

# Practical Challenges and Implementation Pathways of Digital Technology for Educational Equity

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## Abstract

The advancement of digital technology has significantly propelled progress in educational equity, partially resolving longstanding challenges in this domain. However, it has simultaneously introduced substantial practical challenges, chiefly encompassing regional development disparities, gaps in information literacy between urban and rural teachers and students, excessive reliance on visual imagery, disconnection between physical and mental perception due to technological overreach, and mismatched digital technology empowerment. Under the new era's circumstances, pathways to realise digital technology-empowered educational equity can be pursued through three dimensions: macro-level – robust top-level design and planning; meso-level – institutional reforms within the education sector; and micro-level – respect for students' individualised needs. This approach will enhance the flow of educational resources across different regions, narrow disparities in educational resources between areas, and maximise the realisation of educational equity.

## Keywords

Digital technology; Educational equity; Empowerment; Information silos.

## 1. Introduction

Educational equity serves as a vital cornerstone of social justice and stands as a core benchmark for gauging a nation's level of civilisation. It directly impacts both individual development opportunities and the overall vitality of society. The Opinion of the Ministry of Education and Eight Other Departments on Accelerating the Advancement of Education Digitalisation (Jiao Ban [2025] No.3) explicitly proposes “exploring new pathways for education digitalisation to propel equitable and high-quality educational development”, positioning digital technology as the key enabler for resolving educational equity challenges. From a global perspective, the iterative advancement of digital technology is reshaping educational organisation, teaching models, and resource allocation methods, with nations increasingly adopting education digitalisation as a strategic lever for promoting educational equity. International initiatives such as UNESCO's “Future of Education” initiative and the EU's Code of Conduct on General Artificial Intelligence underscore the global consensus on technology-enabled educational equity. In China, decades of development have yielded significant progress in educational equity, yet new challenges posed by digital technologies have emerged. Identifying the sources of these challenges and charting an optimised pathway for digital technology to empower educational equity are pressing issues in this new historical wave.

## 2. Literature Review

Digital technology constitutes a fundamental pillar of the modern information society, encompassing a broad spectrum of applications ranging from basic hardware devices to complex software systems. In practical implementation, this includes hardware and software functionalities such as digital equipment, digital systems, and digital services. The concept of

digital technology empowerment refers to the dynamic process whereby, driven by the development of the internet and the rise of modern information technologies such as big data, cloud computing, artificial intelligence, blockchain, and virtual reality (VR), education and teaching are optimised and upgraded through integration and innovation. This process also stimulates the endogenous momentum of the education system, advancing the goal of educational equity. In essence, it involves establishing a comprehensive empowerment chain supported by technology, spanning from resource provision to personalised services. The scope of digital technology is broad; this paper's examination of its impact is confined to its application within the educational sphere. Specifically, its application encompasses both the use of digital technology in educational environments and resources, as well as its implementation in teaching methodologies, assessment, and management. Technologically, it covers computer hardware, software, internet platforms, artificial intelligence, big data, and related technologies.

Currently, the digital empowerment of education encompasses four primary dimensions: presenting teaching content through digital means; employing modern teaching methods such as online platforms and virtual reality technology for interactive learning; meeting differentiated learning needs through big data and artificial intelligence; and utilising digital technology to construct intelligent educational decision-making platforms and educational management systems.

Regarding the definition of educational equity, different scholars offer varying interpretations. "Equal educational opportunity" constitutes the core tenet of modern Western educational equity philosophy. Torsten Husen [1] contends that educational processes must equitably address the developmental needs of diverse students, representing fairness in the human dimension of education. John Rawls emphasises that educational funding and teacher allocation must align with beneficiaries' interests, embodying fairness in the material dimension. Thus, educational process equity possesses dual dimensions: satisfying human developmental needs while ensuring equitable distribution of material resources, both converging towards shared educational resources. American scholar James S. Coleman posited that equal educational opportunity "can only be approximated, never fully realised." Japanese scholar Yasushi Tomoda identifies efficiency, formality, and substantive equality as the three dimensions of equal educational opportunity [2].

Educational inequality can, to some extent, be regarded as the root cause of a series of other inequalities [3]. Consequently, the factors influencing educational equity have become a focal point of research across various fields. Chinese scholars have conducted extensive research on educational equity, defining its essence from multiple dimensions and perspectives, including educational science, ethics, economics, and jurisprudence. Family factors such as political affiliation, household registration status, and ethnicity can lead to unequal educational opportunities [4, 5], while environmental factors also influence educational equity [6]. The mainstream analytical framework for studying educational equity is Husen's "Three-Stage Theory of Educational Equity", comprising equity of access, equity of process, and equity of outcome. [1] Equity of access emphasises eliminating constraints on educational opportunities imposed by external factors such as family background and region, ensuring equal access to educational resources for all individuals. Equity of process focuses on achieving personalised support and fair treatment within educational activities to meet learners' differentiated needs. Equity of outcome points towards the ultimate goal of enabling every student to maximise their potential and achieve comprehensive development, promoting diverse recognition of learning outcomes and balanced development of abilities, with a focus on equal possibilities for learners to attain outcomes.

Existing literature predominantly analyses the relationship between digital technology and educational governance [7, 8]. Some scholars employ quantitative methods to examine the

impact of digital economic development on educational equity and its underlying mechanisms [9], concluding that leveraging the positive effects of the digital economy can promote coordinated regional educational development and thereby advance educational equity. However, current research lacks analysis on how digital technology can empower educational equity and the specific challenges involved in its implementation. Based on these considerations, this paper examines the challenges and implementation pathways for digital technology to empower educational equity.

### **3. Practical Challenges in Digital Technology Empowering Educational Equity**

The application of digital technology has not only accelerated the modernisation of education but also advanced educational equity. However, as digital technology enters a new phase of empowering educational equity, it brings multifaceted impacts to education—both positive influences and numerous potential crises.

#### **3.1. Regional Development Inequality**

While digital technology serves as a potent tool for advancing educational equity, its uneven development itself can trigger a “Matthew effect” within education. Resource-rich urban schools leverage digital tools to further enhance educational quality, whereas resource-poor rural schools fall further behind in the process of digitally-empowered teaching. This digital divide exacerbates educational inequality. The imbalance between urban and rural development perpetuates the digital divide. The educational digital divide refers to inequalities in accessing and utilising educational resources stemming from economic, geographical, technological, and capability factors. Such disparities directly impact students' learning outcomes, thereby hindering educational equity and overall societal progress [10].

Global practice has amply demonstrated the vital role of public education, particularly basic public education, in alleviating poverty and enhancing citizens' quality of life. In China, persistent and widening disparities in the construction and quality of social public infrastructure between urban and rural areas persist due to uneven development. Rural regions face a chronic shortage of social public educational resources relative to demand, stemming from geographical economic constraints and environmental limitations. Rural students struggle to effectively exercise their right to access social public resources at all levels, including youth palaces, libraries, museums, cultural centres, science and technology venues, and research-based learning bases. Improving the development of social public educational resources and digital connectivity is essential to compensate for their inherent disadvantages in educational conditions.

#### **3.2. Disparities in Information Literacy Among Urban and Rural Teachers and Students**

Rural teachers, constrained by the economic and cultural development of their communities and their educational awareness, often exhibit lower levels of acceptance towards integrating new technologies with education compared to their urban counterparts [11]. They frequently lack both the awareness and skills required to utilise technology for effective teaching. The emergence of intelligent, virtualised, and interactive teaching scenarios in the new era further excludes and marginalises rural teachers in offline activities, making it more difficult for them to support students' personalised learning and development. This exacerbates educational inequality.

The development of students' information literacy is influenced by both family background and school conditions. Compared to their urban counterparts, rural students have less access to information technology devices, resulting in insufficient awareness of digital technology usage

and operational proficiency. Furthermore, systemic issues in the construction and sharing of educational resources mean that the provision of knowledge-based digital resources and infrastructure correlates directly with the level of information literacy development among teachers and students in different regions. Urban and rural students exhibit distinct patterns in their use of information technology. Urban students are accustomed to employing digital devices and the internet for diverse, multifaceted learning activities such as proactive inquiry and peer collaboration. Conversely, rural students' passive approach to digital technology courses hinders their ability to leverage technological support effectively for academic advancement and skill development, thereby widening the urban-rural educational divide. Merely engaging with digital technology does not automatically enhance one's capacity to apply it effectively. Research indicates that digitally advantaged groups predominantly utilise serious applications online, focusing on creative activities such as internet finance, learning, and social engagement to maximise the benefits of digital resources. Conversely, digitally disadvantaged groups predominantly engage with "entertainment applications," with 70% of their online activities centred on socialising and leisure, rarely leveraging the potential advantages of capital and resources [12].

### 3.3. Overreliance on Visual Imagery

Digital technologies find extensive application in resource sharing, personalised learning, online instruction, and educational analytics. Digital resources such as MOOCs predominantly present content through visual imagery. While visual perception offers distinct advantages and convenience in knowledge acquisition, it concurrently fosters superficial thinking patterns and logical gaps, thereby undermining students' developmental progress and cognitive advancement. Media images, being highly entertaining and trending, may easily distract students, leading to inattentiveness, interrupted thought processes, or erratic thinking. Students are readily captivated by the vast array of diverse video content in virtual, fluid environments, thereby struggling to engage in deep, focused reflection on specific topics. Simultaneously, the readily available abundance of video files encourages students to absorb such information uncritically, thereby compromising the integrity and rigour of their logical reasoning.

Media dissemination centred on images and videos frequently fosters information silos. Within these silos, the perspectives students encounter through digital media may not represent a comprehensive view. As a "quick and easy" method of information acquisition, visual imagery shifts students' focus away from rational depth and substance towards superficial evaluation. Consequently, the inappropriate use of digital technology can readily lead to students' logical deficiencies and the formation of information silos.

### 3.4. Technological Overreach Leading to the Disconnection of Mind and Body

When technology excessively overreaches to dominate the educational landscape, it may cause a disconnection between students' mental and physical perceptions. The mind is dependent upon the body, which in turn is rooted in the environment. Cognition, the body, and the environment form an inseparable whole in the learning process [13]. As environments become digitised, digital technology replaces direct physical participation in educational activities with algorithmically generated digital avatars. Students must transform themselves into virtual entities within digital interfaces to enter virtual learning scenarios. This inevitably fosters fragmentation and alienation in their perceptions. For instance, the intervention of digital technology simplifies the physical engagement of "listening, speaking, acting, and touching" in physical classrooms into mere information reception via screen interfaces, reducing cognitive processes to "learning above the neck".

Presently, smartphones and computers have become multifunctional hubs deeply integrated into the educational ecosystem. They serve as repositories of learning resources, vital platforms

for teacher-student interaction and school management participation, while simultaneously brimming with diverse entertainment offerings and social networking capabilities. Students can seamlessly access diverse resources and platforms with a simple tap of the finger. Against this backdrop, the continuous, ordered temporal and spatial framework of educational activities is disrupted, making it difficult to sustain student focus and deep cognitive engagement, thereby progressively weakening the impact of educational practice. Excessive use of electronic devices distracts students, hindering their ability to concentrate on current tasks and consequently diminishing academic performance across subjects.

### **3.5. Digital Technology Empowerment Mismatch**

During digital transformation, some schools exhibit a tendency towards “digitalisation for digitalisation's sake”. This manifests as a disconnect between technological application and pedagogical objectives. For instance, certain institutions blindly introduce advanced digital teaching equipment and software without adequately considering their suitability for the school's actual teaching practices, curriculum content, and student characteristics. When utilising these tools, teachers often treat them merely as simple substitutes or supplements to traditional teaching methods, failing to fully explore their potential for optimising educational outcomes. Furthermore, there is a lack of locally tailored integration strategies. Each school possesses unique cultural characteristics, teaching staff capabilities, student foundations, and educational resources. However, schools in certain regions frequently adopt a one-size-fits-all approach to integrating digital technology into education, replicating successful models from other institutions without adequately considering their own local context.

Furthermore, digital educational resources are insufficient to meet curriculum demands. While the internet hosts vast quantities of digital educational resources, high-quality materials precisely tailored to the needs of different subject levels and grade tiers remain relatively scarce. Certain resources suffer from outdated content, with course examples and data failing to be updated promptly, making it difficult to reflect current societal developments. Additionally, some resources exhibit problematic value orientations, propagating erroneous concepts that challenge the accuracy and authority of subject education. From the perspective of the relationship between teaching resources and pedagogical strategies, excellent teaching materials form the foundation for constructing an efficient teaching system. While digital technology provides convenient access to resources, the uneven quality of these resources increases the difficulty for teachers in selecting appropriate materials. Educators must invest substantial time and effort in discerning and filtering materials, a process that to some extent limits the effectiveness of digital technology in subject-based education. Moreover, the difficulty in swiftly accessing suitable, high-quality resources often complicates instructional strategy design. Teachers may be compelled to lower standards for teaching materials or rely solely on limited, outdated resources, resulting in teaching content that lacks novelty and appeal. This not only risks diminishing classroom vitality and failing to fully engage students' interest but also fosters feelings of boredom among pupils. Over time, the vision of digital technology empowering innovative course delivery becomes increasingly distant, severely hindering improvements in teaching quality and the achievement of educational objectives.

## **4. Pathways for Digital Technology to Empower Educational Equity**

To bridge the structural digital divide, we must transcend technological instrumentalism and construct systematic solutions to achieve educational equity. The fundamental approach involves leveraging modern technologies to enhance the circulation of educational resources across different regions, thereby narrowing disparities in regional educational resources, promoting their effective sharing, and ultimately advancing educational equity. This paper

analyses how digital technology can optimally empower educational equity from macro, meso, and micro dimensions.

#### **4.1. Macro Level: Establishing Institutional Safeguards Through Top-Level Design**

At the central level, formulate overarching strategies and establish a supporting policy framework for technological advancement. Shift education digitisation policies from project-driven initiatives to institutionally embedded frameworks, incorporating digital technology-enabled educational equity into legislation such as the Education Law and Compulsory Education Law to clarify responsibilities and rights. Develop specialised regulations governing the co-construction and sharing of digital educational resources, data security, and standardised technical application procedures. Concurrently, sustain increased financial and policy support for digital technology development. The state's promotion of these digital technologies inherently advances their application in enabling educational equity. This stems from the broad scope of digital technologies: for instance, internet technology overcomes geographical constraints by enabling remote resource delivery and broadening educational access channels; cloud computing supports large-scale resource sharing and collaboration; IoT technology facilitates smart campus sensing and device interconnectivity; virtual reality (VR) technology creates immersive teaching environments, significantly enhancing engagement and learning experiences; Artificial intelligence assists teachers in decision-making and enables personalised learning for both educators and students. These technologies not only form the foundation for educational digital transformation but also provide fundamental support and foundational capabilities for achieving educational equity through their unique functional attributes.

At the national policy level, documents have been issued encouraging the formation of a multi-stakeholder governance system characterised by “government leadership, school-based implementation, corporate participation, and societal collaboration”. The government should play a leading role, coordinating resources across education, science and technology, finance, and industry and information technology departments to create a cohesive policy framework; Schools must be strengthened in their primary responsibility to integrate digital technologies deeply into school operations, teaching practices, and management systems. Enterprises should be encouraged to participate, guiding technology companies to develop products and services tailored to educational equity needs while fulfilling their social responsibilities. Societal forces should be mobilised to provide digital support for disadvantaged groups through charitable donations, volunteer services, and other means.

The dual-faceted incentive capacity of tools such as exemplary benchmark selection should be emphasised. A positive incentive framework must be established to recognise individuals and organisations effectively leveraging digital technologies to empower education. On one hand, the scope of incentives should be broadened to encompass a multi-tiered, efficient framework covering financial support, honours and awards, career advancement, and professional development assistance. On the other hand, emphasis should be placed on strengthening the oversight and evaluation mechanisms following the deployment of incentive tools, ensuring their long-term effectiveness. Precise assessments should be conducted across multiple dimensions—including the rationality of incentive recipients, the effectiveness of incentive measures, and the cost-benefit ratio of resource allocation—to monitor potential issues during the incentive process. This includes promptly tracking the flow of funds to ensure targeted allocation to designated projects, and leveraging the oversight role of higher authorities to objectively review the fairness and credibility of honours and commendations. Such measures prevent resource wastage and inequities in recognition, ensuring incentive tools operate on a

sound trajectory. This approach will sustain the enthusiasm and creativity of all stakeholders in harnessing digital technology to empower educational equity.

#### **4.2. Meso-level: Interdisciplinary Integration Returning to Value Rationality**

Focusing on institutional reforms within the education sector, we must advance disciplinary and curricular reforms to establish an interdisciplinary system integrating science, technology, and humanities education. Current applications of digital technology in education predominantly emphasise instrumental rationality while neglecting value rationality—that is, technology's long-term societal, ethical, and environmental implications. Therefore, policy formulation should promote interdisciplinary integration by combining science and technology with humanities education. Concrete measures may involve curriculum reform to incorporate philosophy, ethics, and sociology into STEM subjects. For instance, integrated humanities-engineering curricula could require engineering students to take philosophy and ethics courses, enabling deeper exploration of technology's societal impacts. Such policies ensure that digital technology-enabled education cultivates ethically conscious, well-rounded citizens rather than merely imparting technical skills.

Innovative models embedding digital technology within education should be developed, promoting digital teaching support initiatives in educationally underserved rural areas. Traditional teaching support models face geographical constraints, resource shortages, and sustainability challenges. However, the introduction of digital technology—particularly internet accessibility, the rise of online education platforms, and advancements in big data and artificial intelligence—offers new possibilities for overcoming these limitations. Digital teaching support can extend the reach of high-quality educational resources through digital means, delivering more flexible and personalised teaching approaches to rural areas. This effectively narrows the gap in access to and utilisation of educational resources between urban and rural areas. Specific methods may include employing modern remote digital teaching tools such as web-based video, virtual simulations, and digital curricula, eliminating the need for teaching staff to be physically present at schools and thus overcoming geographical constraints [14].

Establishing a diversified assessment framework is essential, one that fully leverages the unique strengths of digital teaching. Building upon existing evaluation systems, alongside traditional metrics such as examination results, classroom attendance, in-class performance, and homework submissions, behavioural data from digital learning platforms should be incorporated into assessments. Utilising the analytical tools provided by these platforms enables precise tracking of students' learning time and insights into their engagement with course content. assess their enthusiasm and cognitive engagement by quantifying participation frequency and quality in online interactions; simultaneously evaluate contributions to collaborative group tasks to gauge teamwork and communication skills. [15] Alongside quantitative metrics measuring academic progress and equitable resource distribution, qualitative indicators such as teacher-student satisfaction and societal recognition should be incorporated. Crucially, timely establishment and maintenance of open feedback channels among relevant stakeholders at the practical level is paramount. This fully leverages the pivotal role of opinion-gathering tools, enabling frontline educators, students, parents, and other stakeholders to authentically and freely express their firsthand experiences and improvement suggestions regarding the implementation of digital technology-enabled policies. This creates a closed-loop mechanism for policy refinement, ensuring the dynamic realisation of educational equity objectives.

#### **4.3. Micro Level: Reconstructing Support Systems to Meet Personalised Needs**

Enhance students' awareness of digital learning, refine autonomous learning approaches, and circumvent information silos. When employing digital technologies, establish usage standards

and boundaries, particularly through targeted training for students to minimise digital dependency and information silos. Although digital devices are now widely integrated into school teaching practices, disparities in digital learning persist. Schools should consciously cultivate and enhance students' digital learning awareness and capabilities, breaking the closed nature of school education. Strengthening interaction between schools and society helps students understand the socio-economic development trends of the digital age while deepening their knowledge and comprehension of digital technologies. Key emphasis should be placed on guiding disadvantaged groups to recognise the lifelong value of digital skills for personal development, fostering a preference for digital learning, and enhancing their ability to utilise digital technologies.

Adhering to a people-centred philosophy, schools must respect students' individual needs and reconstruct support systems for their capability development. The developmental goal of this system is that, in the future process of digital technology empowering education, particular attention should be paid to cultivating students' higher-order thinking and capabilities—such as critical thinking, reflective ability, innovation, and socialisation. Centred on students' individual characteristics, a developmental framework should be constructed, integrating the cultivation of higher-order thinking and capabilities into educational objectives and concrete actions. Regarding technological intervention, future education should establish phased, differentiated standards based on students' cognitive development stages and learning needs. Concurrently, sufficient non-technological engagement time must be preserved within teaching processes to foster deep thinking and holistic development.

## 5. Conclusion

The continuous innovation of digital technology in education will inevitably become a new driving force for educational equity. Empowering the education sector through digital technology is an effective means of promoting educational fairness and enhancing educational quality. Moving forward, we must persistently explore models for the deep integration of digital technology with classroom teaching, curriculum evaluation, and other dimensions. We should leverage the unique characteristic of digital technology to transcend temporal and spatial limitations, continuously empowering educational equity. This will enable the ongoing optimisation of teaching practices and the full realisation of digital technology's enabling potential. Throughout policy implementation—from top-down macro to micro levels—we must guard against excessive digital dependency, remain vigilant against emerging risks such as algorithmic bias and digital echo chambers, and establish student-centred data ethics and governance frameworks.

Against the backdrop of rapid technological advancement, the relationship between technology and educational equity has become a pivotal question shaping the future of education. Ultimately, the overarching goal of technology-enabled educational equity is not to create a homogenised system devoid of differences, but rather to foster an inclusive framework that acknowledges and respects diversity while maximising support for the potential development of every individual.

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