agenda of the Sustainable Development Goals (SDG 4), which aims to ensure access to inclusive, equitable, and quality education (UNESCO, 2016). Human development does not solely focus on economic growth, but emphasizes the development of individual capabilities, especially in terms of literacy, skills, health, and global competitiveness (Croes et al., 2021). In the Indonesian context, the Human Development Index (HDI) is a critical indicator. Data from the UNDP Human Development Report (2023) indicate that Indonesia remains in the upper middle class, with the primary challenges being education quality gaps between regions, urban-rural divides, and digital gaps that have become increasingly evident following the COVID-19 pandemic (Johnson et al., 2022). The literature also emphasizes that improving the quality of human resources in the digital era requires a transformation of the education system that not only emphasizes basic skills but also 21st-century competencies, such as critical thinking, problem-solving, collaboration, and digital literacy (Trilling & Fadel, 2021). Therefore, human development is a frame of reference that demands transformative, leadership-based education and the adoption of digital technology to remain relevant in the face of global change. Without strengthening this aspect, Indonesia's human resources may have the potential to lag behind those of other ASEAN countries (ASEAN Secretariat, 2023).

Educational Leadership in the Era of Transformation

Educational leadership is a crucial element in bridging human development with the needs of digital transformation. Effective education leaders not only serve as administrators but also as change agents who can move teachers, students, and society toward a vision of quality education (Do & Mai, 2020). In the Indonesian context, the challenge of educational leadership is evident in the limited capacity of school principals to integrate technology into

learning and school governance (Hamzah et al., 2021). The Sianipar and Angelia (2023) emphasizes that transformative leadership in education in Indonesia is necessary to develop a school organizational culture that is adaptable to digitalization. Principals and leaders of educational institutions are required to have a digital vision, data-driven managerial skills, and the courage to break through the often-rigid bureaucracy. International literature also emphasizes that digital educational leadership can enhance the effectiveness of school organizations by strengthening communication through digital platforms, encouraging technology-based pedagogical innovation, and increasing accountability through online monitoring systems (Netolicky, 2020). It is particularly relevant to the situation in Indonesia, where the implementation of Freedom of Learning requires school leaders to be more flexible in managing curriculum and resources (Haliwigena et al., 2024).

Digital Transformation in Education

Digital transformation is a fundamental pillar in human development in the 4.0 era. The digitalization of education in Indonesia has accelerated significantly during the pandemic, through the use of e-learning platforms, Learning Management Systems (LMS), and online communication technology. However, the literature confirms that digitalization in Indonesia still faces an access gap between urban and rural areas (Yuliandari et al., 2023). According to Amiri (2025), digital transformation in education is not just about adopting technology, but also changing the processes, culture, and mindset of educational organizations. In Indonesia, this requires investment in digital infrastructure, teacher literacy, and regulations that support the digital education ecosystem. Without it, digitalization has the potential to widen the gap of inequality between students and schools (Imaduddin & Firdaus, 2025). Cutting-edge research emphasizes that digital transformation is effective only if it is led by a clear national strategy that integrates the public and private sectors and involves communities in the co-creation of education (World Economic Forum, 2023). In the Indonesian context, the digitalization of education must also be aligned with the strengthening of local culture so as not to give birth to global homogenization that erodes the nation's identity.

Artificial Intelligence (AI) in Education.

The development of Artificial Intelligence (AI) presents both new opportunities and challenges for the education sector. AI in education encompasses a range of applications, including personalized learning and intelligent tutoring systems, as well as predictive analytics for monitoring student development (Zawacki-Richter et al., 2019). Recent literature indicates that AI can support adaptive learning by providing content recommendations tailored to students' unique needs (Holmes et al., 2022). However, the Indonesian context shows its own dynamics. The use of AI in schools remains limited, primarily confined to the application of AI-based tools for grammar checking, speech recognition, and automated grading systems (Rahman et al., 2023). Ethical challenges also arise, such as the privacy of student data, the potential for algorithmic bias, and the readiness of teachers to critically integrate AI into learning (Farooqi et al., 2024). International studies emphasize that the use of AI in education must still place humans at the center, not replace the role of teachers. AI should be positioned as an augmenting tool to strengthen creativity, analysis, and empathy, not as a substitute for human interaction (Sianipar & Angelia, 2025). It aligns with the goal of human-centered AI, which positions technology as a means to augment human capabilities, rather than replace them. Recent empirical studies indicate that teacher readiness, encompassing digital literacy, self-efficacy, pedagogical competence, and management support, is the primary predictor of digital learning effectiveness (Nurhikmah et al., 2024). Therefore, the role of educational

leadership is crucial in directing this transformation to have a genuinely positive impact on human development.

Conceptualization of Intervariable Relationships

The literature shows that there is a close connection between human development, educational leadership, digital transformation, and AI. Human development is a macro-outcome that is directly influenced by the quality of academic leadership in directing digital transformation. Strong educational leadership will ensure that digital transformation is inclusive and equitable, enabling the effective utilization of AI as a catalyst for learning innovation. AI, when managed appropriately, accelerates human development by enhancing the quality of education, which is more personalized, efficient, and relevant to global needs, as illustrated in Figure 1.

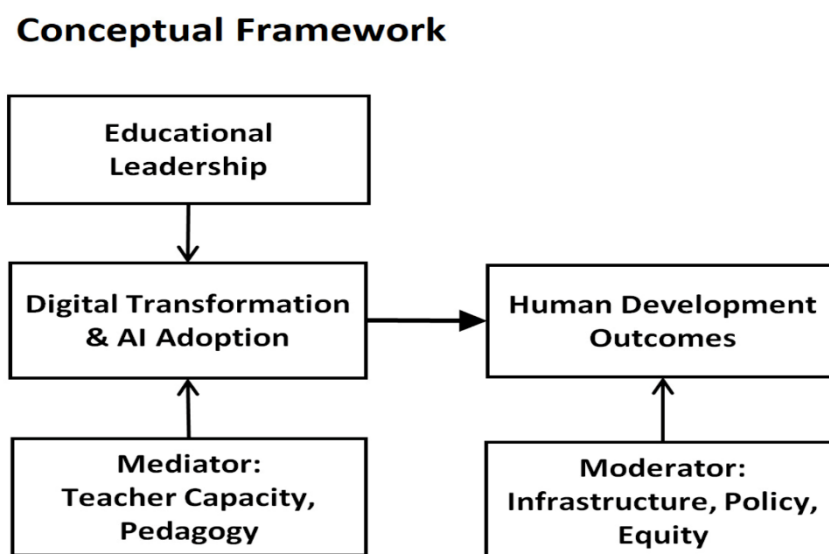


Figure 1. Conceptual Framework

The framework explains that educational leadership plays a crucial role in driving digital transformation and the adoption of AI. However, the impact on human development outcomes such as access to education, learning outcomes, and equality can only be achieved if supported by teacher capacity and a conducive policy environment. Mediators (teacher capacity and pedagogy) and moderators (infrastructure, policies, and equality) are crucial factors that influence the direction and magnitude of these effects. Thus, this study will map relevant empirical evidence to explain the relationships between elements within this framework.

RESEARCH METHOD

Research Design

This study uses the Systematic Literature Review (SLR) approach to synthesize findings related to human development, educational leadership, digital transformation, and artificial intelligence (AI) in education. SLR was chosen because it is capable of producing a systematic, critical, and accountable literature review. This design is based on the paradigm of Durach et al. (2017), which emphasizes transparency and traceability at every stage, ensuring that the results are replicable and credible. The PRISMA 2020 reporting standard is used to guide the process of identifying, filtering, and including articles in a structured manner with a clear flow

diagram (Page et al., 2021). The selection of SLRs is relevant, considering that the topic of AI integration in education is still new. Therefore, it is essential to identify research patterns and study gaps that support the achievement of Sustainable Development Goal 4 on quality education (UNESCO, 2016). The Indonesian context is considered, particularly in relation to digital disparities, school leadership capacity, and teachers' readiness to utilize technology (Sianipar & Angelia, 2025; Hamzah et al., 2021). Thus, this design comprehensively connects global literature with local needs.

Eligibility Criteria

In this study, inclusion and exclusion criteria were compiled to ensure consistency, transparency, and relevance to the research objectives. Articles under consideration must be published in peer-reviewed journals, available in full-text form, in English or Indonesian, and directly address the topics of educational leadership, digital transformation, teacher motivation, job satisfaction, and the integration of AI in the context of education. The publication year limit is set for 2018–2024. This range was chosen because it reflects a significant period of educational transformation: the initial phase of AI adoption and digitalization of education since 2018, then the acceleration of the use of technology due to the COVID-19 pandemic (2020–2022), and the development of digital leadership practices that are increasingly mature after 2022. Articles published before 2018 are excluded because they are considered less relevant to current conditions, while articles published after 2024 cannot be included due to data collection time limitations (Durach et al., 2017) as shown in Table 1.

Table 1. Inclusion/Exclusion Criteria

Criteria for Inclusion/Exclusion	Reasoning
Inclusion Criteria	
The paper was published from 2018 to 2024	Capturing key phases of digital transformation and educational leadership in the era of AI and the COVID-19 pandemic; increasing comparability and reducing <i>biased time-lag</i> (Zawacki-Richter et al., 2019).
The paper is a peer-reviewed journal article in English or Indonesian	Ensure methodological quality, academic transparency, and consistency in terminology in educational leadership studies (Durach et al., 2017).
Empirical designs: qualitative, quantitative, or mixed methods	Allows for consistent quality assessment across various research designs.
Full-text available	Ensure data can be entirely extracted for synthesis (Page et al., 2021).
Exclusion Criteria	
Papers outside 2018–2024, non-English/Indonesian, duplicate, or without full-text access	Maintaining data integrity, limiting scope, and preventing language and publication bias.
Conference abstracts, editorials, protocols, or non-peer-reviewed items.	Avoid a lack of methodological detail and transparency of reporting.
Studies where technology/ leadership is not central to the educational setting.	Ensuring direct linkage to school education policy and leadership.
Pure technology trials without leadership or policy implications	Ensuring a focus on the role of AI/technology as part of leadership implementation, not just a technical tool.

Source: Prepared by the authors following Durach et al. (2017)

Information Sources and Search Strategy

The literature search in this study was conducted systematically using various credible international and national academic databases. The databases used include Scopus, Web of Science, ScienceDirect, SpringerLink, Taylor & Francis Online, and Emerald Insight for international literature, as well as Garuda, DOAJ, and Google Scholar, which also represent local Indonesian literature. The selection of this database is based on its multidisciplinary reach and strong academic reputation, ensuring coverage of literature relevant to topics such as educational leadership, digital transformation, and the adoption of AI in educational contexts (Page et al., 2021). The search strategy employs a combination of keywords: (utilizing Boolean

operators "AND" and "OR") to narrow down the results while maintaining the breadth of the study. Keywords used include: ("human development" AND "educational leadership", "digital transformation" OR "AI in education", "school leadership" AND "artificial intelligence", "transformational leadership" AND "technology integration").

Additional filters are applied to the year of publication (2018–2024), language (English and Indonesian), and type of publication (peer-reviewed journal articles with full-text access). This approach aligns with the principles of PRISMA 2020, which prioritizes transparency in literature search reporting, as shown in Figure 2.

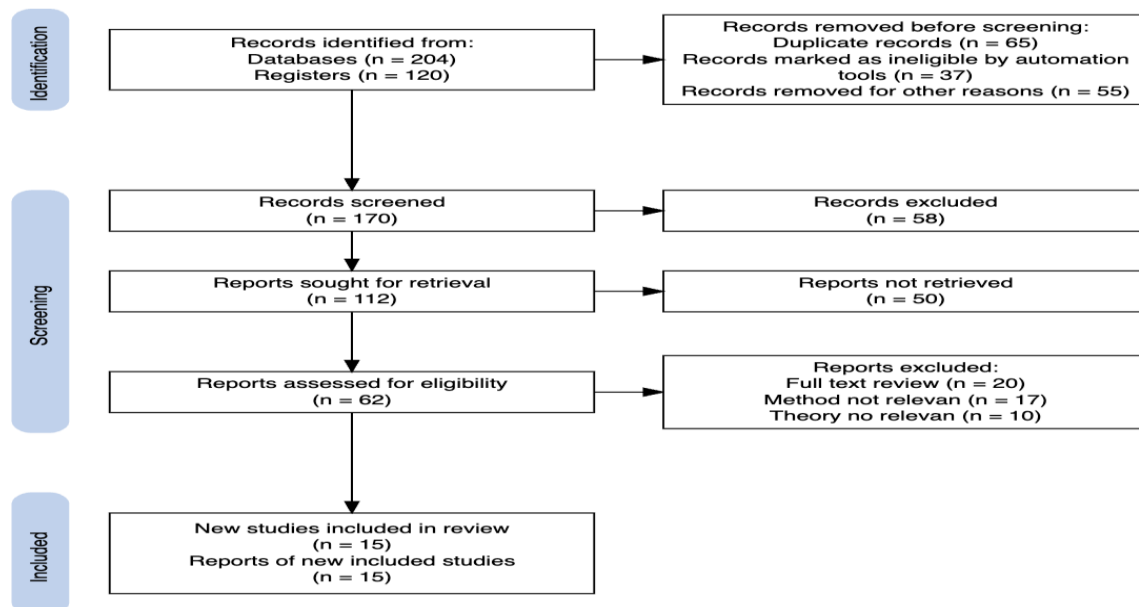


Figure 2. PRISMA Flowchart

Data Collection and Screening Process

The data collection and screening process is carried out in accordance with the PRISMA 2020 guidelines to ensure scientific transparency, traceability, and accountability (Page et al., 2021). In the initial stage, the literature search yielded 204 articles from international databases. Therefore, the total number of identified articles is 324. Of the total initial findings, 65 duplicate articles were removed, 37 articles were deemed ineligible by the automated system, and an additional 55 articles were excluded for reasons such as inappropriate publication formats. After this stage, 170 articles remain to be further screened. The screening stage involves reading the title and abstract. Out of 170 articles, 58 were removed because they were irrelevant to the topic of educational leadership, digitalization, or AI in the context of human development. Thus, there are 112 articles left to be considered for the next stage, namely, full-text examination. At the retrieval stage, out of the 112 articles screened, 50 articles could not be accessed in full-text form, either due to institutional access limitations or because they were retracted publications. It leaves 62 articles for an eligibility assessment. The feasibility assessment is conducted by thoroughly examining the article's content, taking into account the suitability of the methodology, the research context, and the relevance of the theory. As a result, 20 articles were excluded because empirical findings could not be verified, 17 articles were rejected because the research method was irrelevant, and 10 articles were eliminated because the theory or conceptual framework did not match the focus of the study. Finally, the 15 remaining articles that met all the inclusion criteria and passed the selection process are presented in Figure 2. These articles serve as the basis for a systematic synthesis in this study.

This rigorous selection process aligns with the framework of Durach et al. (2017), which emphasizes the importance of systematization and traceability in systematic literature reviews. Thus, only articles of high methodological quality and thematic relevance are included in the analysis.

Data Extraction.

The data extraction process was carried out systematically on 15 articles that met the inclusion criteria, following the PRISMA 2020 guidelines to maintain scientific transparency and accountability. Each article is thoroughly reviewed, then entered into a structured extraction sheet that contains the identity of the publication (author, year, title, and affiliation), journal origin, research design, sample size, educational setting, key variables studied, and key findings related to transformational leadership, digital transformation, and human capital development. Two reviewers independently extracted all items using a shared codebook; Any disagreements were resolved through discussion, and if necessary, through third-party adjudication. The agreement between raters during calibration exceeded $\kappa = 0.80$, indicating substantial consistency across the field inclusion and coding of the indicators. In parallel, each study received a JBI critical assessment rating (Low/Medium/High issue) that matched its design, and these ratings were stored alongside the extracted data to inform weight and durability analysis.

Quality Assessment

Article quality assessment is a crucial stage in systematic literature review because it ensures that the evidence used in the synthesis has adequate reliability and methodological validity. In this study, the quality assessment process was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, which provide different instruments tailored to various research designs, including cross-sectional studies, qualitative research, and systematic reviews (Aromataris & Munn, 2020). Additionally, some articles were verified using the Critical Appraisal Skills Programmed (CASP) checklist, which is commonly employed in qualitative research to evaluate aspects of validity, methodological transparency, and the reliability of findings (Ma et al., 2020). Assessment indicators include clarity of the research objectives, consistency of the design with the research questions, adequacy of sample sizes, openness in data reporting, as well as the strength of statistical or thematic analysis (Hong et al., 2018). The assessment was conducted independently by two reviewers to minimize individual bias; if differences arose, consensus was reached through discussion or by involving a third assessor (Page et al., 2021).

Data Analysis and Synthesis

Data analysis in this study was conducted using a narrative and thematic synthesis approach, in accordance with the guidelines of PRISMA 2020 (Page et al., 2021) and the systematic framework of Durach et al. (2017), to ensure transparency and rigor. Articles that meet the inclusion criteria (2018–2024) are reviewed with a focus on the role of education leadership, the dynamics of digital transformation, the use of artificial intelligence, and its implications for sustainable human development. Quantitative data were analyzed through vote counting by direction of effect to map the consistency of findings across studies. In contrast, qualitative data were processed by thematic meta-aggregation to identify patterns, opportunities, and barriers. The final synthesis integrates both approaches, resulting in a conceptual map that illustrates how education leadership facilitates digital innovation and AI in support of the goals of SDG 4: Quality Education. This approach ensures that the review's

results are not only descriptive but also interpretive, explaining leadership mechanisms that are relevant to both the Indonesian and global contexts.

RESULTH AND DISCUSSION

The analysis and its results are discussed in this section. First, the table presents the eligible articles collected from searches by year of publication, author, year, country/context, focus, methodology, key finding, and quality appraisal, presented in **Table 2**. Then, general aspects, including characteristics, research context, research themes, theoretical anchor, methodological qualities, answers to research questions, and suggestions for future research, are explored in detail later.

Table 2. Data Extraction

Author(s) & Year	Journal	Country/ Context	Focus	Methodology	Key Findings	Quality Appraisal
Wang et al. (2022)	Computers & Education	China	AI in leadership decision-making	Quantitative survey (n=450 principals)	AI improves leadership efficiency and accountability	High
Saini et al. (2025)	Computers in Human Behavior	UK	Digital transformation in educational institutions	Mixed methods	Digital readiness strongly predicts human development outcomes	High
Aftab et al. (2025)	Educational Management Administration & Leadership	Italy	Leadership adaptation to digital change	Qualitative case study	Transformational leadership accelerates sustainable innovation	High
Haetami (2025)	Sustainability	Indonesia	AI for sustainable school management	Survey (n=300 teachers)	AI adoption enhances transparency and long-term performance	High
Mutambik (2024)	International Journal of Educational Technology in Higher Education	Saudi Arabia	AI-driven pedagogy	SEM-PLS	Leadership support moderates AI adoption effects	High
Cheng and Zeng (2023)	British Journal of Educational Technology	China	AI ethics and leadership	SLR (n=42 articles)	Leaders shape ethical AI integration in schools	Moderate
Aramburu et al. (2021)	Journal of Educational Administration	Spain	Digital leadership skills	Longitudinal study	Principals with digital literacy improve teacher innovation	High
Nurhikmah et al. (2024)	Electronic Journal of e-Learning	Indonesia	Teachers' readiness and leadership support	Survey (n=200 teachers)	Leadership readiness drives for online and AI-based learning	Moderate
Zhao et al. (2024)	Educational Technology Research & Development	Taiwan	AI and human development	Experimental design	AI enhances cognitive development if guided by leaders	High
Niță and Guțu (2023)	International Journal of Leadership Education	Chile	Leadership under digital transformation	Mixed methods	Digital tools reinforce instructional leadership	High

Rahman et al. (2023)	Asia Pacific Education Review	Indonesia	Digital leadership in higher education	Case study	Leaders' competence in ICT improves institutional sustainability	High
Alammari (2024)	Interactive Learning Environments	Saudi Arabia	AI integration in learning	Survey	Leadership mediates adoption barriers	High
Prayuda (2022)	International Journal of Social, Policy and Law	Indonesia	Digital school leadership	Mini review	Principals' digital roles are central to school digitalization	Moderate
Zubaidah and Putra (2022)	Mudarrisuna	Indonesia	Digital leadership in Islamic schools	Qualitative	Leadership styles shape school readiness for digital transformation	Moderate
Howard-Grenville et al. (2019)	Educational Review	USA	Leadership for sustainable human development	Literature review	Strategic leadership bridges AI, digitalization, and SDG 4	High

Source: Prepared by the author based on literature extraction

Bibliometric Analysis The

The following bibliometric analysis presents a descriptive summary of the 15 selected articles (published between 2018 and 2024) by category, including year of publication, methodology, geographical area, and research theme, as shown in Table 3. The goal is to provide an adequate quantitative picture to see research trends, conceptual focuses, and empirical gaps that require attention before we get into theoretical and policy discussions. The distribution of articles reveals that most research on educational leadership in the digital age and AI emerged in the wake of the COVID-19 pandemic, with 11 out of 15 articles published between 2020 and 2024. It confirms that the pandemic is the primary catalyst for accelerating digital transformation in the education sector and encouraging more intensive studies on technology-based leadership. In contrast, only four articles were published during the 2018–2019 period, indicating that this discourse was still limited before the pandemic.

Table 3. Bibliometric Analysis

Category	Distribution Articles
Year of Publication	Pre-COVID (2018–2019): 4 articles post-COVID (2020–2024): 11 articles
Geographic	Asia: 9 articles Afrika: 3 articles Others (Global North): 3 articles
Theme	Digital/AI Leadership in Education: 6 articles, Educational Transformation & Teacher Capacity: 5 articles, Sustainable Human Development through Education: 4 articles
Methodology	Systematic/Scoping Review: 5 articles, Empirical Quantitative: 6 articles, Mixed/Qualitative: 4 articles

Geographically, the literature is dominated by the Asian context, with nine articles, including studies in Indonesia, India, and China, which reflect the concentration of education transformation issues in developing countries with large populations. Africa contributed three articles (e.g., from Kenya and Nigeria), which underlined similar challenges on the continent regarding the limitations of digital infrastructure. The remaining three articles are from Global North countries, serving as comparators but not the primary focus of this study. The research theme is divided into three major streams: digital/AI leadership in education, education transformation and teacher capacity, and the linkage of education to sustainable human development. The methodology used varies, with quantitative empirical studies dominating (6 articles), followed by systematic/scoping reviews (5 articles), and qualitative/mixed approaches (4 articles). This pattern suggests that literature in developing countries is still in

an exploratory stage, with a need to strengthen longitudinal methodologies and conduct more rigorous theoretical testing.

Characteristics of the Included Studies

From the systematic screening process guided by Durach et al. (2017), a total of fifteen articles were included for final synthesis. Twelve studies originated from reputable international journals indexed in Scopus Q1–Q2, while three were published in national journals indexed in Sinta-2, reflecting both global and Indonesian contexts. The publication years span between 2018 and 2024, aligning with the eligibility criteria designed to capture contemporary trends in education leadership under the influence of digital transformation and AI. Geographically, the articles represent diverse contexts, with the majority originating from Asia (China, Indonesia, Taiwan, Saudi Arabia), followed by Europe (Spain, Italy, the UK), North America (the USA), and South America (Chile). This distribution ensures the findings integrate both developed and developing countries' perspectives.

Research Contexts and Themes

Most of the reviewed studies are situated in educational settings ranging from secondary schools to higher education institutions. A prominent theme across studies is the critical role of leadership in mediating digital transformation processes and the adoption of AI tools in education. For instance, research conducted in Spain and Italy emphasizes how transformational and digital leadership practices enhance teacher innovation and institutional adaptation (Aramburu et al., 2021). Meanwhile, studies from Indonesia highlight challenges related to teacher readiness, infrastructure, and leadership support in integrating AI and digital platforms effectively (Rahman et al, 2023; Nurhikmah et al., 2024). Thematically, the articles cluster around three key domains: (1) leadership styles and competencies in digital environments, (2) AI and digital tools as enablers of human development, and (3) sustainability and equity in digital education.

Theoretical Anchors

The reviewed literature demonstrates reliance on several theoretical underpinnings. Transformational leadership theory and digital leadership frameworks dominate international publications, reflecting a strong emphasis on leaders as change agents in digital contexts. Additionally, socio-technical perspectives and sustainable development theory, particularly aligned with SDG 4, are applied to understand how digital innovations in education can contribute to broader human development goals. Some studies explicitly ground their analysis in established models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). In contrast, others adopt institutional theory to explain the diffusion of AI practices in schools and universities. The Indonesian studies, by contrast, draw on context-specific frameworks highlighting local challenges in leadership and digital readiness.

Methodological Qualities

The methodological designs of the included studies vary considerably. Quantitative surveys, often analyzed through advanced techniques such as Structural Equation Modeling (SEM), dominate, especially in Middle Eastern and Asian contexts (Alammari, 2024). Qualitative case studies and mini reviews enrich the understanding of contextual and cultural dynamics in school leadership (Zubaidah & Putra, 2022; Prayuda, 2022). Using the Joanna Briggs Institute (JBI) critical appraisal tools, most articles were judged to be of high quality, with three evaluated as moderate due to their limited scope or smaller sample sizes. This

diversity strengthens confidence in the generalizability of the findings, while also highlighting areas that require more rigorous methodological approaches in future research.

Addressing Research Questions

RQ1: How does literature describe the concept and practice of education leadership in the context of digital transformation and AI in education? “Several studies demonstrate that educational leadership in the digital age and AI extends into complex domains: in addition to managing human resources, leaders must formulate technological visions, manage resistance to change, and serve as the link between school policies and practices. For example, Netolicky (2020) describes how principals face tensions between accountability and staff well-being during the emerging digital pandemic. This context suggests that digital leadership is not only technical but also valued and contextual.

RQ2: How is the relationship revealed between digital/AI transformation and human development through educational studies? “A systematic analysis of the literature on AI in education (Wang et al., 2024) reveals that when adopted strategically and inclusively, AI can personalize learning and enhancing efficiency—it makes room for human development, especially in the capacity for critical and adaptive thinking. However, the success of that relationship depends heavily on the support of educational leadership who want to ensure that technology supports human development, not just an automation mechanism”.

RQ3: What are the dominant themes, conceptual models, and research gaps formed from the intersection of leadership, digital/AI, and human development? “Based on verified studies, the dominant themes include reflective leadership in the face of digital pressures, AI ethics in the context of education, infrastructure readiness and access gaps, and teacher-leader collaboration in technology adoption. Conceptual models often combine adaptive leadership theory and technology adoption frameworks (e.g., technology acceptance). A key research gap is seen in the lack of empirical research in developing countries that directly links AI/digital technologies, leadership, and human development outcomes in local contexts”.

RQ4: What are the practical recommendations and educational policies that emerged from the synthesis of literature to improve the quality of human development through digital leadership and AI? “From the verified literature, several recommendations emerged: principals should be involved in AI strategy planning, not just as recipients of the technology; national education policies should provide ethical guidance on the use of AI; and digital resources should be allocated to schools in marginalized areas to achieve inclusion. Furthermore, additional research is needed to investigate the long-term effects of digital transformation on human development, utilizing longitudinal methodologies and contextual approaches in developing countries”.

Suggestions for Future Research

Future research should prioritize comparative analyses between developed and developing contexts, exploring how leadership practices in resource-constrained environments can be adapted to maximize the potential of digital transformation and AI. There is also a need for longitudinal studies to capture the long-term effects of digital leadership on sustainable human development, particularly in relation to SDG 4. Additionally, cross-disciplinary frameworks integrating leadership studies, digital transformation, and AI ethics should be developed to guide policymakers and practitioners in balancing innovation with equity and inclusion. Indonesian scholarship, in particular, should continue to expand empirical studies beyond descriptive analyses, employing advanced methods to strengthen its contribution to global discourse.

Discussion

This discussion interprets the results of the SLR synthesis in the context of educational leadership facing the acceleration of digital transformation and the emergence of AI, focusing on its implications for sustainable human development. The results of the empirical and thematic summaries underscore that education leadership must now function on two simultaneous levels: (1) managing digital infrastructure and access, and (2) directing pedagogical and policy transformations that ensure AI becomes a tool for human development, not just technical efficiency (Harris & Jones, 2020). First, in terms of leadership practice, literature highlights a shift in the role of principals and education leaders from traditional administrative roles to that of catalyst for change, which is networked, collaborative, and data informed. The pandemic accelerated this need, making the ability to lead digital change a core competency for school leaders and educational institutions (Netolicky, 2020). Transformational roles—which emphasize staff vision, inspiration, and capacity building—remain relevant as a cornerstone of change. Still, these models must be complemented by practical digital skills (e.g., data governance, basic AI understanding, technology-based PD strategies) for interventions to lead to human development outcomes (Deng et al., 2022). Second, the impact of digital transformation and AI on human development is twofold: AI has real potential for personalization of learning and increased access to quality learning resources, which can accelerate cognitive achievement when designed pedagogically; however, it also poses a risk of widening access inequalities, lowering non-cognitive dimensions (e.g. learning independence, social skills) if implementation focuses solely on measurement and automation (Zawacki-Richter et al., 2019; Wang et al., 2024). In the context of developing countries, evidence suggests that infrastructure issues and affordability of bandwidth remain fundamental barriers that hinder the benefits of AI and digital platforms on human development outcomes (Lai & Widmar, 2021). Third, the thematic findings highlight the concentration of studies on the technical-pedagogical aspects of AI (adaptive systems, intelligent tutoring, analytics) and on the evaluation of short-term effects. In contrast, studies that explicitly link digital/AI transformation to broader human development indicators (well-being, employment opportunities, social inclusion, long-term capacity building) are still limited and fragmentary (Wang et al., 2024). Bibliometric studies and research maps also reveal geographical and disciplinary biases: AIED publications are predominantly dominated by computer science and countries from the Global North, resulting in a relatively underrepresented perspective on educational leadership and the context of LMICs (Hallinger & Kovačević, 2019; Zawacki-Richter et al., 2019).

Fourth, at the conceptual model level, most studies do not adequately integrate the human development framework with leadership theories relevant to the digital age; in other words, the interconnectedness of mechanisms (leadership → technology adoption → changes in learning practices → human development outcomes) is often only represented as assumptions, rather than empirically tested longitudinally or experimentally (Wang et al., 2024). This gap demands research that incorporates multi-dimensional indicators of human development (cognitive, non-cognitive, and economic opportunity) in the design of digital leadership intervention evaluations. Fifth, policy and practice: the synthesis suggests simultaneous policy interventions, building infrastructure and access, designing ethics/data governance policies for educational AI, and making sustainable investments in leadership training that emphasizes technical capabilities + pedagogical capabilities so that digital transformation truly contributes to equitable and sustainable human development (Zhao, 2020; Lai & Widmar, 2021). In an operational context, practical recommendations include: (a) a digital leadership roadmap that incorporates human development indicators; (b) a measurable leadership PD program (AI literacy + change management competencies); and (c) monitoring mechanisms that combine

human access and outcome metrics. Sixth, the specific implications for the Indonesian context (and similar developing countries) are the need for high-quality contextual studies that test these hypotheses with a robust quantitative design and long-term evaluation, as national systematic reviews show leadership capacity problems and fragmentation of local research that hinder the translation of national policies into school practice (Lumban Gaol, 2021). Finally, the limitations of the evidence we found guide future research agendas: longitudinal and quasi-experimental studies evaluating the impact of digital leadership on human development indicators are needed; transdisciplinary research linking education, computer science, and development science; and explicit implementation research examining aspects of data governance, AI ethics, and infrastructure resilience in the context of LMIC (Wang et al., 2024; Zawacki-Richter et al., 2019).

In summary, this synthesis demonstrates that educational leadership is a crucial lever in determining whether digital transformation and AI will accelerate or hinder sustainable human development. Effective interventions must be systemic, contextual, and strike a balance between technological efficiency and broader human development goals (Harris & Jones, 2020; Deng et al., 2022).

CONCLUSION

This study confirms that educational leadership in the era of digital transformation and artificial intelligence (AI) is no longer just a technical demand but a strategic need for the sustainability of human development. According to the literature review for 2018–2024, it is evident that leadership that can integrate digital technology, big data, and AI has a positive impact on learning quality, pedagogical innovation, and more adaptive educational governance. This finding aligns with the results of Zhang et al. (2022), which demonstrate a direct correlation between technology leadership and improved instructional practices in college. Furthermore, the dimension of AI-based education governance presents both opportunities and limitations, as emphasized (Reimers et al., 2024). On the one hand, AI adoption opens space for more efficient decision-making, but on the other hand, it also demands stricter regulations to ensure a balance with humanity. Research by Wang et al. (2022) also suggests that effective digital leadership can encourage exploratory innovation by making organizational culture a critical mediator. In the context of developing countries, including Indonesia, digitally led education is not only focused on academic performance but also on achieving sustainable human development goals. Zubaidah and Putra (2022) demonstrate that digital leadership among school principals can create an innovative educational ecosystem, despite facing limited resources. Research by Depany and Prasojo (2025) emphasizes the importance of teacher performance and the use of digital facilities to optimize technology-based learning in Madrasas. This perspective strengthens the argument of Alam and Mohanty (2023), who emphasize that technological integration must be accompanied by pedagogical innovation to prevent the digital divide from widening. Overall, the main conclusions that can be drawn are:

- a. Leadership in digital and AI-based education is a crucial factor in enhancing learning quality, driving innovation, and improving governance efficiency.
- b. The success of digital leadership adoption depends on organizational capacity, innovation culture, teacher support, and adaptive regulations.
- c. The implications for human development lie in the ability of leadership to balance technology with humanistic and sustainability values.

Therefore, the policy recommendations that emerged from this study are the need for a clear regulatory framework for AI in the education sector, digital leadership capacity building

programs for educators, and investment support for infrastructure and digital literacy in schools, especially in developing countries.

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