Macrothink Institute™

Journal of Educational Issues
ISSN 2377-2263
2025, Vol. 11, No. 2

Digitalisation of an Initial Teacher Education Curriculum in the Democratic Republic of Congo and Rwanda

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Received: June 18, 2025 Accepted: July 27, 2025 Published: August 15, 2025

doi:10.5296/jei.v11i2.22954 URL: https://doi.org/10.5296/jei.v11i2.22954

Abstract

The pervasive influence of digitalization has increasingly extended into multiple dimensions of human life, particularly within the educational sector. This study explores the integration of digitalization into initial teacher education curricula in the Democratic Republic of the Congo (DRC) and Rwanda. The primary objective is to understand how digitalization is

conceptualized within these curricula and to assess its potential as a sustainable pedagogical strategy in the context of the contemporary digital era—especially in light of the global pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). To this end, curriculum frameworks for nursery and primary teacher education programs in both the DRC and Rwanda were analyzed using a content analysis approach, drawing on both deductive and inductive reasoning. The findings reveal a divergent landscape in the digitalization of teacher education between the two countries. In Rwanda, digitalization is explicitly embedded within the curriculum, accompanied by concrete didactic and pedagogical tools to support effective implementation. These efforts are aligned with the Rwandan government's broader objective of transforming, empowering, and developing its citizenry for active participation in the digital age. In contrast, the DRC's approach to curriculum digitalization remains underdeveloped and lacks comprehensive implementation. Based on these findings, the study recommends that both governments engage in mutual exchange of experiences, recognizing and leveraging their respective strengths and capacities to enhance the digital readiness of their teacher education systems.

Keywords: Educational digitalization, Digitalized curriculum, Initial teacher education

1. Introduction

Delivering quality education depends on strong and sustainable teacher training that addresses all aspects of the profession. The COVID-19 pandemic (caused by the SARS-CoV-2 virus) has highlighted the urgent need for hybrid models of teacher training that combine digital and in-person methods. In Rwanda, several policies and strategies have been put in place to reform education and encourage teachers to adopt more effective and innovative practices (Mugiraneza, 2021). In contrast, the Democratic Republic of the Congo (DRC) is currently implementing a four-year teacher training program aimed at aligning teacher preparation with the country's specific social and educational needs (UNESCO, 2021). Today, education must equip learners with practical skills that can respond to complex challenges—political, social, economic, cultural, and environmental. This paper investigates how digital tools and approaches are being integrated into pre-service teacher education programs in Rwanda and the DRC. The goal is to assess how initial teacher training can be strengthened to prepare future educators for emerging crises, including the ongoing COVID-19 pandemic and potential future epidemics. The discussion begins with an overview of the study's context, followed by the problem statement and the significance of the research.

1.2 Context and Problem of the Study

The digital age has rapidly extended into the Global South, a development recognized by an increasing number of scholars. This expansion has been accompanied by the rise of digital technologies that have enabled new forms of connectivity and collaboration. However, this shift has also introduced a range of new vulnerabilities and challenges, including legal, infrastructural, and pedagogical gaps (Schia, 2018). In today's globalized educational landscape characterized by constant transformation curricula are increasingly shaped by uncertain, complex, and fragile environments (UNESCO, 2021a). The COVID-19 pandemic,

caused by the SARS-CoV-2 virus, significantly disrupted education systems worldwide. As a result, educational institutions were closed to nearly two billion learners globally (Faturoti, 2022).

In response, there has been a sharp increase in the digitalization of education, especially in sub-Saharan Africa. Governments across the region have scrambled to improve their digital preparedness for future crises, as seen in their responses to the COVID-19 emergency. This study focuses on the cases of Rwanda and the Democratic Republic of the Congo (DRC) to examine how digitalization has been integrated into initial teacher education curricula. These curriculum reforms are often modeled after international frameworks. However, educational stakeholders in both countries emphasize the need for context-specific databases that reflect local needs and resources (Mugiraneza, 2021; UNESCO, 2021a). Prior to the pandemic, many nations despite their technological advancement did not give sufficient attention to integrating digital innovation into educational practice (Abari & Orunbon, 2020). Crises such as COVID-19 offer governments an opportunity for strategic planning, systemic reflection, and proactive reform. Rwanda and the DRC have been part of this global shift, working to contain the effects of the pandemic while rethinking the role of digitalization in education.

Although the digital transformation of the Global South has fostered new opportunities and increased global connectivity, it has also outpaced the development of legal and policy frameworks necessary to manage these changes effectively (Schia, 2018). Within this context, the present study investigates the extent to which digitalization has been embedded into the initial teacher education curricula of Rwanda and the DRC, and evaluates how these efforts aim to strengthen teacher professionalism before deployment into the education system

2. Digitalization Theory Concepts

This chapter explores the theoretical foundations of digitalization by critically analyzing its key conceptualizations and the rationale for its growing importance across all areas of human interaction in the 21st century-commonly referred to as the digital age. The chapter begins by defining and unpacking the theoretical concept of digitalization, highlighting its relevance in contemporary educational discourse. It then examines how digitalization has been integrated into the curricula of initial teacher training colleges in the Democratic Republic of the Congo (DRC) and Rwanda. Finally, the chapter addresses the major challenges associated with the digitalization process, particularly within the context of teacher education in these two countries.

2.1 Understanding Digitalization

Over the past two decades, pedagogical approaches have evolved significantly in response to technological advancements and their integration into educational processes (Hussain et al., 2017). Digitalization extends beyond the mere adoption of new technologies; it involves the transformation of organizational practices, the development of institutional infrastructures, and the emergence of new managerial norms and beliefs (Schildt, 2022). This broader conceptualization reveals the foundational organizational principles of digitalization, which often contradict traditional institutional logics prevalent in contemporary organizational

systems. Within many organizations, including those in the education sector, digital networks are seen as key drivers of connectivity, communication, collaboration, community, and participation (cf. Schildt, 2023; Gere, 2012). Schildt (2023) defines digitalization as "an increasing reliance on software-based automation grounded in data and algorithms over human expertise and work" (p. 236), signaling a profound shift in how institutions function and interact with their stakeholders. Furthermore, the proliferation of the internet has enabled broader access to global markets, pushing institutions to refine their services in order to meet increasingly diverse user needs (Rose et al., 2019). In such an environment marked by service fragmentation and varied user demands organizations are compelled to embrace co-creation models that prioritize innovation and value generation. This dynamic is particularly relevant in the educational contexts of the Democratic Republic of the Congo (DRC) and Rwanda, where digital transformation necessitates new approaches to stakeholder engagement, innovative service delivery models, and alternative relationship structures (Mergel et al., 2019).

Institutional theory provides a useful lens for understanding the complex, large-scale changes driven by digital transformation. These processes disrupt established institutional frameworks through the introduction of new digital products and services commonly referred to as digital innovations that significantly impact existing structures and norms (Schildt, 2023). However, Perez-Estebanez, Urquía-Grande, and Rautiainen (2017) caution that such transformation is unevenly distributed, particularly in the Global South, due to limitations in infrastructure, education, training, and financial resources. In the DRC, the digitalization process remains largely uncoordinated, despite efforts by smaller institutions. By contrast, Rwanda has made more concerted efforts toward digital transformation since the early 2000s, with government-led initiatives aimed at building a digital economy. Nonetheless, these initiatives have not been fully integrated across all sectors, including education. The COVID-19 pandemic in 2020 tested the resilience of education systems globally. Approximately two billion learners experienced interruptions in their education due to school closures (Faturoti, 2022). As Faturoti (2022), and Schia (2018) argue, these abrupt disruptions could have been mitigated if alternative digital teaching and learning systems had been in place prior to the crisis. Importantly, digitalization is not only a technical evolution but also a strategic tool embedded in the socio-economic and political agendas of international organizations and donor countries. As Schia (2018) notes, the promotion of digital technologies and capacity-building initiatives in developing countries is increasingly viewed as a way to foster stability, growth, and favorable inter-state relations.

Given this context, the digitalization of structured curricular content within initial teacher education institutions in the Democratic Republic of the Congo (DRC) and Rwanda is a critical area of investigation. Understanding how digitalization is conceptualized and applied in these two settings is essential for identifying both progress and gaps in teacher training reform. Existing literature from the DRC suggests a significant lack of attention to the digitalization of teacher education programs. Notably, studies by Richard, Anyona, and Piliyesi (2018) and Ngoma (2010) do not reference any formal attempts to integrate digital technologies into the curricula of teacher training colleges. The Congolese government's efforts in this area appear limited, with minimal policy implementation or institutional follow-through. Although some

policy discussions have acknowledged the need for digital integration, concrete actions to embed digitalization into teacher training curricula remain largely absent, resulting in a range of structural and operational challenges. In contrast, Rwanda has made more deliberate efforts toward incorporating digital technologies into education. Through the Rwanda Education Board (REB), the government has integrated Information and Communication Technologies (ICTs) into teaching and learning processes as didactic and pedagogical tools (REB, 2015). While Rwanda initiated this digital push as early as 2000, several persistent obstacles continue to hinder full implementation. These include inadequate infrastructure, financial constraints, and a shortage of trained teachers capable of effectively using ICT tools in the classroom. This study contributes to the ongoing discourse on digitalization in education by analyzing the status and challenges of ICT integration in initial teacher education in both the DRC and Rwanda. It also aims to enrich the limited body of literature currently available on this subject, particularly in the context of sub-Saharan Africa

2.2 ICT and Digital Transformation

Over the past few decades, digital technologies have significantly reshaped global society. The widespread adoption of the internet, mobile devices, social media, and various forms of information and communication technologies (ICTs) has transformed the ways in which individuals communicate, learn, and interact on both local and global scales (Sausen, Muhire, & Musabyeyezu, 2020). Digitization is broadly defined as the process of integrating digital technologies into all aspects of daily life, business operations, and organizational structures (Mergel, Edelmann, & Haug, 2023; Sausen et al., 2020). Brennen and Kreiss (2016), as cited in Gorenšek and Kohont (2019), describe digital transformation as a paradigmatic societal shift driven by the expansive influence of digital media and communication infrastructures across multiple spheres of social life. Additionally, they characterize digitization as the material conversion of analog information streams into digital data formats a foundational process underlying broader digitalization efforts. Digitalization, therefore, can be understood as the integration of digital technologies into the fabric of everyday life, permeating political, social, and economic activities. This growing digital ecosystem encompasses innovations such as the Internet of Things (IoT), cloud computing, blockchain technologies, artificial intelligence (AI), big data analytics, and 5G networks. These technologies collectively form a complex infrastructure of digital systems, often referred to in global governance and policy frameworks, including the OECD's "Internet Library" (OECD, 2023).

Digitization refers to the process of converting analog data and processes into machine-readable digital formats. This transformation is foundational to broader digital transformation processes that impact both economic systems and societal structures (Mergel, Edelmann, & Haug, 2023; OECD, 2023; Sausen, Muhire, & Musabyeyezu, 2020). In contrast, the term *information and communication technology* (ICT) extends the concept of *information technology* (IT) by emphasizing the integration of telecommunications including telephone lines and wireless signals with computers and essential enterprise software systems (Hussain et al., 2017; OECD, 2023). ICT comprises a range of technical devices and resources used for the transmission, storage, and management of information (Hussain et al., 2017). Within the educational context, ICT plays a pivotal role and is generally categorized into two domains:

ICT for education and *ICT in education*. *ICT for education* refers to the development and use of digital tools specifically designed to enhance teaching and learning, whereas *ICT in education* involves the application of general ICT resources within instructional settings (Hussain et al., 2017; Mergel et al., 2019; Schildt, 2022). ICT has significantly shaped educational practice by transforming instructional strategies, facilitating access to information, and supporting research activities (Faturoti, 2022). As students are increasingly exposed to vast and diverse sources of information, cognitive engagement and critical thinking are accelerating at an unprecedented rate. This shift demands that educators develop advanced content mastery and adopt effective pedagogical techniques suited for digital learning environments. To ensure the successful integration of ICT into teaching and learning, several influencing factors must be addressed. These include teachers' attitudes toward technology, their level of ICT competence, opportunities for ongoing professional development, teaching experience, educational attainment, accessibility of resources, and institutional pressure to adopt technology (Hussain et al., 2017; Perez-Estebanez, Urquía-Grande, & Rautiainen, 2017).

2.3 Systemic Orientation of Digitalization

A modern education system increasingly relies on technology to facilitate knowledge acquisition and skill development (Faturoti, 2022). The digitization of education presents a unique opportunity to foster cognitive resource-based learning mechanisms among students, while also enhancing skills development, lifelong learning, and continuous education (Kadir & Adebayo, 2019). In today's rapidly evolving educational landscape, traditional instructional approaches are no longer sufficient to meet the needs of contemporary learners. This generation of students is characterized by heightened curiosity and diverse learning interests that cannot be effectively supported by outdated educational models (Ainslee, 2018; Kadir & Adebayo, 2019). Digitalization in 21st-century education is marked by a blended approach that integrates both in-person classroom instruction and online learning modalities (Platonova et al., 2022). This dual structure requires a dynamic environment for knowledge creation, sharing, dissemination, and presentation. Digital platforms play a central role in this transformation by enabling innovative teaching and learning strategies within a technologically mediated environment (Pettersson, 2020; Platonova et al., 2022). Moreover, the digitization of education contributes to the more efficient use of educational resources. Online platforms help reduce reliance on printed materials, thereby limiting paper consumption and minimizing deforestation. In this way, digitization supports both educational and environmental sustainability (Haleem et al., 2022). As a result, classroom instruction is becoming increasingly participatory, with students engaging a wide array of digital resources to explore and understand complex concepts. Figure 2 below illustrates the integration of internet-based tools and digital classrooms into the modern learning process.

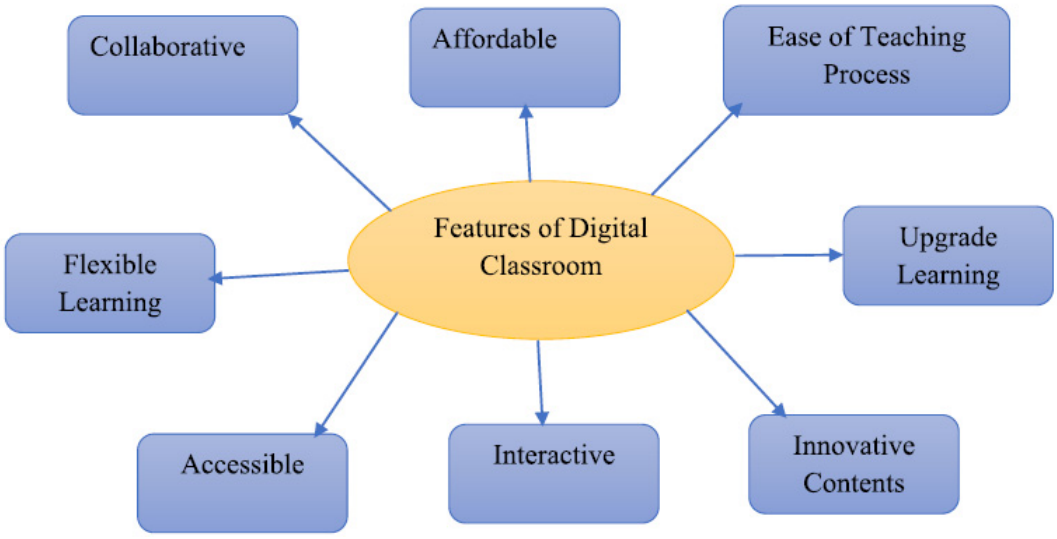

Figure 1. Features of a digital classroom

Source: Haleem et al. (2022).

The digitalization of the classroom has significantly transformed the teaching and learning environment by fostering positive educational outcomes and enhancing learners' cognitive development. As illustrated in the figure above, digitalization promotes a shift toward participatory, learner-centered instruction, encouraging the acquisition of a wide range of lifelong skills and competencies. This pedagogical reorientation aligns with contemporary educational goals that emphasize active engagement, critical thinking, and collaboration in digital learning spaces (Pettersson, 2020; Platonova et al., 2022). Given these benefits, it becomes imperative to address and improve the current state of digital integration in education systems, particularly in Rwanda and the Democratic Republic of the Congo (DRC). Strengthening digital infrastructure, teacher training, and policy implementation in these contexts is essential to fully realize the transformative potential of digital classrooms and to bridge existing gaps in educational quality and access (Faturoti, 2022; UNESCO, 2021).

2.4 Digitalisation and Teacher Training in the Democratic Republic of Congo

Information and communication technology (ICT) is widely recognized as a key driver of transformation in political, economic, and social institutions globally. In the 21st century, no institution including those in the education sector can thrive without the integration of ICT. The cases of Rwanda and the Democratic Republic of the Congo (DRC) exemplify this imperative. In the DRC, ICT was first introduced into the education system in the 1980s, sparking optimism among educators about its potential to revolutionize the sector (Richard, Anyona, & Piliyesi, 2018). However, technological development in education has since remained stagnant, with little tangible progress in integrating ICT into teaching and learning processes (Ngoma, 2010; Richard et al., 2018). The DRC's position on the ICT Development Index in 2017 ranked 171 globally and 33 within Africa further reflects the country's lag in ICT adoption (Richard et

al., 2018). This stagnation is particularly troubling considering that the DRC possesses vast subsoil resources, including minerals essential for the manufacture of ICT hardware. The paradox of resource abundance coexisting with ICT underdevelopment presents a complex and pressing challenge requiring strategic reflection and reform.

One of the root causes of this challenge lies in the legacy of a colonial-era education system that has remained largely unreformed. This outdated model, originally designed not to empower local populations, continues to influence curriculum development in the DRC (Ngoma, 2010). The result is a misaligned and underdeveloped curriculum that fails to meet the contemporary needs of learners and teacher trainees. A significant shortage of qualified teachers with digital competencies and the lack of comprehensive teacher education programs further exacerbate the situation (Ngoma, 2010; Woomer, 2019). Although the DRC recognized the importance of ICT in 2004 through the launch of the "Computers in Education" project, the initiative has remained largely dormant and outdated, failing to reflect current paradigms in digital education (World Bank Group, 2020; Ngoma, 2010). The country's weak performance in digital innovation can be attributed to the absence of enforceable ICT policies, outdated telecommunications legislation, and the lack of a coherent national framework for ICT integration in education (Fall, 2007; World Bank Group, 2020).

Initial teacher education, which is foundational to any education reform, remains neglected in national digital strategies. Although there have been isolated initiatives such as the establishment of the Autorité de Régulation de la Poste et des Télécommunications du Congo (ARPCT) to oversee telecommunications regulation, and a partnership between the Office Congolais des Postes et Télécommunications (OCPT) and Korea Telecom to develop optical fiber infrastructure these actions have not translated into meaningful improvements in digital education (Fall, 2007). Despite this slow pace, the DRC did make an early attempt at developing a national ICT policy for education in 2004. This policy outlined two main areas of focus: expanding internet infrastructure and promoting e-governance across three domains basic education, higher education, and the broader community (Fall, 2007; Ngoma, 2010; World Bank Group, 2020). However, implementation remains limited, fragmented, and insufficient to meet current educational demands.

In September 2019, the Democratic Republic of the Congo (DRC) introduced a new strategic vision for its digital economy through the *Plan National du Numérique (PNN) – Horizon 2025*. The urgency of implementing this vision was amplified by the onset of the COVID-19 pandemic, which exposed critical gaps in digital infrastructure and accelerated the need for digital transformation. Despite this policy shift, the DRC remains one of the most underdeveloped and underinvested broadband markets in Africa. As of 2020, internet penetration stood at approximately 9%, while mobile connectivity reached only 38% (World Bank Group, 2020). Over the years, the DRC government has launched several digitalization projects. However, these efforts have been hampered by the absence of essential foundational structures required to support a coordinated, whole-of-government approach and the development of a robust national e-commerce ecosystem (Ngoma, 2010; Richard, Anyona, & Piliyesi, 2018; World Bank Group, 2020). In an effort to address some of these deficiencies, the University of Kinshasa led by a group of committed faculty members developed a program

aimed at interconnecting Congolese universities via optical fiber. To Fall (2007), this initiative had successfully connected ten universities, marking a small but noteworthy step toward national academic digitalization.

Nevertheless, analysis of existing documentation reveals that initial teacher training institutions in the DRC have largely excluded digital training from their programs. This absence of digital competency development for future educators is concerning and provides compelling evidence that initial teacher education in the country lacks alignment with 21st-century educational demands. Consequently, this study seeks to examine the current state of digital training within teacher education and argues for the urgent implementation of a fast-track digitalization initiative tailored specifically for teacher preparation programs.

2.5 Digitalisation in Rwanda; Curriculum Development at the Crossroads

The Rwandan educational system has been deliberately structured to serve as a foundation for human capital development in support of the country's broader economic and social transformation goals. According to national education policy documents, the government has prioritized the integration of information and communication technologies (ICTs) as both didactic and pedagogical tools, embedding them directly into the school curriculum (Rwanda Education Board [REB], 2015). This commitment is further substantiated by Ntalindwa et al. (2022), who highlight the Ministry of Education's development of a competency-based curriculum centered on seven key competencies: citizenship and national identity, ICT, literacy, numeracy, entrepreneurship and business development, science and technology, and communication (Ministry of Education, 2021). These initiatives underscore the Rwandan government's proactive and visionary approach to educational reform. The integration of ICTs into Rwanda's education system dates back to the year 2000, when digital tools were formally introduced with the intent of using education as a vehicle for technological and economic transformation (Rubagiza, Were, & Sutherland, 2011). At the core of this effort was the provision of computers to schools and the incorporation of ICT components into the national curriculum (Ntalindwa et al., 2022; Rubagiza et al., 2011). This strategy emerged in the aftermath of the 1994 genocide against the Tutsi, during which the Rwandan government adopted a development trajectory focused on national recovery through investment in education and technology.

Despite this early adoption, the integration of ICT into initial teacher training remained limited for many years. It is only in more recent policy efforts that the training of educators has begun to align with the broader national digital agenda. For instance, the 2014 draft ICT policy in education outlines key principles, objectives, and strategies for leveraging innovation and cost-effective technological tools (REB, 2015). This highlights the need to critically examine both in-school and out-of-school ICT policy implementation, especially in relation to equity, access, and the digital competencies of teachers and learners (Rubagiza et al., 2011; World Bank Group, 2020). However, despite these commendable efforts, several barriers have hindered the full realization of Rwanda's ICT goals in education. Among the most significant challenges are limited infrastructure, financial constraints, and the insufficient formal training of teachers in the use of digital technologies (Perez-Estebanez, Urquía-Grande, & Rautiainen,

2017). These limitations must be addressed if ICT is to become a truly transformative force in Rwanda's education system.

Structured efforts to integrate digital technologies into Rwanda's education system gained momentum in 2009 when the Ministry of Education (MINEDUC) launched the One Laptop Per Child (OLPC) initiative in primary schools. This was followed by the implementation of the SMART Rwanda Master Plan 2015-2020, a comprehensive strategy that has since been extended to 2050. In alignment with these national goals, MINEDUC issued the *ICT in Education Master Plan* in 2016 to provide a structured framework for embedding digital tools in teaching and learning (UNESCO, 2019). According to Mugiraneza (2021), the breadth of reforms through policies, strategies, and action frameworks-has placed increasing expectations on teachers to adopt improved pedagogical practices responsive to digital transformation. These reforms are further supported by policy instruments such as the 2016 *ICTs for Education Policy*, which aimed to develop ICT literacy among students and teachers through the provision of digital content, internet connectivity, and learning devices. Within Rwanda's educational landscape, ICT is positioned as a core driver of teaching and learning innovation (Mugisha et al., 2021).

The government's vision to elevate digital competence among teachers is tied to its ambition of transforming Rwanda into a knowledge-based, middle-income country. However, despite this proactive stance, significant challenges persist. Notably, there remains a shortage of teachers trained in the effective use of digital tools, as many are unaware of existing opportunities for their professional development through digital resources (Mugiraneza, 2021; Rubagiza, Were, & Sutherland, 2011). Quality pre-service and in-service training are essential for equipping teachers with pedagogical content knowledge and digital skills to prepare lifelong learners capable of thriving in a knowledge-driven, digital economy (Mugiraneza, 2021). Nevertheless, many teacher training colleges in Rwanda still do not provide adequate digital content for classroom application (Perez-Estebanez, Urquía-Grande, & Rautiainen, 2017; UNESCO, 2019). The trajectory of digital training for teachers in Rwanda highlights two critical dimensions. First, between 2000 and 2016, the government demonstrated a proactive commitment to embedding ICT in education, implicitly preparing educators and learners for a fast-evolving digital world, including unanticipated disruptions such as the COVID-19 pandemic. Second, this trajectory reveals a gap between policy intentions and practice, particularly in ensuring that teachers acquire and sustain the digital skills necessary for long-term educational continuity and resilience.

2.6 Teaching Digital Competences for Teacher Training in a Digital World

The preceding analysis reveals that the integration of competence-based digital skills within teacher training colleges in both the Democratic Republic of the Congo (DRC) and Rwanda presents a complex and multifaceted challenge particularly due to the limited and non-explicit application of such competencies, most notably in the DRC. Digitalization is a multidimensional process that extends beyond the mere adoption or dissemination of technology; it encompasses a systemic transformation in how individuals interact, work, and learn through the mediation of digital tools (Schildt, 2022). As such, digital competences

include a wide range of skills such as digital communication and collaboration, data management and preservation, data analysis and visualization, critical digital design, information and media literacy, digital content creation, and higher-order thinking abilities like problem-solving and critical thinking (Basilotta-Gómez-Pablos, 2022; Bryn Mawr College, 2016). In spite of the recognized importance of these skills in fostering effective and forward-looking teaching practices, there is little evidence of their integration within the curricula of teacher education programs in either country. In the case of Rwanda, although the government has demonstrated commendable policy efforts to promote digital tools in education, the implementation remains limited. According to the World Bank's *Digital Economy for Africa* initiative, Rwanda possesses a robust policy framework aimed at enhancing digital skills; however, the absence of operational plans and practical mechanisms for skill development represents a significant implementation gap (Mugiraneza, 2021; Rubagiza, Were, & Sutherland, 2011).

In the Democratic Republic of the Congo (DRC), the prospects for digitalizing the education system remain limited and underdeveloped, despite the government's stated commitment to modernizing its educational infrastructure (Fall, 2007; World Bank Group, 2020). The integration of digital technologies and information and communication technologies (ICT) within the DRC's educational framework has largely been driven by private actors and a select number of proactive universities rather than through comprehensive government-led initiatives (Dedola et al., 2023; World Bank Group, 2020). This decentralized and fragmented approach underscores the absence of a cohesive national strategy capable of systemically embedding digital competencies into teacher education. Given the complex nature of curriculum digitalization, there is a pressing need to disaggregate the various dimensions of digital competence to ensure teachers are equipped with foundational skills. These include digital communication and collaboration, data management and preservation, data analysis and presentation, media literacy, and digital content creation (World Bank Group, 2020). Developing these competencies necessitates a thorough reevaluation of teacher training frameworks in both the DRC and Rwanda to integrate relevant content and pedagogical strategies into the teaching-learning process while promoting long-term sustainability. At present, however, such structured and intentional processes remain largely absent from existing educational practices and policy implementation in the DRC

2.7 Digitality: Interconnection and Cultural Amalgamation

The concept of digitality, or *digitalism*, refers to the condition of living within a digital age or culture, characterized by the pervasive influence of digital networks that foster collaboration, connectivity, and participation (Gere, 2012). Digitality serves as a theoretical framework for examining the societal and ontological transformations precipitated by the digital paradigm. Philosopher of information technology Luciano Floridi conceptualizes this shift as an "analogue-digital ontology," which explores the fundamental distinction between analogue and digital mediation and interrogates which better captures the nature of human experience (Hassan, 2020). In this view, the scale and automation of digital networks increasingly diminish the autonomy and agency of the individual as an analogue actor. Rather than being tools acted upon, these systems increasingly act upon users, reflecting an inversion of

human-technology agency (Bowen & Giannini, 2021; Cramer, 2014; Hassan, 2020). Contrary to assumptions that digital technologies inherently enhance connection, relationality, or community, digital culture often reveals the inherent discontinuities in human interaction. These technologies underscore the gaps in communication those imperceptible differences that separate individuals in time and space rendering the notion of touch and immediate contact inconceivable in many digital encounters (Özkula, 2021). Bowen and Giannini (2021) argue that digital technologies participate in what they describe as the "queer narrative of the Death of God," a metaphor for the collapse of an overarching metaphysical or communal framework that once bound human relations.

Furthermore, the cultural fabric of modern urban life has undergone significant disruption as a result of these technologies. Rather than cultivating new forms of authentic community, digital tools often produce what Mishra, Henriksen, and Mehta (2015) term *non-relations* and *non-communities*, marked by fragmentation rather than cohesion. From an ecological and existential standpoint, the ubiquitous interactivity of digital technologies profoundly disrupts both human environments and our relationship with the natural world, offering no organic equivalence to human or ecological systems (Hassan, 2020). In sum, digitality exposes a critical ontological divide: humans are analogue beings, embedded in a reality shaped by direct, embodied communication. The rise of digital media constructs an alienating domain, one that is incommensurable with the analogue nature of human experience and communication, highlighting the disjunctions that emerge when analogue beings engage in a digital ecosystem.

2.8 Problem and Research Question

The contrasting educational contexts of the Democratic Republic of the Congo (DRC) and Rwanda reflect a complex and disorienting disparity in the integration of digitalization within initial teacher training programs. In the DRC, the lack of a restructured educational curriculum has resulted in the near absence of formal initial teacher training that meets the needs of both teachers and learners. Efforts by the Congolese government to implement initiatives such as the "Computers in Education" project have largely failed due to insufficient follow-up and implementation mechanisms (Fall, 2007; World Bank Group, 2020). Although policy frameworks have been drafted to support ICT and digital innovation alongside the creation of regulatory bodies like the Autorité de Régulation de la Poste et des Télécommunications du Congo (ARPCT) and international partnerships tangible progress remains limited (Ngoma, 2010; World Bank Group, 2020). The expansion of digital infrastructure and the conceptualization of "digital blocs" do not align with the pressing need for digital inclusion within the teacher education curriculum. As a result, digital training for prospective teachers is practically non-existent, rendering the transfer of essential 21st-century digital competencies to learners fundamentally absent an alarming reality in an increasingly digitalized global ladscape (Dedola et al., 2023).

Conversely, Rwanda has demonstrated a comparatively more strategic and sustained approach. Despite structural instability, the Rwandan government has shown consistency and intentionality in advancing ICT integration into education. Scientific literature confirms Rwanda's proactive policy trajectory, including curricular reforms and digital infrastructure

investment aimed at equipping the education sector for a digital future (Mugiraneza, 2021; Rubagiza, Were, & Sutherland, 2011; UNESCO, 2019). Nevertheless, significant gaps remain in fully operationalizing digital content within teacher training programs. Despite the evidence-based advantages of digitalization, education authorities in both the DRC and Rwanda must intensify their efforts to transform teacher training curricula into digitally enriched, forward-looking frameworks. In light of these observations, the current study is guided by the following research questions:

(1) How is digitalization organized in the curriculum of initial teacher training in the DRC and Rwanda?

(2) What are the competences needed in the digital age to enhance education for life?

(3) What are the challenges encountered in the implementation of this process of digitalization?

3. Methodology

In order to find answers to the above research questions and achieve the planned objectives, it is important to determine the method and techniques used. In concrete terms, in this part of the work, we present the various methodological aspects supporting the writing of this article, namely the research approach and method, the data collection technique, and the data documentary analysis.

3.1 Research Design

This study adopted a desk-based documentary research design to examine how digitalization is embedded in the curricula of initial teacher training institutions in Rwanda and the Democratic Republic of the Congo (DRC). Documentary research enables the systematic analysis of written materials that contain insights into social phenomena, including policy, education, and institutional reform (Ahmed, 2010). This design was particularly suitable for investigating the integration of digital competencies in teacher education, as it allowed the researcher to access a range of policy and academic sources without requiring direct fieldwork. The core aim of the study was to describe and analyze the extent to which digitalization is reflected in the educational content and policies governing teacher preparation in both countries. The method allowed for a retrospective and interpretive approach to existing documentation in the public and private domains.

3.2 Data Collection

The data for this study were collected from a curated selection of written documents relevant to initial teacher education and digital transformation. Sources included: national curriculum, frame works for teacher education, government policy documents on ICT and education, peer-reviewed academic journal articles, reports from international organizations such as UNESCO and the World Bank, scholarly books and edited volumes on digital pedagogy and curriculum reform. Documents were selected based on their originality (ensuring authoritative, primary-source status) and relevance (focused on digitalization and teacher education in Rwanda and the DRC). Electronic databases, official ministry websites, and academic

repositories were searched using keywords such as “digitalization,” “ICT in education,” “teacher training,” and “curriculum reform.” The process involved evaluating electronic and physical documents to interpret them, gain an understanding of their meaning and develop upon the information they provided (Sarkaneh 2015) present study. Above all, Fortin and Gagnon (2016), indicated that the documentary technique in its application follows 5 stages, namely: preparing research, select information sources, search and locate documents, evaluate the quality and relevance of sources, setting up a document watch which were rigorously followed.

3.3 Data Analysis

The study employed qualitative content analysis to analyze the collected documents. This method involved the systematic classification and coding of textual data to identify patterns, themes, and meanings related to the integration of digital competencies in teacher training (Sarkaneh, 2015). Both deductive and inductive coding approaches were used. Deductive codes were drawn from the research questions and predefined themes, including “digital skills,” “policy implementation,” and “curriculum innovation.” Inductive codes emerged from the documents themselves, capturing unforeseen insights and contextual nuances unique to each country. The documentary technique assembled the data and we immerse ourselves in the content of written sources relating to our themes (cf. Ahmed, 2010; Godaert et al., 2022) to identify what was needed to handle the indicators of questions of the study. A comparative analysis was subsequently conducted to draw distinctions between the two national contexts, focusing on curriculum structure, policy intent, implementation barriers, and institutional readiness.

3.4 Ethical Considerations

Although the study did not involve human participants, ethical research principles were maintained throughout. All sources were properly cited to acknowledge intellectual property and prevent plagiarism. Official documents and reports used in this study were accessed from publicly available and reputable databases, ensuring transparency and academic integrity. Moreover, care was taken to interpret data objectively, without bias or misrepresentation. The use of government and institutional documents was handled responsibly, with attention to their publication dates and contexts to avoid drawing conclusions from outdated or obsolete materials.

3.5 Limitations

Several limitations should be noted in relation to the chosen methodology. As a documentary analysis, the study did not incorporate direct interviews or surveys with curriculum developers, teacher educators, or policymakers. As a result, it may lack insight into current practices and lived experiences. In some cases, the most recent documents from government agencies were unavailable, which may have restricted access to real-time updates or reforms currently underway, particularly in the DRC. Some official documents, particularly those from the DRC, are primarily available in French. While every effort was made to interpret them accurately, subtle nuances may have been lost in translation. The disparity in institutional transparency

between Rwanda and the DRC may have affected the depth and balance of the analysis, with Rwanda offering more structured documentation on digital education policies than the DRC. Despite these limitations, the study provides a valuable comparative overview of the state of digitalization in teacher training curricula and lays the groundwork for future empirical research.

4. Findings/Results

The core focus of this study was to examine how digitalization is structured and implemented within the curriculum of initial teacher training in the Democratic Republic of the Congo (DRC) and Rwanda. Utilizing a qualitative documentary research approach, this chapter presents the findings based on a systematic content thematic analysis of the selected documents. This method enabled the researcher to identify key themes, categories, and subcategories relevant to digital integration in teacher education (Ahmed, 2010; Sarkaneh, 2015). The analysis is organized into two major sections: the first explores the digitalization efforts within the initial teacher training curriculum of the DRC, while the second focuses on Rwanda's corresponding framework. These two focal areas constitute the foundational units of analysis for the study. In addition to these primary categories, several cross-cutting themes emerged from the data, providing deeper insights into institutional readiness, policy implementation, digital competency development, and infrastructural challenges. The categorization and subcategorization of themes were guided by recurring patterns and policy objectives found in the reviewed documents. These are systematically presented in Table 1, which outlines the major thematic domains and their associated sub-themes for both the DRC and Rwanda. This structure facilitates a comparative analysis and highlights both the shared and divergent pathways taken by the two countries in embedding digitalization into initial teacher training.

Table 1. Categories and Sub-Categories Developed from Documents

Categories	Sub-Categories
Infrastructure	Resources, formal education, training, curriculum
Policy enforcement (DRC)	Weak government legislation, lack of a national position on digitalisation
Inclusion in the curriculum (Rwanda)	ICTs and digitalisation, didactic and pedagogical tools, push from the government
Human right	Equality, equity, gender mainstreaming
Digitalisation in the 21st century	Transformation, empowerment, development
Digitality	Intercultural linkages, global values, peace and understanding

Source: Authors creation.

Table 1 presents an in-depth thematic analysis and classification of key categories and sub-categories derived from the documentary data. These themes emerged through a systematic review of national policy documents, curriculum frameworks, and relevant scholarly literature related to the digitalization of initial teacher training curricula in both the

Democratic Republic of the Congo (DRC) and Rwanda. To enhance the interpretive clarity of these categories and sub-categories, the subsequent section provides a conceptual breakdown or decoding of the principal themes identified. This interpretive effort aims to articulate how each category reflects the current state of digital curriculum development in teacher education within the two case study countries. The decoding process draws upon the meanings embedded within the selected documents, providing contextualized insights into the extent of digital integration, challenges encountered, and institutional responses in each national context. By delineating these thematic elements, the study seeks to offer a nuanced understanding of how digitalization is framed, operationalized, and perceived within the curricula of initial teacher training institutions in the DRC and Rwanda.

4.1 Initial Teacher Training in the DRC and the Digitalisation of the Curriculum

The state of initial teacher training in the Democratic Republic of the Congo (DRC), particularly concerning digitalization, remains concerning. As illustrated in the preceding analysis, significant gaps persist in both infrastructure and the enforcement of education policy by relevant stakeholders.

4.1.1 Infrastructure

In both the DRC and Rwanda, infrastructure development has been critical yet difficult to achieve in the journey toward digitalizing education. Schildt (2022) emphasizes that digital transformation necessitates not only new technologies but also new organizational practices, institutional infrastructures, and managerial norms, as these changes affect the way institutions function and deliver services. To effectively implement digitalization in teacher training, it is essential to ensure access to both material and financial resources, train teachers using a well-developed curriculum that integrates digital content, and support long-term capacity building. In the DRC, although an educational action plan extending through 2025 has been outlined, digitalization has not been prioritized. There is a noticeable lack of urgency and investment in infrastructure necessary for implementing digital tools in teacher training programs. In contrast, Rwanda has made measurable progress by incorporating digitalization into its curriculum and aligning infrastructure development with its broader education strategy (Rwanda Education Board [REB], 2015).

4.1.2 Policy Enforcement

The enforcement of national policies and government directives concerning digitalization is inconsistent, particularly in the DRC. While there has been some policy formulation, implementation has remained weak. For instance, the DRC launched the “Computers in Education” project in 2004 to promote ICT in schools. However, this initiative failed to materialize due to the lack of follow-through, weak telecommunications legislation, and the absence of a clearly defined national digital education policy (Ngoma, 2010; World Bank Group, 2020). In comparison, Rwanda demonstrates a more proactive and structured approach. ICT and digitalization have been explicitly included in the teacher training curriculum, and policies supporting their integration have been implemented progressively (REB, 2015). This

difference highlights the need for stronger policy enforcement mechanisms in the DRC and continued support for Rwanda's growing digital education system.

4.2 The Curriculum of Initial Teacher Training in Digitalisation in Rwanda

The situation of initial teacher training on digitalisation guided by the programmes in the curriculum are more focused even if not holistically implemented as required. We will look at it with the aid of the following categories; inclusion, and human rights, with the government doing all to have it implemented through a trained personnel.

4.2.1 Inclusion in the Curriculum

According to several key policy documents and reports, the government of Rwanda has implemented legislation and introduced a competence-based curriculum that includes Information and Communication Technologies (ICTs) among its core competencies, alongside citizenship and national identity, literacy, numeracy, entrepreneurship, and business development (Ntalindwa et al., 2022; Rwanda Education Board [REB], 2015; World Bank, 2020). The integration of ICTs as both a didactic and pedagogical tool in the teaching and learning process was designed to rely on well-trained educators, especially those prepared through initial teacher training programs. This policy direction has been part of Rwanda's long-term educational vision, which began as early as 2000. At that time, the government sought to introduce ICTs and other digital tools through the education sector as a means to support national human development (Rubagiza, Were, & Sutherland, 2011). These efforts were supported by formal policy frameworks and the inclusion of ICTs directly within the curriculum. Implicit in these initiatives is the understanding that training teachers is critical to ensuring effective ICT integration. Despite some gaps in implementation, the government's commitment to digital education reform is clear and proactive (Mugiraneza, 2021). This stands in contrast to the situation in the Democratic Republic of the Congo (DRC), where ICT-related policy development exists but lacks comprehensive implementation or clear integration into teacher training programs.

4.2.2 Human Rights

In the envisioned initial training of teachers for digitalization, gender mainstreaming is an essential yet often implicit component. Human capital development in education should not differentiate between male, female, or gender-diverse individuals. Equipping all trainee teachers with foundational digital skills ensures that no one is excluded from the opportunities of the digital era (Dedola et al., 2023). Inclusive teacher training helps prepare educators to pass on these critical skills to learners without discrimination, supporting equitable access to education for all. Education is a fundamental human right, and digital competence is now a necessary part of that right. Without access to these skills through school and teacher training, women and girls, in particular, may become more vulnerable to online harms. These risks include cyberbullying, hate speech, non-consensual sharing of private images, virtual sexual abuse, and child exploitation (EU-Brazil Dialogues, 2019). In this context, failing to integrate gender-sensitive digital training into teacher preparation programs may unintentionally perpetuate inequality and increase the risks of digital violence. Moreover, without proper

digital education, many learners especially girls may be ill-equipped to navigate or protect themselves in online environments. As the World Bank Group (2020) notes, the increasing complexity of digital platforms requires users to be well-prepared to manage both the benefits and the risks of digital engagement. Thus, gender-inclusive digital training is not only a matter of equity but also of protection and empowerment.

4.3 Digitalization in the 21st Century

Digitalization in the 21st century represents a fundamental shift from the analog era to the digital age. It is not limited to the adoption of new technologies but also involves new organizational practices, the development of institutional infrastructure, and the transformation of management norms and systems (Faturoti, 2022). According to an evaluation by the World Bank's *Digital Economy for Africa Initiative*, Rwanda has demonstrated a strong policy orientation toward digitalization; however, challenges remain at the level of practical implementation (Mugiraneza, 2021; Rubagiza, Were, & Sutherland, 2011).In contrast, the Democratic Republic of the Congo (DRC) shows significantly less progress in implementing digital technologies in its educational sector (Fall, 2007; World Bank Group, 2020). Based on a review of official documents from both countries, there is a clear intention to adopt digitalization, but the extent and effectiveness of these efforts differ considerably between Rwanda and the DRC. In the context of today's global economy, digitalization is essential for the empowerment of human capital. It plays a critical role in shifting national systems from analog to digital and is vital for achieving long-term, sustainable development.

4.4 Digitality

Digitality has become a key rationale for interaction and connection in the digital age and the global environment. Human beings have demonstrated a high level of adaptability to digital technologies, engaging in multiple forms of interaction through devices such as smartphones and tablets. These tools provide access to a broad range of digital content, enabling levels of creativity that were not previously possible (Bowen & Giannini, 2021). As traditional public spaces are increasingly abandoned, new social movements and interactions are now primarily visible on digital screens. This shift has resulted in a significant loss of physical social interaction, replaced by a form of digital social distancing. Furtherance to this, the rise of constant digital interactivity has deeply affected our fragile environment and altered how individuals relate to one another (Mishra, Henriksen, & Mehta, 2015). Digitality today promotes collaboration, connectivity, and the appreciation of intercultural exchange in a globalized digital world (Hassan, 2020). Given this context, both Rwanda and the Democratic Republic of the Congo (DRC) are under growing pressure to adopt digital systems and infrastructures in order to remain connected and relevant in the global space.

5. Discussion

This study aimed to examine how digitalization is integrated into the Initial Teacher Education (ITE) curricula in the Democratic Republic of the Congo (DRC) and Rwanda. The primary objective was to explore how digital education is structured within the teacher training

curricula of both countries. To achieve this, the researchers adopted a documentary research methodology, focusing on reviewing and analyzing key texts to better understand the digital challenges confronting the education sectors in these contexts (Ahmed, 2010; Sarkaneh, 2015). The study relied on qualitative text analysis to identify relevant themes and patterns. Data collection involved sourcing various types of documents, including peer-reviewed journal articles, academic books, national policy documents, and legal frameworks related to education and digitalization. Through a careful and systematic reading of these documents, the researchers conducted content-based thematic analysis, using deductive and iterative techniques to generate relevant insights. Based on this approach, several key themes were identified. These themes offered a foundation for reflecting on the state of digitalization in initial teacher training in Rwanda and the DRC and are presented in the subsequent sections of this paper.

5.1 Digital Education is a Necessity at all Levels of the Education System

The documentary analysis of initial teacher training programs in the Democratic Republic of the Congo (DRC) and Rwanda highlights significant differences between the two countries. The literature indicates that the Rwandan government and policy makers have taken proactive steps toward integrating digitalization into the national curriculum for teacher training (Ntalindwa et al., 2022; REB, 2015). Despite this effort, implementation remains a major challenge due to limited infrastructure and a shortage of formally trained teachers in information and communication technologies (ICTs) (Perez-Estebanez, Urquía-Grande, & Rautiainen, 2017). While the political will for digital transformation is evident in Rwanda (Dedola et al., 2023; Mugiraneza, 2021; UNESCO, 2019; World Bank Group, 2020), the provision of digital content for classroom use remains insufficient. Nevertheless, public authorities appear aware of the gaps and are actively working to address them (Mugisha et al., 2021). These efforts are particularly important in a rapidly digitalizing world, where the COVID-19 pandemic underscored the critical role of technology in sustaining teaching and learning processes.

In contrast, the situation in the DRC is both challenging and precarious. Despite early ambitions, the country has not yet successfully incorporated digitalization into its national teacher training curriculum (Ngoma, 2010; Richard, Anyona, & Piliyesi, 2018). Although the DRC developed an educational action plan extending to 2025, the plan lacks any reference to digital education (World Bank Group, 2020). Moreover, the country remains one of the most underdeveloped and underinvested in terms of broadband infrastructure, with internet and mobile penetration rates at only 9% and 38%, respectively (World Bank Group, 2020). The lack of digital content and training for initial teacher education in the DRC has serious implications for the education system's ability to adapt to global technological demands. This omission makes it difficult for teachers to prepare students for participation in a digital world. In both countries though more urgently in the DRC there is a need for structured policies, sufficient resources, and institutional coordination to ensure that digital competencies are developed across all levels of the education system. Teachers at the nursery, primary, secondary, and tertiary levels, as well as professionals in various sectors, must be equipped with relevant digital skills to meet contemporary global demands.

5.2 Digital Education: A Pre-Requisite for Initial Teacher Training

Teachers are central to the success of any educational reform, and it is therefore essential that they begin their professional training with a clear understanding of digitalization. According to the World Bank Group (2020), Rwanda has established a strong policy framework for digital education. However, the lack of a practical operational plan for implementation presents a significant gap (Mugiraneza, 2021). In contrast, the Democratic Republic of the Congo (DRC) continues to face major challenges, as it lacks both the structural and infrastructural foundations necessary for effective digital integration in education (Dedola et al., 2023). Although the DRC government has shown a willingness to support digital transformation, this process is hindered by a lack of collaboration among stakeholders and implementation partners (Rubagiza, Were, & Sutherland, 2011). As digital education becomes increasingly vital, particularly in national curricula, a consistent and sustained effort is required to move these systems forward. This momentum must be guided by three primary factors: (1) the transition from an analog to a digital-based economy, (2) the urgent need to equip teachers with relevant digital skills for modern teaching environments, and (3) the preparation for global emergencies such as the COVID-19 pandemic. In today's world, digital skills are multidimensional and indispensable. Without them, societies risk falling behind. As Hassan (2020) warns, the rise of artificial intelligence and automation could render many traditional jobs obsolete, underscoring the need for comprehensive digital training. Teachers who lack digital competencies and, by extension, their students are at risk of being excluded from participation in the digital economy.

This study has shown that many teachers have been trained under outdated curricula that do not account for current technological realities. To address this, continuing professional development programs must be restructured to prioritize digital literacy and practical integration strategies. The design of a digital curriculum should take into consideration the available infrastructure and resources (Schildt, 2022), and must include effective didactic and pedagogical approaches to ensure its long-term sustainability (Ntalindwa et al., 2022; REB, 2015). Moreover, it is critical that human rights are upheld throughout this process. Equal treatment for all teachers, regardless of gender, must be guaranteed, and gender-sensitive practices should be mainstreamed to dismantle discriminatory norms, such as the assumption that digital or technical jobs are reserved for men (Dedola et al., 2023). As the 21st century continues to move rapidly toward digital transformation, the empowerment of human capital through inclusive digital education becomes essential. This transformation must include a shift in collective mind set towards digitality, fostering global connections, intercultural dialogue, and peaceful coexistence (Faturoti, 2022; Mugiraneza, 2021).

6. Conclusion

The study, ‘Digitalization of an Initial Teacher Education Curriculum in the DRC and Rwanda’ shows some complex challenges with the training of teachers from the two countries. It is evident that the world is slowly transforming itself into a digital network and framework. In view of the fast evolving changes, the enhancement of this process of digitalization has to be precipitated by the government of the two countries. In Rwanda, the process of digitalization is far advanced in relation to the policy insertion into the curriculum.

In the DRC, the situation is clearly limping and poorly coordinated. It is not adapted to the curriculum and as such, all teachers trained, leave such institutions with their analogue mindsets. Hence in the two contexts, one of them needs the institutions and resources while the other one is working to make it a full policy process and include it in their curriculum. This notwithstanding, there are not two options available, in regards to the speedy evolution of the digital age, otherwise, referred to as digitality. Digitality is living life in the digital age or cultural shock absorption, and dynamic networks that bring about connections, collaboration and joint participation (Gere, 2021). This would lead to the acquisition of global values through interconnections of people culturally, thereby enhancing 'abstract sociality' (Scheunpflug 2020).

7. Recommendations

In view of the foregoing situation in the two countries, the following recommendations are proposed in the framework of practice and research. This can be seen below in the following suggestions:

7.1 Suggestions for Practice

(a) Government

- ✓ The Congolese government authorities should design robust policy statements regarding the insertion of digitalisation in the curriculum with the requisite infrastructure and resources for its effective implementation.
- ✓ In the case of Rwanda, the government should put in place the necessary resources, equipment and infrastructure for a successful implementation of the program. The policies in Rwanda are apparently gaining momentum and covering new grounds.

(b) Teachers

- ✓ The training of teachers should be taken seriously in the education system of the two countries and the acquired skills and competences should be used to facilitate the teaching-learning process in the digital age.

7.2 Suggestion for Research

(c) Researchers

- ✓ A quantitative and qualitative study should be undertaken to gauge their perceptions and to measure the level of the digital skills and competences that they have already mastered.

8. Limitations

This study did not collect primary data to support some key assertions but depended only on secondary sources like journals, policy documents and documents from international organizations. It is imperative for researchers to investigate using qualitative and quantitative methods to get more insights from those to benefit from such processes

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Acknowledgments

We are deeply grateful to the coordinating teams from the three cohorts participating in this project in Rwanda and the Democratic Republic of Congo for their valuable contributions and commitment throughout the research process. We also extend our sincere appreciation to Brot für die Welt for their unwavering support and dedicated provision of the resources that made this work possible.

Authors Contributions

Dr. Tangwe, was responsible for the study design, data acquisition, data analysis, interpreting, drafting manuscript, critical revision of manuscript, Dr. Niyibizi, took charge of the conceptualization, critical revision of manuscript, and Prof. Kamundu, was responsible for data acquisition, data analysis and drafting the manuscript. All authors read and approved the final manuscript.

Funding

This article was written in the framework of the implementation of the project "Resilience of Educational Institutions Digitalization—A Reaction to COVID-19 (ReDiCo)" A-AFM-2021-0380 in Great Lakes Region funded by Bröt für die Welt, Germany. The funding was very helpful for the payment of facilitation during the writing retreat as well as publication fees of the article.

Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed Consent

Obtained.

Ethics Approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and Peer Review

Not commissioned; externally double-blind peer reviewed.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data Sharing Statement

No additional data are available.

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