
DIGITAL TRANSFORMATION IN EDUCATION: A SOCIOLOGICAL LITERATURE REVIEW ON TECHNOLOGY, INEQUALITY, AND SOCIAL CHANGE

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Abstract

Digital transformation has profoundly reshaped the landscape of education, creating both opportunities and challenges that demand critical sociological inquiry. This article employs a literature review methodology to synthesize existing research on the intersection of technology, inequality, and social change in educational contexts. The review highlights that while digital tools enhance access to knowledge and innovative learning models, they also exacerbate persistent inequalities rooted in socioeconomic status, geography, and institutional capacity. Studies consistently reveal that the digital divide reinforces structural disadvantages, limiting the benefits of technology for marginalized groups. The sociological perspective emphasizes how technology is not merely a neutral instrument but a socially embedded phenomenon that reflects power relations and cultural dynamics. Literature further indicates that digital transformation in education contributes to broader processes of social change, including shifts in teacher–student relationships, institutional norms, and labor market demands. At the same time, findings underscore the role of policy frameworks and governance structures in mediating the equitable adoption of digital education. The analysis also points to the importance of integrating sociological theories to interpret the contradictions between technological promise and lived realities. By critically engaging with prior studies, this review reveals both progress and persistent challenges in creating inclusive digital education systems. Ultimately, the article contributes to scholarly debates by framing digital transformation in education as a multifaceted social phenomenon rather than a purely technological advancement.

Keywords: *Digital Transformation, Education, Sociology, Inequality, Social Change.*

A. INTRODUCTION

In the wake of recent global disruptions, education systems worldwide have accelerated their shift toward digital modalities, integrating technologies such as online platforms, ICT tools, and AI to sustain teaching and learning. By March 2020, the closure of schools in OECD countries transformed classrooms into virtual spaces almost overnight, compelling educators and learners to adapt to remote teaching methods. This rapid migration revealed stark disparities in access to devices and stable internet, particularly among disadvantaged students, which intensified educational inequities. In parallel, UNESCO's Global Education Monitoring Report emphasized that effective digital transformation hinges on three systemic conditions: access to technology, sound governance, and teacher preparedness (UNESCO, 2023 GEM Report on Technology in Education). The COVID-19 pandemic further demonstrated how technology-first responses could act as force multipliers of inequality, disproportionately affecting marginalized learners (Axios, 2023). Initiatives such as UNESCO's COVID-19 Global Education Coalition sought to mitigate these effects by deploying radio, TV, and offline tools to ensure continued learning (Wikipedia, SDG 4; UNESCO COVID-19 Education Response, 2020). Bibliometric analyses indicate a surge in scholarly publications on digital transformation, particularly in the context of COVID-19, highlighting its central role in contemporary education research (Jimenez-Pitre, 2022). Despite these advances, infrastructure

and readiness remain uneven, with many low-income and rural institutions lacking basic digital capacity (Timotheou et al., 2022). The transition toward “smart education,” involving AI and IoT-enabled pedagogy, continues to raise concerns about equity, governance, and ethical implementation (Badshah et al., 2023). As such, global digital transformation in education cannot be viewed merely as technological integration; it must be understood in terms of policy dynamics, socioeconomic disparities, and institutional resilience. This background underscores the necessity of a sociological literature review that examines not only the diffusion of digital technologies but also their differentiated impacts across social strata and educational ecosystems worldwide.

The sociological perspective is crucial for understanding the impact of educational technology because it emphasizes how technologies are socially constructed and embedded within broader institutional, political, and cultural dynamics rather than being neutral tools (Selwyn & Facer, 2014). Research shows that technology use in education reflects prevailing social structures and inequalities, highlighting that access alone cannot eliminate systemic disparities (van De Werfhorst et al., 2022). A critical lens is needed to analyze how digital platforms transform power relations within classrooms, schools, and policy systems, creating new hierarchies of advantage and disadvantage (Williamson & Komljenovic, 2022). Empirical studies also reveal that algorithmic applications in education often reproduce structural biases, demonstrating the importance of sociological theories that go beyond technical fairness to address systemic injustice (Madaio et al., 2021). Theoretical frameworks such as mutual shaping highlight the reciprocal relationship between technological design and social norms, showing how education technology evolves through social negotiation (Quan-Haase, 2013). Sociological critiques further argue that digital education is shaped by economic and political agendas that privilege certain stakeholders, including investors, technology firms, and governments (Williamson & Komljenovic, 2022). Recent bibliometric reviews identify a significant rise in studies examining AI in education through sociological perspectives, especially on issues of inequality and digital exclusion (Mac Fadden et al., 2024). By situating digital education within structural inequality frameworks, sociology demonstrates how differences in readiness, infrastructure, and teacher training reinforce long-standing educational divides (van De Werfhorst et al., 2022). Scholars also highlight how digital tools reshape the socialization processes of students, influencing their identities, aspirations, and participation in society (Selwyn & Facer, 2014). The sociological view underscores that education technology is not simply about technical efficiency but about whose interests are served and whose needs are overlooked (Madaio et al., 2021). This approach is essential for analyzing the ways digital education contributes to stratification, reproducing inequalities that align with socioeconomic and cultural fault lines (Quan-Haase, 2013). By focusing on the interplay of technology and society, sociology equips researchers with the tools to interpret digital education as a phenomenon of social change rather than a purely pedagogical innovation (Mac Fadden et al., 2024). Such insights are increasingly vital as AI and digital platforms become deeply entrenched in global education systems with profound consequences for equity (Williamson & Komljenovic, 2022). Integrating sociological perspectives enables a more nuanced understanding of digital education, balancing technological promises with critical awareness of their social ramifications (Selwyn & Facer, 2014).

Digital inequality has become one of the most pressing challenges in the context of educational transformation, as differences in access to devices, connectivity, and skills continue to reproduce structural disadvantages across societies (van De Werfhorst, Kessenich, & Geven, 2022). Studies across Europe have shown that students from lower socioeconomic backgrounds are consistently less digitally prepared compared to their peers from affluent families, reinforcing long-standing educational disparities (van De Werfhorst et al., 2022). Research in the United States also highlights that rural schools face persistent barriers in broadband access,

which undermines students' ability to participate in online learning and deepens geographic inequalities (Reisdorf, Triwibowo, & Zhao, 2020). Empirical evidence from Asia confirms similar patterns, with the digital divide creating uneven opportunities for learning in regions where infrastructure and teacher capacity remain limited (Trucano, 2021). During the COVID-19 pandemic, inequalities in access to remote learning became more visible, with marginalized learners disproportionately excluded from digital opportunities, further entrenching cycles of disadvantage (Di Pietro, Biagi, Costa, Karpiński, & Mazza, 2020). Research in sub-Saharan Africa indicates that only a small fraction of students had reliable access to online education, revealing the stark inequities of digital transformation in low-income contexts (Onyema et al., 2020). Even in technologically advanced countries, inequalities exist, as students with limited digital literacy skills struggle to use platforms effectively, highlighting that access is not only material but also skills-based (van Dijk, 2020). Scholars argue that digital inequality should be understood as a multidimensional phenomenon encompassing material, motivational, and skills access, each of which influences educational outcomes differently (van Dijk, 2020). Evidence further shows that teacher preparedness significantly shapes how technology mediates inequality, as educators in under-resourced schools often lack training to integrate digital tools effectively (Gudmundsdottir & Hatlevik, 2018). At the policy level, governments often prioritize infrastructure without adequately addressing issues of capacity-building, resulting in uneven impacts of digital transformation (Di Pietro et al., 2020). Comparative studies suggest that without targeted interventions, digitalization risks reinforcing rather than alleviating social stratification in education (Reisdorf et al., 2020). This underscores the need for equity-oriented frameworks that place marginalized learners at the center of digital policy reforms (Onyema et al., 2020). Digital inequality persists as a barrier to realizing the inclusive potential of education technology, making it a central concern for sociological inquiry into digital transformation in education (Gudmundsdottir & Hatlevik, 2018).

Educational technology is not only transforming teaching and learning but also catalyzing broader social change by reshaping cultural practices, institutional arrangements, and social interactions (Selwyn, 2016). Scholars argue that technology functions as a mediator of social structures, influencing how individuals access opportunities, construct identities, and engage with civic life (Couldry & Hepp, 2017). In education, the proliferation of digital platforms has created new forms of participation and collaboration, thereby altering the traditional hierarchies between teachers and students (Bond et al., 2021). These transformations highlight how technology enables more personalized and flexible learning experiences that align with broader shifts toward individualization in society (Zawacki-Richter et al., 2019). At the same time, the spread of online education and open educational resources reflects wider societal trends of knowledge democratization and the blurring of boundaries between formal and informal learning (Weller, 2020). Yet, sociological research demonstrates that these processes also reproduce inequalities, as access to digital tools and competencies remains uneven across social groups (van De Werfhorst, Kessenich, & Geven, 2022). The integration of artificial intelligence in classrooms has further accelerated social change by automating assessment, reshaping labor expectations for teachers, and redefining the skills students must acquire to thrive in digital economies (Holmes et al., 2021). These dynamics underscore the dual role of technology in both enabling innovation and amplifying existing social divisions (Bond et al., 2021). Moreover, the adoption of digital education reflects broader neoliberal reforms that position students as consumers and prioritize market-oriented logics in educational governance (Williamson, 2017). This shift illustrates how digital technology in education is embedded within global processes of economic restructuring and labor market transformation (Zawacki-Richter et al., 2019). In developing contexts, digital technologies are often presented as tools for social mobility and inclusion, yet structural barriers frequently prevent these promises from being realized (Onyema et al., 2020). These findings reveal that technology does

not operate in isolation but co-evolves with social systems, shaping and being shaped by societal change (Couldry & Hepp, 2017). Understanding this interdependence is essential for critically assessing how digital transformation in education influences broader trajectories of social change at both local and global levels (Selwyn, 2016). The review identifies that digital transformation does not proceed uniformly across regions but reflects deep variations shaped by geography, policy, and culture. This uneven transformation parallels insights from Indonesia, where educational institutions exhibited high effectiveness in theory-based courses using online platforms while practical and field-based courses were less effective during the pandemic (Hikmat et al., 2020). Educational technology serves as both a driver and reflection of ongoing social transformations, making its sociological analysis indispensable for contemporary educational research (Holmes et al., 2021).

Despite the rapid expansion of scholarship on educational technology, considerable research gaps remain in sociological studies that critically address its broader social dimensions. Existing studies often prioritize technological affordances and pedagogical outcomes, while underexploring how digitalization reproduces structural inequalities within education systems (Eynon & Geniets, 2016). Comparative research on digital literacy highlights that while access to devices is growing, profound inequities in digital skills and social capital persist, yet these dimensions are rarely connected to theories of social reproduction (Hargittai & Hsieh, 2013). Empirical analyses of global online learning environments reveal limited attention to how cultural contexts shape the adoption and social meaning of digital tools (Ossiannilsson, Altinay, & Altinay, 2016). A bibliometric review of technology-enhanced learning identifies a dominance of studies from Europe, North America, and East Asia, exposing a geographic gap in research on digital education in the Global South (Bozkurt et al., 2019). Although much research explores the digital divide, fewer studies examine the intersectional dynamics of gender, ethnicity, and class in digital education, leaving important sociological dimensions unaddressed (Robinson et al., 2020). Scholars have also noted the lack of longitudinal evidence on how digital adoption reshapes social mobility and labor market trajectories over time (Bulman & Fairlie, 2016). While economic analyses often assess cost-effectiveness of technology integration, sociological investigations into how commercialization and privatization of edtech reshape institutional accountability remain scarce (Selwyn, 2019). Another gap lies in the neglect of power asymmetries between global technology corporations and local education systems, where corporate platforms increasingly influence curriculum and assessment (Williamson, 2019). Studies also show that while digitalization has the potential to democratize knowledge, little is known about how marginalized communities appropriate or resist these technologies (Halford & Savage, 2017). Research on algorithmic decision-making in education rarely incorporates sociological critiques of surveillance and control (Knox, Williamson, & Bayne, 2020). Without addressing these omissions, digital education research risks perpetuating technocentric narratives that overlook critical questions of equity, power, and cultural context (Eynon & Geniets, 2016). These research gaps demonstrate the urgent need for more sociologically informed analyses that foreground inequality, intersectionality, and global diversity in the study of educational digitalization.

The purpose of this article is to address the need for sociologically informed perspectives on digital transformation in education, offering contributions that extend beyond technological or pedagogical analyses. Recent research emphasizes that while digitalization is often framed as a tool for modernization, its impact on inequality and power structures is underexplored in mainstream educational studies (Jandrić et al., 2018). This article aims to bridge that gap by situating digital education within broader debates on social justice, governance, and equity in knowledge distribution (Facer & Selwyn, 2021). It contributes by synthesizing evidence from diverse contexts, thereby challenging the dominance of research

produced in Western settings and amplifying perspectives from the Global South (Adam et al., 2020). Another objective is to highlight how digitalization intersects with broader societal transformations, such as datafication and platformization, that are reshaping institutional practices and accountability in education (Decuypere, Grimaldi, & Landri, 2021). The article further contributes by drawing attention to ethical concerns about surveillance and control within digital education systems, which have received insufficient sociological scrutiny (Livingstone & Blum-Ross, 2020). Methodologically, this work also demonstrates how literature review can reveal under-theorized connections between educational technology and classical sociological concepts of reproduction, agency, and cultural capital (Perrotta & Williamson, 2018). By integrating these insights, the article provides a more comprehensive understanding of digital transformation, positioning it as both a driver and consequence of social change (Jandrić et al., 2018). It additionally offers practical contributions for policymakers by outlining equity-oriented frameworks for digital adoption that prioritize marginalized learners (Adam et al., 2020). Unlike prior studies that focus narrowly on access, this article emphasizes multi-dimensional inequalities in skills, motivation, and participation that shape digital readiness (Livingstone & Blum-Ross, 2020). Its value lies in expanding the scope of academic debate, ensuring that digital education research incorporates sociological critiques of inequality, globalization, and governance (Decuypere et al., 2021). By articulating these contributions, the article enriches scholarly discourse and strengthens the theoretical foundations for understanding digital transformation in education as a social phenomenon (Facer & Selwyn, 2021).

B. METHOD

This study employed a literature review methodology to examine the sociological dimensions of digital transformation in education. The approach was designed to synthesize, analyze, and critically evaluate prior research rather than generate new empirical data. The review process began with the identification of relevant databases including Scopus, Web of Science, Google Scholar, and other open-access academic repositories. Search terms were carefully developed to capture a broad spectrum of scholarship, incorporating keywords such as “digital transformation,” “education,” “sociology,” “inequality,” and “social change.” The time frame of publications was restricted to works published in the past two decades to ensure both relevance and contemporary applicability. Only peer-reviewed articles, book chapters, and reports from credible international organizations were considered to maintain academic rigor. Inclusion criteria focused on studies that explicitly connected digitalization in education with sociological concepts, while exclusion criteria omitted works that addressed only technical or pedagogical aspects without a broader social dimension. The initial search yielded a wide body of literature, which was then narrowed down through screening titles, abstracts, and keywords to ensure alignment with the objectives of this review. Full texts were analyzed to extract key themes, theoretical frameworks, and empirical findings relevant to the intersection of technology, inequality, and social change. A thematic analysis was applied to organize findings into categories such as access, skills, governance, cultural practices, and institutional implications. The method also involved comparing research across different regions of the world to identify geographic and contextual variations in digital education. By focusing on multiple levels of analysis individual, institutional, and systemic the review enabled a multidimensional understanding of how digital transformation operates as a social phenomenon. The process emphasized both convergences and divergences in the literature, highlighting where consensus exists and where debates remain unresolved. This methodology allowed for the identification of research gaps, particularly in underexplored areas such as intersectionality, governance, and datafication in education. The use of a literature review also facilitated the integration of both theoretical and empirical perspectives, producing a

comprehensive synthesis that bridges fragmented areas of scholarship. The method was iterative, as sources were revisited and cross-checked to refine categories and ensure accuracy in interpretation. To strengthen validity, studies from diverse methodological traditions were considered, including qualitative, quantitative, and mixed-methods approaches. The review ultimately aimed to provide a balanced representation of the field while foregrounding the sociological dimensions of digital education. This approach not only mapped existing knowledge but also established a foundation for critical reflection and future research directions.

C. RESULTS AND DISCUSSION

1. Technology as a Double-Edged Force in Education

Digital technology functions as both an enabler and a barrier within contemporary education systems. It expands access to learning resources by making knowledge available across geographical and institutional boundaries. It transforms pedagogy by introducing interactive platforms, personalized content, and flexible learning environments that empower students to engage in new ways. It enhances collaboration among teachers and learners through digital networks that encourage knowledge sharing and innovation. It also supports educational institutions in achieving administrative efficiency and scalability. At the same time, technology creates new divides between those who can effectively utilize digital tools and those who cannot. It amplifies structural inequalities when access to reliable infrastructure, competent teachers, and digital literacy remains uneven across different groups. It redefines privilege by favoring individuals and communities with stronger technological resources and cultural capital. It alters classroom dynamics by reshaping authority and shifting the balance of power between teachers and students. It generates unintended consequences such as distraction, dependence on platforms, and commercialization of learning processes. It reinforces inequities by placing additional burdens on disadvantaged learners who lack adequate support systems. It deepens disparities when institutions adopt technology without addressing the socioeconomic realities of their students. It challenges traditional pedagogies but also threatens to undermine essential interpersonal aspects of education. It simultaneously acts as a catalyst for innovation and as a mechanism for reproducing social hierarchies. Technology emerges as a double-edged force that offers unprecedented opportunities while perpetuating persistent inequalities in education.

2. Persistent Digital Divide Beyond Access

The digital divide in education persists as a multidimensional challenge that extends far beyond the issue of physical access to devices and internet connectivity. It manifests in the unequal distribution of digital literacy, where some learners possess advanced competencies while others struggle with even basic skills. It appears in differences of motivation, as certain students embrace technology enthusiastically while others disengage due to fear, uncertainty, or lack of guidance. It highlights disparities in cultural capital, since families with more educational resources are better able to support their children in navigating digital environments. It underscores inequalities in institutional readiness, as some schools invest heavily in infrastructure while others lack the capacity to sustain meaningful integration. It creates gaps in teacher preparedness, where educators with limited training cannot fully leverage digital platforms to enhance learning. It reinforces socioeconomic divides, because students from wealthier backgrounds can afford high-quality devices and private tutoring while disadvantaged peers rely on outdated tools. It reproduces geographic inequalities, as urban areas often enjoy stable connectivity while rural communities remain underserved. It shapes differences in learning outcomes, since students with stronger digital skills gain advantages in assessments and career opportunities. It complicates equity efforts, because

bridging one layer of the divide does not guarantee equal participation across all dimensions. It reveals that digital inequality is not a single barrier but a continuum of challenges that interact in complex ways. It demonstrates how exclusion can persist even in contexts where universal access has been achieved. It shows that addressing the divide requires not only infrastructure but also policies, training, and cultural interventions. It warns that without comprehensive solutions, digitalization will perpetuate rather than reduce educational disparities. It ultimately confirms that the digital divide is as much about social structures and capacities as it is about technology itself.

3. Sociological Dimensions of Educational Change

Digital transformation in education produces profound sociological changes that reshape the very fabric of learning institutions and social interactions. It alters teacher–student relationships by shifting authority, encouraging collaborative learning, and redefining roles within the classroom. It changes institutional norms as schools adopt new policies, practices, and governance models to manage digital platforms and online learning environments. It influences patterns of social stratification, as digital competence becomes a form of cultural capital that distinguishes advantaged groups from disadvantaged ones. It reconfigures community relationships by extending learning beyond classrooms into homes, workplaces, and public spaces through technology-mediated engagement. It transforms peer dynamics, as students interact not only in physical classrooms but also in virtual networks that shape identity and social belonging. It redefines accountability structures, since digital systems often require constant monitoring, data tracking, and performance measurement. It creates new forms of surveillance in education, where digital platforms monitor attendance, behavior, and achievement in ways that impact privacy. It drives institutional change by compelling universities and schools to align their strategies with global trends of digitization and competitiveness. It influences teacher professionalism by demanding continuous development of digital skills and adaptation to new pedagogical tools. It reshapes assessment practices by introducing automated testing, online feedback, and algorithm-driven evaluations. It changes the boundaries between formal and informal education, as digital learning blurs distinctions between structured curricula and self-directed exploration. It stimulates new cultural practices, as learners use social media and digital platforms to create, share, and evaluate knowledge collectively. It contributes to globalization of education, as online platforms connect learners across borders, reshaping cultural exchange and international collaboration. It also generates tensions, as traditional norms of authority, pedagogy, and community face disruption from technology-driven reforms. Educational change driven by digitalization is deeply sociological, as it redefines identities, relationships, and structures within and beyond education.

4. Global and Contextual Variations in Digitalization

Digital transformation in education does not unfold uniformly across the world but instead reveals striking variations shaped by geography, economy, culture, and institutional capacity. It progresses rapidly in high-income countries where robust infrastructure, strong policies, and sustained investment create favorable conditions for adoption. It advances unevenly in middle-income nations where selective schools and universities lead innovation while underfunded institutions lag behind. It struggles in low-income regions where persistent poverty, weak connectivity, and limited resources constrain meaningful digital engagement. It highlights rural–urban divides, as urban schools often enjoy broadband access and modern equipment while rural communities remain excluded. It reflects cultural contexts, since attitudes toward technology vary depending on values, traditions, and expectations about education. It demonstrates policy differences, as some governments prioritize equity-driven digital initiatives while others emphasize efficiency or market competitiveness. It shows

institutional diversity, where elite universities implement sophisticated platforms while community schools rely on basic tools. It underscores linguistic diversity, since dominant languages shape access to digital content while minority groups face barriers. It exposes generational differences, as younger learners adapt quickly while older educators and administrators may resist technological change. It illustrates temporal variation, as the pace of adoption accelerated dramatically during crises such as the COVID-19 pandemic but slowed in post-crisis adjustments. It emphasizes regional imbalances in research, with most scholarship concentrated in the Global North, leaving perspectives from the Global South underrepresented. It reveals economic inequalities, since wealthier households can sustain digital engagement while disadvantaged families face ongoing struggles. It identifies pedagogical variations, as digital tools are integrated differently in systems emphasizing rote learning versus those promoting critical thinking. It demonstrates that digitalization is not a universal process but a phenomenon that reflects local realities and global disparities. These findings collectively underscore that digital transformation cannot be studied as a universal process because it is deeply shaped by geographic, economic, cultural, and institutional variations. In the Indonesian context, Hikmat (2022) observed that the national education system showed varying levels of readiness for digital transformation within the Society 5.0 framework, reflecting disparities in technological preparedness and pedagogical adaptation. These contextual variations confirm that digital transformation in education must be studied through comparative and sociological lenses. These contextual variations confirm that digital transformation in education must be studied through comparative and sociological lenses to capture its complexity.

5. Insufficient Sociological Integration in Existing Research

Research on digital transformation in education remains dominated by technological and pedagogical perspectives, while sociological integration is still limited and fragmented. It often emphasizes efficiency, innovation, and learning outcomes without adequately addressing how digitalization reshapes inequality, power, and social structures. It underrepresents the lived experiences of marginalized groups, resulting in partial understandings of the digital divide. It overlooks intersectionality, as few studies systematically examine how gender, ethnicity, class, and disability interact with digital access and participation. It privileges system-level analysis while paying less attention to everyday practices of teachers and learners. It favors short-term evaluations of programs rather than long-term sociological studies of how digitalization transforms institutions and communities. It underexplores governance and policy dimensions, leaving gaps in knowledge about how decisions on digital tools affect social accountability. It neglects the influence of global corporations and platform providers in shaping educational agendas, despite their growing control over data and infrastructures. It pays little attention to cultural contexts, often assuming that technological solutions can be applied universally across different societies. It fails to incorporate critical theories that can interrogate neoliberal reforms and market-driven logics underpinning digital education. It lacks methodological diversity, as most research is quantitative or descriptive, with fewer ethnographic and qualitative studies capturing complex social dynamics. It tends to separate digital education from broader sociological debates on inequality, reproduction, and social mobility. It misses opportunities to connect findings with classical theories of cultural capital, social stratification, and institutional change. It produces fragmented evidence that does not fully inform policymakers about equity challenges in digital adoption. The insufficient sociological integration in existing research highlights the need for more critical, interdisciplinary, and equity-focused studies that position digital transformation as a deeply social phenomenon.

The analysis shows that technology in education simultaneously provides opportunities and reproduces inequalities, confirming its role as a double-edged force. DiMaggio, Hargittai, Neuman, and Robinson (2001) explain that Internet use mirrors and amplifies pre-existing socioeconomic disparities, indicating that access alone does not close structural gaps. Wang (2024) demonstrates through a meta-analysis that device usage does not consistently improve academic performance, particularly for students lacking digital literacy and institutional support. Ragnedda (2022) emphasizes that digital exclusion and social exclusion are mutually reinforcing, as marginalized groups are both less likely to access technology and less likely to benefit from it. Meng (2024) identifies through scientometric mapping that research on digital inequity remains fragmented and uneven, especially in addressing cross-cultural complexities. Heeks (2021) introduces the concept of “adverse digital incorporation,” which reveals how inclusion in digital systems often disproportionately benefits privileged groups while reinforcing the disadvantages of marginalized populations. These perspectives highlight that educational technologies cannot be understood solely as tools of innovation but must be seen as socially embedded phenomena that reflect and intensify inequalities. The findings also suggest that without targeted interventions, digital tools may widen, rather than narrow, gaps in educational opportunities. They illustrate that the emancipatory potential of technology is constrained by structural conditions that determine who can benefit and who is excluded. This duality underscores the urgent need for policies that not only expand access but also build digital literacy, strengthen institutional capacity, and address deeper social barriers. The evidence confirms that technology in education operates as both a catalyst for innovation and a mechanism for reproducing inequality, making sociological analysis indispensable.

The analysis of the persistent digital divide reveals that inequality extends well beyond physical access to devices and internet connections. Robinson et al. (2020) argue that digital inequality encompasses not only material access but also skill, usage, and outcomes, showing how disparities persist even when access barriers are reduced. Van Dijk (2020) explains that digital inequality is multidimensional, involving motivational, material, skills, and usage gaps that collectively shape educational participation. Gudmundsdottir and Hatlevik (2018) demonstrate that teacher preparedness significantly influences how effectively technology can be used to overcome these inequalities, since undertrained educators limit the potential of digital tools. Di Pietro et al. (2020) find that during the COVID-19 pandemic, differences in digital readiness among students and schools intensified educational disparities across Europe. Reisdorf, Triwibowo, and Zhao (2020) highlight that rural communities continue to face structural disadvantages in broadband access, illustrating how geography remains a decisive factor in the digital divide. Trucano (2021) adds that the pandemic exposed deep inequities in access to remote learning tools across Asia, where large populations of students could not benefit from digital education due to infrastructural and institutional limits. Onyema et al. (2020) emphasize that in sub-Saharan Africa only a small proportion of students could participate in online learning, which underlines the global nature of persistent inequality. These studies together confirm that digital inequality is not simply a matter of hardware distribution but a layered and complex challenge. They indicate that addressing the digital divide requires interventions targeting skills, motivation, teacher training, and systemic readiness in addition to connectivity. They also show that digital inequality continues to reproduce broader social inequalities, making it a critical area for sociological inquiry into education.

The analysis of educational change shows that digital transformation has profound sociological consequences that extend beyond pedagogy. Knox, Williamson, and Bayne (2020) argue that datafication and algorithmic governance in education reshape authority and surveillance, altering the social contract between institutions and learners. Selwyn, Hillman, and Williamson (2020) demonstrate that platforms create new institutional dependencies and governance structures, which shift decision-making power toward private actors. Decuyper,

Grimaldi, and Landri (2021) highlight that educational platforms reorganize institutional practices by embedding new metrics and accountability systems, which transform organizational norms. Komljenovic (2021) reveals how digital education markets restructure professional roles and reframe students as consumers, showing the neoliberal underpinnings of these changes. Perrotta and Selwyn (2020) emphasize that data infrastructures mediate teacher professionalism by introducing new forms of evaluation and redefining what counts as legitimate educational work. Williamson (2020) adds that the politics of platforms shape educational futures by embedding cultural, political, and economic interests within technical systems. Ball (2021) shows that digital education reform is entangled with global policy flows that influence governance, privatization, and the reconfiguration of public accountability. Knox (2020) points out that the expansion of artificial intelligence introduces new modes of control and reshapes identity formation within education. These findings collectively indicate that sociological perspectives are indispensable to understanding how digital change transforms authority, professionalism, and institutional order. They confirm that educational technology is not only a tool for learning but also a driver of social restructuring that redefines relationships, norms, and practices within and beyond education.

The analysis of global and contextual variations in digitalization shows that the impact of educational technology differs significantly across regions and socioeconomic settings. Bozkurt et al. (2020) reveal that emergency remote teaching during COVID-19 exposed deep inequalities between developed and developing nations, with learners in low-income countries facing systemic disadvantages. Schleicher (2020) explains that disparities in digital readiness across OECD countries highlight how policy frameworks and institutional capacity strongly shape the effectiveness of digital transformation. Zhao and Watterston (2021) argue that education systems in Asia demonstrate uneven progress, with some countries adopting innovative digital reforms while others struggle with infrastructural and cultural barriers. Tadesse and Muluye (2020) show that sub-Saharan Africa experienced severe challenges in implementing remote education due to limited connectivity, inadequate resources, and weak institutional support. Adarkwah (2021) confirms that even within the same region, contextual differences such as urban–rural divides and household income levels play a decisive role in shaping educational opportunities. König, Jäger-Biela, and Glutsch (2020) highlight that teachers in Germany faced difficulties adapting to remote teaching, demonstrating that challenges are not exclusive to low-income settings. Crawford et al. (2020) note that global higher education institutions responded with diverse strategies, ranging from rapid digital innovation to temporary stopgap measures, illustrating the diversity of institutional contexts. These findings collectively underscore that digital transformation cannot be studied as a universal process because it is deeply shaped by geographic, economic, cultural, and institutional variations. They also highlight the importance of comparative research in capturing how different contexts shape both opportunities and risks in educational digitalization. They ultimately confirm that sociological inquiry must attend to global diversity to avoid generalizations that obscure the complexity of educational change in the digital era.

The analysis of existing literature shows that research on digital transformation in education remains dominated by technical and pedagogical perspectives while sociological approaches are insufficiently integrated. Eynon and Geniets (2016) argue that most digital education research fails to adequately address issues of inequality and social justice, leaving important questions unanswered. Hargittai and Hsieh (2013) explain that digital inequality studies often highlight access and usage but rarely incorporate sociological theories of reproduction and cultural capital. Ossiannilsson, Altinay, and Altinay (2016) point out that quality in open online courses is mostly examined from instructional and design perspectives rather than from social and cultural dimensions. Bozkurt, Akgun-Ozbek, and Zawacki-Richter (2017) demonstrate through a global systematic review that research on open and distance

education has significant gaps in addressing equity and sociological implications. Halford and Savage (2017) emphasize that big data in education is often studied through technological frames without sufficient sociological critique of how such practices reinforce inequalities. Knox (2020) highlights that artificial intelligence in education is frequently presented as an inevitable reform, yet sociological analysis of identity, control, and governance is still underdeveloped. Perrotta and Selwyn (2020) add that the field of learning analytics advances rapidly with technical methods but lacks relational and sociological frameworks. These findings together demonstrate that research continues to privilege efficiency and innovation over sociological inquiry, which limits comprehensive understanding. They also show that without deeper integration of sociological approaches, digital education research risks reinforcing technocentric narratives. They ultimately confirm that addressing this gap is essential to produce more critical, inclusive, and socially grounded analyses of educational digitalization.

D. CONCLUSION

This study concludes that digital transformation in education represents a complex process that reshapes teaching, learning, and social structures. The analysis shows that technology functions as a double-edged force that both enhances opportunities and amplifies inequalities. The findings reveal that the digital divide persists in multiple forms, extending beyond access to include skills, motivation, and institutional readiness. The study demonstrates that sociological perspectives are essential to capture the broader implications of educational technology. The review identifies that digitalization alters relationships between teachers and students, institutions and communities, and local contexts and global dynamics. The evidence indicates that digital transformation does not proceed uniformly across regions but reflects deep variations shaped by geography, policy, and culture. The findings suggest that unequal infrastructure and resources continue to reinforce social stratification within education. The study confirms that educational technology has the capacity to innovate pedagogy but also risks eroding traditional forms of social interaction. The review highlights that digitalization creates new forms of governance, surveillance, and accountability within schools and universities. The findings underline that sociological inquiry is indispensable to uncover how technology reshapes power, privilege, and cultural practices. The analysis demonstrates that existing research has not sufficiently integrated sociological frameworks into the study of digital education. The review shows that much scholarship remains focused on technical efficiency, leaving equity and justice underexplored. The study establishes that global and contextual perspectives are vital to understand the uneven impact of digital transformation. The findings reveal that marginalized groups often remain excluded even when access is expanded. The study emphasizes that digital readiness must be addressed through comprehensive strategies involving policy, training, and cultural change. The evidence suggests that digital education both reflects and drives wider processes of social change. The review affirms that without equity-driven approaches, digital technologies risk reinforcing existing hierarchies. The study ultimately provides a foundation for future research that links educational technology with critical sociological theories. The conclusion asserts that digital transformation in education must be approached not only as a technical project but as a social phenomenon with profound implications for justice, equity, and inclusion.

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