

CHAPTER: 04

TECHNOLOGY AS AN ENABLER: REDEFINING INCLUSIVE CLASSROOMS IN THE DIGITAL AGE

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ABSTRACT

Technology has emerged as a powerful catalyst for reimagining inclusive education, transforming classrooms from rigid, one-size-fits-all models into flexible, learner-centered ecosystems. By aligning with Universal Design for Learning (UDL), digital tools create multiple pathways for engagement, representation, and expression, ensuring that learners with diverse needs – including those with disabilities – can participate meaningfully in the learning process. Assistive technologies such as screen readers, speech-to-text software, and adaptive platforms enhance accessibility, while collaborative digital environments amplify learner voice and agency. Yet, technology's enabling power is not automatic; it requires teacher preparedness, institutional support, equity-driven policies, and ethical governance of learner data. Bridging the digital divide is particularly crucial to prevent disparities in access from undermining inclusive goals. Drawing on sociocultural and constructivist theories, this study positions technology as both a mediator of learning and a transformative force for educational equity. It argues that when thoughtfully implemented, technology does more than assist inclusion – it reshapes educational norms, empowers marginalized learners, and fosters classrooms that are more just, participatory, and responsive to human diversity.

Keywords: Technology, Inclusive Education, Digital Age, Teaching & Learning.

INTRODUCTION

The digital age has reframed teaching and learning: classrooms are increasingly blended, resources are multimodal, and learners expect personalization. For inclusive education, technology offers more than convenience – it has the potential to redefine what inclusion means by making curricula accessible, enabling differentiated instruction, and supporting learner agency. When thoughtfully integrated, technologies (assistive tools, learning management systems, adaptive software, mobile devices, analytics, and collaborative platforms) can remove barriers related to sensory, cognitive, physical, social, and linguistic differences. However, technology is not a panacea;

its power depends on design principles (Universal Design for Learning), teacher capacity, policy alignment, and ethical, equity-focused implementation. This paper theorizes how technology can act as an enabler and proposes frameworks for realizing inclusive digital classrooms.

Technology as an Enabler

Technology today functions as a powerful enabler that bridges the gap between learners of diverse abilities and equitable learning opportunities. It creates an environment where multiple modes of learning are possible, ensuring that students are not confined to rigid, one-size-fits-all approaches but can instead engage through flexible, digital pathways. Assistive technologies, ranging from screen readers to voice-to-text tools, provide direct support for learners with disabilities, making participation and performance more accessible. Digital platforms also foster a shift toward learner-centered environments, where personalization of teaching is achievable and students can progress at their own pace. When integrated with Universal Design for Learning (UDL), technology supports the design of inclusive curricula that address the varied strengths and challenges of every learner. Teachers, empowered with digital pedagogical skills, are able to deliver differentiated instruction, enhance collaboration, and create a participatory classroom culture. Beyond pedagogy, technology expands opportunities for peer interaction, communication, and social inclusion, enabling learners to engage with content and with each other regardless of barriers. However, the effectiveness of technology is conditional on equity-driven implementation, ensuring that marginalized or disadvantaged students also benefit fully. At the same time, the ethical governance of learner data builds trust and safeguards student rights in digital spaces. In this way, technology moves beyond its role as a mere supportive tool and emerges as a transformative force that redefines inclusive education, amplifies learner agency, and strengthens the responsiveness of classrooms to human diversity.

Inclusive Classrooms in the Digital Age

Inclusive classrooms in the digital age represent a paradigm shift in how education responds to learner diversity. No longer confined to uniform teaching models, these classrooms leverage digital tools to personalize instruction and support differentiated learning needs. Technology enables real-time feedback, adaptive content delivery, and flexible learning pathways that accommodate students with varied abilities. Assistive devices and digital platforms break down barriers, allowing students with disabilities to participate meaningfully alongside their peers. Collaborative online environments foster peer-to-peer learning, promoting social inclusion and reducing isolation. The digital age also empowers teachers with data-driven insights to tailor pedagogy more effectively. Importantly, inclusivity in this context extends beyond access, emphasizing equity, fairness, and respect for diverse learning identities. When integrated with Universal Design for Learning principles, digital classrooms ensure multiple means of representation, engagement, and expression. Ethical considerations around

accessibility and data privacy remain central to sustaining trust. Ultimately, inclusive classrooms in the digital age reflect a vision of education that is flexible, just, and responsive to the complex realities of human diversity.

REVIEW OF LITERATURE

Rose and Meyer (2002) laid the theoretical foundation for Universal Design for Learning (UDL), which has become central to the conversation on inclusive education and educational technology. Their work emphasizes the importance of providing multiple means of engagement, representation, and action/expression so that learners with diverse abilities and learning preferences can access content equitably. By highlighting flexibility as the cornerstone of instructional design, the authors show how rigid teaching practices often marginalize students with disabilities, while UDL offers proactive solutions to these systemic barriers. Their research continues to influence both policymakers and practitioners by framing technology not simply as a tool, but as a medium that must be designed inclusively from the outset rather than retrofitted later. Al-Azawei, Serenelli, and Lundqvist (2016) reviewed empirical studies on the adoption of UDL principles within digital learning contexts, offering evidence that such frameworks substantially enhance accessibility and learner engagement. Their findings suggest that digital environments, when carefully designed, can accommodate learner variability far more effectively than traditional models. Importantly, they reveal that UDL is not just a theoretical construct but a practical guide for designing online courses that adapt to different cultural, cognitive, and physical needs. The authors advocate for increased awareness and training among educators to embed UDL principles into their pedagogical strategies, thereby improving inclusivity in technology-mediated instruction. Burgstahler (2015) focused on the practical applications of universal design in higher education, identifying strategies and institutional frameworks that can foster accessible environments for all learners. Her work bridges the gap between theory and practice by demonstrating how universities can implement universal design policies across classrooms, laboratories, and online platforms. Burgstahler also emphasizes the importance of faculty development programs and administrative support, arguing that accessibility must be seen as a shared responsibility rather than an individual accommodation. Her contribution underscores that institutional culture plays a decisive role in determining whether inclusive practices become sustainable in the long term. Edyburn (2013) provided a critical perspective on the widespread optimism surrounding educational technology by cautioning that technology alone is insufficient for achieving true inclusion. He argues that without pedagogical alignment and systemic support, even advanced tools risk failing to meet the needs of marginalized learners. His critique points to a recurring problem in EdTech adoption: the assumption that introducing new technologies will automatically result in improved outcomes. Instead, Edyburn advocates for deliberate integration of pedagogy, teacher training, and infrastructure, thereby ensuring that technology enhances rather than undermines inclusive practices. Dell, Newton, and Petroff (2017) catalogued a range of assistive

technologies (AT) and examined their applications in classrooms, with a particular focus on communication, literacy, and social inclusion. Their findings suggest that AT can empower students with disabilities to actively participate in academic and social contexts when educators receive adequate training to use them effectively. The authors also identify barriers such as cost, lack of teacher preparedness, and insufficient institutional support that often prevent AT from reaching its full potential. Nonetheless, their research highlights the transformative role of AT in bridging gaps for students with speech, cognitive, or mobility challenges.

Means et al. (2010) conducted a comprehensive meta-analysis comparing online, blended, and traditional face-to-face instruction. Their evidence showed that, when designed thoughtfully, online and blended approaches can be equally or more effective than traditional models. This finding has direct implications for inclusive education, as blended learning provides opportunities for differentiated instruction, flexibility, and individualized pacing. The study highlights the potential of technology to level the playing field for diverse learners while cautioning that effectiveness depends heavily on instructional design rather than the mode of delivery alone. Selwyn (2016) takes a more skeptical stance, offering a critical examination of the complex relationship between education and technology. He challenges the often utopian assumptions that EdTech inherently democratizes education, instead drawing attention to the political, economic, and cultural dynamics that shape its implementation. Selwyn encourages educators and policymakers to adopt a balanced view – one that recognizes both the promises and the limitations of technology. His work invites reflection on how inclusivity may be compromised when technological solutions are driven by market forces rather than educational values. Parette and Peterson-Karlan (2007) underscored the importance of collaboration among teachers, families, and therapists in the successful integration of assistive technologies. Their research demonstrates that AT does not exist in isolation but requires coordinated support from multiple stakeholders to be meaningful for students with disabilities. They argue that shared decision-making and joint training enhance the likelihood of consistent and effective use of AT. This collaborative model shifts the focus from individual devices to holistic ecosystems of support, which are critical for sustaining inclusive education practices. Ok, Rao, and Bryant (2017) examined the role of teacher knowledge and attitudes in shaping the effectiveness of assistive technologies and inclusive practices. Their study revealed that even when tools are available, teachers' willingness and confidence to use them decisively affect outcomes. Negative attitudes, lack of training, or low self-efficacy can hinder the potential of AT, while supportive and knowledgeable teachers create environments where technology truly supports inclusion. The authors call for professional development programs that not only build technical competence but also address perceptions and beliefs about inclusive education.

UNESCO (2015) provided a global perspective by publishing policy frameworks and guidelines for the integration of technology in inclusive education. The organization advocates for

systemic approaches that extend beyond individual classrooms, emphasizing national-level strategies such as capacity-building, monitoring, and evaluation. These frameworks highlight that inclusive education requires alignment across policy, infrastructure, teacher training, and community engagement. By situating inclusion within the broader agenda of sustainable development, UNESCO demonstrates how technology can serve as both a tool and a driver for equitable education worldwide. Hegarty and Priego (2014) explored multimedia learning design principles, focusing on how carefully constructed digital resources can reduce cognitive load and support learners with diverse needs. Their findings highlight that instructional design must account for the cognitive processes involved in learning, ensuring that multimedia materials are not overwhelming but instead facilitate understanding. By applying cognitive load theory, they show that inclusive multimedia design enhances both accessibility and effectiveness for learners across different contexts.

Azevedo and Cromley (2004) applied self-regulated learning (SRL) theory to digital learning environments, emphasizing the importance of scaffolds that help learners manage their own cognitive and motivational processes. They argue that SRL is critical for success in online contexts, where learners often have greater autonomy but less direct support from instructors. Their work demonstrates how digital scaffolds such as prompts, feedback, and monitoring tools can enhance metacognitive awareness and improve outcomes for diverse learners. Fichten et al. (2009) gathered accounts from faculty and students that revealed significant accessibility gaps in e-learning environments. Their research underscores that, despite technological advances, many online courses still fail to adequately address the needs of learners with disabilities. They highlight challenges such as inaccessible course materials, insufficient technical support, and faculty unfamiliarity with inclusive practices. This study reinforces the necessity of proactive and systematic design to ensure that digital education truly reaches all learners. Kozma (2003) contributed a socio-cultural perspective, arguing that technology mediates new pedagogical possibilities and fundamentally reshapes classroom cognition when integrated thoughtfully. He contends that the true impact of technology lies not in the tools themselves but in how they interact with pedagogical practices to transform learning experiences. By framing technology as a catalyst for new forms of knowledge construction, Kozma emphasizes its potential role in advancing inclusive and participatory classrooms.

Marino et al. (2014) examined the use of game-based and multi-modal resources in engaging learners with diverse needs. Their findings demonstrate that interactive and playful learning environments can significantly improve motivation, comprehension, and participation among students who may struggle in traditional settings. By highlighting the multimodal nature of games – visual, auditory, and kinesthetic – the study shows how such tools align with UDL principles and provide multiple entry points for learning. Boot, Macdonald, and Reed (2018) discussed equity issues and the challenges of implementing inclusive technology in low-resource contexts. They argue that while advanced tools may be available in well-funded schools, scalable and low-cost solutions are

crucial to ensure that inclusion does not remain a privilege of wealthier institutions. Their research points toward innovative, adaptable, and context-sensitive strategies that prioritize equity in technology adoption, making a strong case for sustainable inclusion worldwide. Finally, Rao, Ok, and Bryant (2014) reviewed the transferability of Universal Design practices from online environments to face-to-face classrooms. Their work demonstrates that principles such as flexibility, multiple representations, and scaffolding can be applied across modalities, enhancing accessibility in both digital and physical spaces. The study highlights the universality of UDL and its potential to reshape instructional practices across contexts, underscoring that inclusivity is not tied to a particular medium but to a mindset of design for all.

Theoretical Framework

This paper synthesizes three complementary frameworks to explain technology-enabled inclusion:

1. **Universal Design for Learning (UDL):** Technology should provide multiple means of representation, engagement, and expression so that curricula are flexible and learner-centered (Rose & Meyer, 2002).
2. **Socio-Technical Systems:** Inclusion emerges from the interaction of tools, people (teachers, students, families), policies, and contexts — not from technology alone (Selwyn, 2016; Kozma, 2003).
3. **Self-Regulated and Socially Situated Learning:** Digital tools must scaffold metacognition and foster social presence; successful inclusion requires supports that develop learner autonomy and community (Azevedo & Cromley, 2004; Hegarty & Priego, 2014).

RESEARCH METHODOLOGY

This is a theoretical, narrative synthesis based on secondary sources (peer-reviewed literature, policy documents, and major syntheses) from 2000–2021.

The method involved:

- Systematic keyword searches in established academic databases (terms: “inclusive education,” “assistive technology,” “UDL,” “accessibility,” “digital pedagogy”),
- Thematic coding of findings into: design principles, classroom practices, institutional supports, and equity considerations, and
- Translational analysis to convert theoretical insights into practical recommendations.

Objectives of the study

1. To conceptualize how educational technology can enable and transform inclusive classroom practices.
2. To synthesize theoretical and empirical literature into actionable design and policy recommendations for creating technology-enabled inclusive classrooms.

ANALYSIS & INTERPRETATION: JUSTIFICATION OF OBJECTIVES

Objective 1: To conceptualize how educational technology can enable and transform inclusive classroom practices.

The first objective is rooted in the broader discourse of inclusive education, which emphasizes equal opportunities for students with diverse abilities, learning needs, and socio-cultural backgrounds. Traditionally, inclusive classrooms have relied heavily on differentiated instruction, teacher adaptability, and peer collaboration. However, these approaches, while valuable, have shown limitations in addressing the unique challenges faced by students with physical disabilities, sensory impairments, cognitive difficulties, or neurodiverse learning patterns. Educational technology (EdTech) introduces a paradigm shift by offering assistive and adaptive tools that can *bridge these limitations*. Theoretical models such as the Universal Design for Learning (UDL) (Rose & Meyer, 2002) argue that learning environments must be designed with multiple means of engagement, representation, and expression. Technologies such as screen readers, speech-to-text systems, and interactive learning platforms provide precisely these multiple pathways, enabling equitable access to curriculum content.

From a sociocultural theory perspective (Vygotsky, 1978), technology functions as a “mediational tool” that extends the learner’s zone of proximal development (ZPD). For instance, a student with dyslexia can access digital text-to-speech applications that scaffold reading comprehension, allowing the learner to engage with advanced concepts without being hindered by decoding difficulties. This demonstrates how EdTech transforms traditional classroom practices by restructuring not just *what* is taught, but *how* it is accessed and demonstrated. Moreover, critical disability studies highlight the importance of dismantling systemic barriers rather than “fixing” the individual learner (Oliver, 1996). Assistive technologies, when integrated meaningfully, reposition disability as a mismatch between learner needs and rigid instructional formats, thereby promoting agency and participation. Thus, conceptualizing EdTech in inclusive classrooms is not only about technical efficiency but also about redefining pedagogical values toward equity and empowerment. Therefore, the objective emphasizes the transformational potential of technology – moving beyond its role as a supplementary tool to becoming an essential enabler of inclusive pedagogical reform, where diverse learners can participate fully and meaningfully.

Objective 2: To synthesize theoretical and empirical literature into actionable design and policy recommendations for creating technology-enabled inclusive classrooms.

The second objective extends the study from theoretical conceptualization to practical application. While there is a growing body of empirical work demonstrating the effectiveness of assistive technologies in specific contexts – such as text-to-speech improving reading fluency (Wood et al., 2018) or augmented reality supporting students with autism (Chen et al., 2020) – the field still suffers from fragmentation. Different studies highlight isolated benefits without providing comprehensive frameworks that schools and policymakers can adopt systematically. A key gap lies in the translation of research insights into actionable strategies. For example, the Technology Acceptance Model (TAM) (Davis, 1989) has been applied to understand teachers’ willingness to adopt EdTech. Findings suggest that perceived ease of use and perceived usefulness influence adoption. However, unless these insights are synthesized and contextualized within inclusive education policies, they remain underutilized. Similarly, theories such as Diffusion of Innovation (Rogers, 2003) provide critical perspectives on how innovations spread within institutions, which can inform structured implementation strategies in inclusive settings. This objective is also justified by the need for evidence-based policymaking. Governments and educational boards increasingly mandate inclusive education under frameworks like the UN Convention on the Rights of Persons with Disabilities (UNCRPD, 2006) and Sustainable Development Goal 4 (SDG 4: Quality Education). Yet, implementation gaps persist, often due to the absence of synthesized guidelines that integrate pedagogy, technology, and accessibility standards. By collating theoretical and empirical insights, this study seeks to provide coherent recommendations that address such policy-practice gaps. Furthermore, synthesizing literature supports the design of inclusive learning environments that are scalable and sustainable. For example, integrating Learning Analytics with inclusive pedagogy can help educators monitor diverse learners’ progress in real time, ensuring timely interventions. Similarly, aligning EdTech use with teacher professional development frameworks ensures that technology adoption does not remain superficial but becomes a sustained practice. Thus, this objective is theoretically justified because it responds to the urgent need for coherence in a fragmented research field, translating scattered insights into practical, policy-oriented, and design-based recommendations that can guide inclusive education in the digital age.

Findings of the study

- Technologies enable differentiation at scale: adaptive learning systems and analytics allow content and pacing to match individual readiness. When aligned with UDL, this supports learners who need alternative representations or extra processing time (Means et al., 2010; Al-Azawei et al., 2016).

- Assistive technologies (screen readers, AAC, text-to-speech, alternative input devices) directly address barriers to access, enabling participation that would otherwise be impossible (Dell et al., 2017; Parette & Peterson-Karlan, 2007).
- Digital platforms can promote social belonging through structured collaboration tools (forums, breakout rooms, peer review) and multimodal communication (video, audio, text), which help students with social-communication difficulties engage in peer learning (Marino et al., 2014).
- Instructor presence—visible in timely feedback and scaffolding—mitigates isolation and supports confidence, particularly for marginalized learners.
- Teacher capacity is the linchpin: technologies only enable inclusion when teachers can integrate tools pedagogically (Ok et al., 2017; Edyburn, 2013). Ongoing professional development grounded in UDL, accessibility, and pedagogical integration is essential.
- Co-design approaches—where teachers, students, and specialists jointly select/adapt technologies—improve relevance and uptake (Parette & Peterson-Karlan, 2007).
- System-wide policies (procurement requiring accessibility, central captioning services, data privacy and ethics, and funding for infrastructure) determine scalability and sustainability (UNESCO, 2015; Burgstahler, 2015).
- Inclusive procurement and platform selection ensure tools meet accessibility standards (WCAG) and interoperability with ATs.
- The digital divide remains a core constraint: device access, connectivity, and home learning environments shape who benefits from technology (Boot et al., 2018). Low-bandwidth design, offline resources, and community access points are necessary mitigations.
- Cultural and linguistic responsiveness in content and interfaces increases relevance and lowers affective barriers for diverse learners.
- Learning analytics can personalize supports but raise concerns about surveillance, bias, and consent. Equity-centered analytics policies are needed to ensure data-driven personalization doesn't stigmatize or exclude learners.

Practical Recommendations (Actionable)

1. Make UDL the default for curriculum development and digital content.
2. All learning platforms must meet recognized accessibility standards (e.g., WCAG) and be interoperable with assistive devices.

3. Offer continuous, practice-focused training and create co-design teams (teachers + students + therapists) for contextual tool selection.
4. Embed goal-setting templates, progress dashboards, peer mentoring modules, and instructor feedback loops.
5. Provide offline materials, mobile-first interfaces, and community access points for learners without home connectivity.
6. Develop policies for transparent, equitable use of learner data, with opt-outs and explainable interventions.
7. Establish indicators for access, participation, learning outcomes, and student-reported inclusion to guide continuous improvement.

CONCLUSION

Technology in the digital age offers profound opportunities to redefine inclusive classrooms — shifting from one-size-fits-all to flexible, learner-centered systems. But technology's enabling power is conditional: it requires alignment with Universal Design for Learning, teacher expertise, institutional policies, equity-driven implementation, and ethical governance of learner data. When these elements cohere, technology does not merely assist inclusion — it transforms classroom norms, amplifies learner agency, and makes education more just and responsive to human diversity. Furthermore, assistive and adaptive technologies bridge gaps for learners with sensory, cognitive, and physical disabilities, providing them with tools to access content on par with their peers. However, effectiveness is not inherent in the tools themselves but emerges from thoughtful integration into pedagogy and curriculum. For instance, screen readers, speech-to-text software, and interactive platforms are only impactful when supported by teacher training and systemic adaptability. At a theoretical level, this aligns with Vygotsky's sociocultural framework, where tools mediate learning, and inclusive technologies act as cultural mediators for marginalized learners. Similarly, principles of constructivism reinforce that learners thrive when provided with multiple pathways to engage, represent, and express knowledge — all made possible through educational technology. From a policy perspective, inclusion cannot rely solely on device availability; it demands sustainable infrastructure, ongoing technical support, and context-sensitive design that acknowledges linguistic, cultural, and socio-economic differences among learners. Bridging the digital divide is, therefore, a precondition for technology-enabled inclusion, ensuring no learner is excluded due to affordability or accessibility barriers. Ethically, educators and policymakers must guard against technological determinism — the assumption that digital tools automatically guarantee inclusion. Instead, technology must be evaluated for its cultural responsiveness, long-term sustainability, and potential unintended consequences such as dependency, privacy risks, or exacerbation of inequities. In synthesizing these

perspectives, the objectives of this study become essential: first, to conceptualize how educational technology can reconfigure inclusive practices, and second, to translate insights into actionable recommendations that inform curriculum design, teacher preparation, and inclusive policy development.

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