

RESEARCH ARTICLE:

Education 4.0 (ED4.0): A Global Higher Educational Paradigm for BRICS Countries

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Abstract

The importance of digitalisation in teaching and learning, which is addressed in Education 4.0 systems, is a relatively recent concept. Education 4.0 involves integrating advanced digital technologies, such as artificial intelligence, big data, the Internet of Things, and automation, into the teaching and learning process. The need to transform the perception of educational resources arose from the transformation of productive resources, which is exemplified by Industry 4.0. Digitalisation in education has been rapidly advancing in recent years, regardless of a country's level of development, and has transformed how education is accessed and delivered. The COVID-19 pandemic has had a significant impact on higher education institutions worldwide, accelerating the use of digital tools in education. The BRICS countries face the immense challenge of maintaining their growing influence in the global order renewal, which requires bridging the educational technological gap with best practices from developed countries in line with Society 4.0. This article highlights the undeniable need for Education 4.0 in BRICS countries and the importance of striking a delicate balance between embracing technological advancement and preserving national cultural identities to promote sustainable development.

Keywords: digitalisation; education 4.0; higher education; BRICS countries

Introduction

Education 4.0 (ED4.0) denotes the transformative influence of the Fourth Industrial Revolution (4IR) and the Fifth Industrial Revolution (5IR) on the educational landscape, integrating emergent technologies, including artificial intelligence (AI), robotics, the Internet of Things (IoT), and other advancements, into educational frameworks. The implementation and development of ED4.0 vary across different countries and institutions. In higher education institutions (HEIs) in emerging economies, ED4.0 is characterised by several distinct trends. The paradigm places great importance on the seamless integration of technology into the learning process, encompassing diverse modalities such as online learning platforms, virtual classrooms, and digital resources to augment pedagogical efficacy. Adaptive learning systems and AI play crucial roles in tailoring educational content to the unique needs of individual students, fostering a personalised approach that accommodates diverse learning styles and paces. HEIs are increasingly focused on equipping students with skills suited to the dynamic demands of the contemporary job market, integrating curriculum elements that stress critical thinking, problem-solving, creativity, and digital literacy. As a global higher education paradigm, ED4.0 advocates for international collaboration and connectivity, with emerging nations leveraging online platforms to facilitate cross-cultural collaboration and the exchange of knowledge among students and faculty members.

The traditional educational model is adapting to accommodate flexible learning arrangements, including blended learning approaches and distance education options. The integration of data analytics within educational institutions has become an instrumental facet, guiding informed decision-making concerning curriculum design, student performance, and institutional efficacy, enhancing the overall efficiency and effectiveness of educational processes. ED4.0 also places a strong emphasis on cultivating an entrepreneurial mindset and fostering innovation

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among students, achieved through project-based learning, internships, and exposure to real-world problem-solving scenarios. The realisation of ED4.0 depends on contextual variables, resource availability, and institutional priorities, with ongoing developments in technology and education likely to refine or introduce new trends. Despite their different stages of development and cultural particularities, BRICS countries (Brazil, Russia, India, China, and South Africa) have no choice but to embrace ED4.0 within HEIs to remain competitive on the global stage. The successful implementation of ED4.0 in these nations depends on several critical factors, including infrastructure development, investment in education, policy frameworks, and the ability to adapt global educational trends to local contexts. Furthermore, ongoing monitoring and evaluation will be necessary to ensure the effectiveness and relevance of ED4.0 initiatives in the specific socio-economic and cultural contexts of each BRICS nation. While the literature clearly outlines the benefits of the ED4.0 process, its implementation is highly complex, with diverse interpretations and possibilities for each BRICS country.

The aim of this research is to explore the implementation of ED4.0 in BRICS countries and to identify the challenges and opportunities associated with this paradigm shift in higher education. The study focuses on three key objectives: (1) analysing the current state of ED4.0 implementation in BRICS countries, (2) identifying best practices and barriers encountered during this process, and (3) providing recommendations for the successful integration of ED4.0 in these emerging economies. To achieve these objectives, this paper includes a selective literature review, highlighting and discussing digitalisation initiatives and ED4.0 in BRICS countries. The article begins with an overview of ED4.0 and digital transformation in the higher education sector. It then highlights the best practices of BRICS countries' initiatives towards ED4.0. The final section synthesises the discussions of the research, offering recommendations that provide valuable perspectives for shaping the future of education in BRICS countries in the digital age.

Implementation of ED4.0 in BRICS Countries

This study conducted a systematic literature review to explore the implementation of ED4.0 in BRICS countries. The review focused on peer-reviewed papers and reports published between 2017 and 2023, with an emphasis on identifying key trends, challenges, and best practices in ED4.0 adoption. The term "Education 4.0" began to gain prominence in educational and technological circles in the late 2010s. Given the exploratory nature of this paper, a Scopus-based search for "Education 4.0" from 2017 to 2023 yielded 596 documents, primarily consisting of articles and conference papers. Among these, 94 documents have been cited 10 or more times. These documents have 415 authors from 82 countries and feature a total of 160 keywords representing various subjects. The 10 most cited keywords include: 'Education 4.0', 'Industry 4.0', 'Student', 'Engineering education', 'Higher education', 'E-Learning', 'Educational Innovation', 'Learning systems', and 'Teaching'. The BRICS countries account for 16% of all participating countries, while the G7 countries account for 11%. The search indicates that researchers from the Global South have greater participation in such documents than those from Global North countries (Dao *et al.*, 2023; Tikhonova and Raitskaya, 2023). The sampled documents show publication rankings for Malaysia (10%), Mexico (10%), Indonesia (8%), and India (8%). Since 2017, there has been a rapid increase in publications on the subject of ED4.0 (Figure 1), indicating growing interest in this subject. However, this does not necessarily imply more ED4.0 initiatives are present in Global South countries compared to those in the Global North.

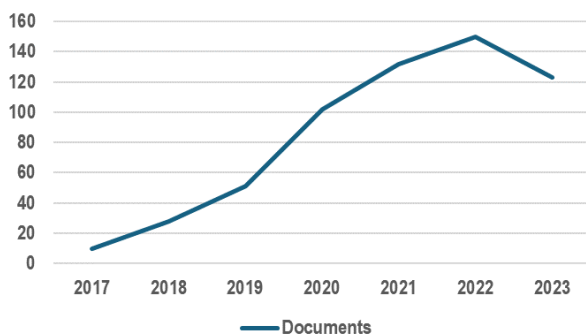


Figure 1: Documents per year (2023 not the full year)

Benešová and Tupa (2017) explored Industry 4.0 (ID4.0), advocating for a gradual transition for companies toward advanced production through new technologies. They emphasised the growing demand for skilled workers in computing and data analysis, which necessitates adjustments in higher education. The study also highlighted the replacement of physically demanding roles with automated processes. Wahlmüller-Schiller (2017) identified ED4.0 as the pathway to the future of education. Almeida and Simoes (2019) further examined ED4.0 as a paradigm for the 4IR by conducting a study on the impact of technologies such as serious games and ID4.0 on higher education, analysing 25 case studies at Portuguese institutions. The results indicated limited adoption of these technologies, with noted benefits such as increased student engagement, skill development, and real-world application. However, challenges included the simplification of reality, integrating technology into the curriculum, and achieving greater interactivity without relying on external stimuli. These findings are comparable to those observed in developing nations.

Since the early 2020s, ED4.0 has become a more established concept in the literature, with a growing awareness of the potential for advanced technologies to transform teaching and learning. Researchers, educators, and policymakers worldwide are increasingly discussing the implications of digital transformation in education and its potential to reshape teaching and learning methodologies. These discussions are rooted in the widely recognised causal relationship between education and economic development. While education can drive development, development, in turn, can facilitate better educational outcomes (Chang *et al.*, 2018; Bhattacharyya 2019; Li *et al.*, 2023). This reciprocal relationship underscores the importance of investing in education as a critical component of sustainable development strategies. The literature also reveals that in 2020, the COVID-19 pandemic disrupted the operations of HEIs worldwide, accelerating digital transformation in the changing scenario of the early 21st century. Teaching institutions were compelled to rethink their management models and adapt to the new reality. HEIs have faced unique challenges, particularly those in the private sector, where reliance on tuition revenue and the need to maintain high levels of student satisfaction have intensified these challenges (Do Lago *et al.*, 2023). In this context, sustainable management strategies are essential for HEIs to maintain the quality of their programmes and ensure their long-term viability.

Bucea-Manea-Țoniș *et al.* (2023) argue that the hybrid model is a promising option because it aligns well with the ongoing changes in education. To successfully implement this model, HEI management must be guided by sustainable values, ensuring synchronicity between courses and the use of innovative methodologies. Benavides *et al.* (2020) explored the emerging field of applying digital transformation approaches to HEIs. Using the Kitchenham protocol, they analysed 19 relevant papers from 1980 to 2019. Their findings revealed that while digital transformation in HEIs is an emerging field, current proposals lack a holistic dimension. The study calls for further research to gain a better understanding of the complex relationships involved in digital transformation within the education domain, particularly as the 4IR unfolds. Acurio Hidalgo *et al.* (2021) state that HEIs are fundamental elements in the development of society and have been significantly threatened by the COVID-19 pandemic. This has impacted the advancement of education and, consequently, led to closures accompanied by economic recession. Borishade *et al.* (2021) argue that remote teaching is just one approach to the digital transformation process that HEIs are undergoing. In this sense, managing HEIs based on customer experience, through a clean and healthy environment where students feel safe and welcomed, has been found to increase student satisfaction. Chiappe and Monique (2021) identified Massive Open Online Courses (MOOCs) as a transformative force in education with significant potential for democratisation and educational transformation. They conducted a systematic review covering studies from 2009 to 2019, employing a 6-step method to analyse 486 studies. Their review highlighted key areas of focus in MOOC research, including Open Educational Practices, MOOC design, engagement generation, dropout rates, and connectivism. Their comprehensive analysis reflects educators' and researchers' concerns about the evolving educational landscape, particularly within the context of Society 4.0.

Furthermore, Costan *et al.* (2021) investigated the barriers to implementing ED4.0 in HEIs by conducting a systematic literature review. They identified 12 barriers across seven themes: human resources, infrastructure, financial constraints, linkages, educational management, learner-related challenges, and health and environment. The study constructed a theoretical predictive model, offering insights for stakeholders to address challenges associated with implementing ED4.0 in developing economies. Sanjeev and Natrajan (2021) further highlight the transformative role of online education, particularly through MOOCs, which they see as integral to ED4.0. Their study emphasises the potential of social media tools in enhancing learner engagement and creating interactive, student-centric online courses. They argue that this approach aligns with ED4.0, offering a blended learning experience that incorporates disruptive technologies and promotes personalised education environments. Castro-

Benavides *et al.* (2022) scrutinised the digital transformation of HEIs within the context of the 4IR. Their systematic literature review identified diverse teaching scenarios emerging from digital transformation, emphasising the decentralised nature of these initiatives. The study underscores the potential risk of fragmented, uncoordinated digital transformation efforts within HEIs, emphasising the need for holistic solutions that address both current and future institutional requirements.

Hashim *et al.* (2022) contribute to the discourse on digital transformation in higher education by proposing a qualitative model designed to leverage digital transformation for building competitive advantages in universities. The study recognises the evolving nature of competitive advantage in the digital era, emphasising the need to understand impactful changes and effectively utilise digital transformation strategies. Safonov *et al.* (2022) address the growing importance of digitalisation in policymaking, particularly in response to the COVID-19 pandemic. Their study focuses on the digital transformation of educational policy, analysing and justifying the directions of digitalisation in modelling education and science policies in the Ukraine and abroad. The research highlights the European Union's focus on developing digital skills, while the Ukraine prioritises digital literacy as a means of economic stimulation and social progress. Furthermore, the authors stress the importance of digital transformation in shaping education policy. Akour and Alenezi (2022) argue that the accelerated digitalisation of higher education due to the COVID-19 pandemic raises several questions about the future of professions and the courses offered by HEIs, leaving the place and role of universities in this evolving landscape still unclear. Alenezi (2023) adds that this transformation involves a complex process requiring a series of actions, including pedagogical adaptation, changes in the operational structure of HEIs, and the adoption of new learning models for both students and teachers, all accompanied by a shift in educational management.

Leitão *et al.* (2023) found that hybrid universities are becoming a reality, driven by several factors. They highlight the crucial role of open innovation, where creativity knows no bounds and stakeholders actively participate in the process. Digital governance is also essential, as the democratisation of knowledge through societal involvement lends legitimacy to the model. Additionally, sustainability emerges as a key factor, resulting from actions that reinforce the dynamics and success of the hybrid university model. McCarthy *et al.* (2023) argue that virtual spaces are increasingly replacing face-to-face interactions. In their research, Mudaly and Chirikure (2023) explore the divergent drivers of STEM (Science, Technology, Engineering, and Mathematics) education in the Global North and Global South. They suggest that STEM education in the Global North is driven by a neoliberal agenda rooted in political dominance and economic stability, while in the Global South, the focus is on massification with equity, aiming to address past colonial imbalances. The paper underscores the growing trend of convenient collaborations, driven by the Global North's interest in exploiting the Global South's advantages. Recommendations include greater vocationalisation of STEM education in the Global South, STEM integration with humanities, and balanced, mutually beneficial collaborations between the two regions, highlighting the need for equitable power dynamics. The authors advocate for a humanistic conception of STEM education, stressing the importance of collaboration for the greater good. Mukul and Büyüközkan (2023) provide a comprehensive review of ED4.0, examining its emergence within the context of ID4.0. Their study investigated current research topics, knowledge gaps, and future directions by reviewing literature on ED4.0. The authors highlight the disruptive nature of ED4.0, its potential impact on education and training strategies, and the pivotal role of technology. They identify key areas such as the need for innovation-driven education programmes, digital culture integration, and personalised education environments. Furthermore, they stress the crucial role of technology in implementing the ED4.0 approach and call for further research to evaluate, measure impact levels, and identify suitable technologies.

The Impact of Digital Transformation on Higher Education Sustainability

Polin *et al.* (2023) posit that the advent of ED4.0 has given rise to the concept of 'smart campuses', envisioned as microcosms of smart cities. This paradigm shift in higher education integrates digital transformation opportunities, turning campuses into living laboratories for the research, development, and adoption of smart technologies alongside their traditional educational roles. Through a systematic literature review using the PRISMA approach, the authors categorise existing research into four major domains: society, economy, environment, and governance, each aligned with the core smart campus concepts of digital technology and big data. Their findings highlight the early stages of smart campus conceptualisation and practice, emphasising the need for a new conceptual foundation. Shenkoya and Kim (2023) underline the pivotal role of education in driving sustainable development and innovation within national innovation systems, particularly as the 4IR matures. Their study addresses a gap in the literature regarding the impact of digital transformation on higher education sustainability. By combining a

systematic literature review with bibliometric analysis, they highlight the positive influence of digital transformation on higher education, fostering sustainable curricula, innovation, and improved student performance. The study also anticipates future developments such as the advancement of ED4.0, increased use of gamification, datafication in decision-making, and the integration of AI to reshape the landscape of higher education.

Adigun *et al.* (2024) investigated the evolving role of libraries amid the advancements of the 5IR. They noted the importance of incorporating cutting-edge technologies such as AI, IoT, and blockchain into library systems to enhance user experiences, operational efficiency, and sustainability. The study addresses challenges related to data privacy, ethical considerations, and the digital divide, while advocating for libraries to redefine their roles as dynamic hubs of knowledge in an increasingly digital world. The research underscores the potential of libraries to cultivate sustainable knowledge systems. Moola *et al.* (2024) explored the integration of technology and humanism in Life Sciences education within the framework of the 5IR. Using a mixed-method approach, they examined teachers' perspectives on the symbiotic relationship between humanity and technology, stressing the need for a balanced, human-centred approach in technologically advanced classrooms. Their findings highlighted the challenges and opportunities of aligning Life Sciences teaching with 5IR standards, promoting educational innovations that prioritise both technological fluency and humanistic values to improve learning outcomes and prepare students for a rapidly evolving future. In summary, these diverse studies collectively contribute to the evolving discourse on ED4.0 and digital transformation in higher education. From the conceptualisation of smart campuses to the challenges and opportunities presented by MOOCs, digital transformation in education, and the barriers to ED4.0 implementation, each study offers unique insights. As the global education landscape undergoes significant changes, these research endeavours provide valuable perspectives for shaping the future of BRICS education in the digital age.

The review reveals that a multifaceted strategy is imperative to effectively implement ED4.0 in BRICS countries. National commitment is essential, underpinned by the development of comprehensive policies and frameworks that endorse the seamless integration of technology in education and foster collaboration among educational institutions, industry stakeholders, and government bodies. Adequate investment in digital infrastructure, including hardware and software, ensures widespread access to technology. At the same time, prioritising professional development for educators cultivates digital literacy and proficiency. Curriculum redesign, emphasising 21st-century skills and project-based learning, prepares students for the evolving job market. Public-private partnerships harness collective resources, while flexible learning models and incentives for innovation promote adaptability and creativity. The integration of data analytics informs decision-making, community engagement ensures collective commitment, and international collaboration facilitates knowledge exchange. Continuous evaluation and feedback mechanisms are important for guiding iterative improvements and ensuring that education remains aligned with the demands of ED4.0.

Below we provide research debates and make recommendations that provide valuable views for influencing the future of education in the BRICS countries in the digital era.

Education 4.0 Initiatives: Global Best Practice and Reflections from BRICS Countries

Several countries have distinguished themselves through their approaches aligned with ED4.0. The following examples showcase a commitment to leveraging technology, fostering innovation, and preparing students for future challenges. Singapore has taken a proactive approach in formulating comprehensive national policies that prioritise technology integration in education. Initiatives like "Smart Nation" focus on creating a technology-enabled society and influencing educational practices accordingly. The country places significant emphasis on continual professional development for teachers, providing training programmes to enhance their digital literacy and instructional technology skills (Government Technology Agency of Singapore, 2017). Finland is recognised for its innovative curriculum design, which places a strong emphasis on critical thinking, problem-solving, and collaborative skills. The education system in Finland is aligned with the principles of ED4.0, with a particular focus on interdisciplinary learning and project-based assessments. Moreover, teachers in Finland are granted a high degree of autonomy, enabling them to adapt their teaching methods to integrate technology effectively. These actions are based on the European Union Digital Education Action Plan (2021–2027) initiative, which seeks to establish a shared vision of high-quality, inclusive, and accessible digital education in Europe. The aim of this initiative is to support Member States in adapting their education and training systems to the digital age. The European Commission has also provided a 2030 vision for the future of European universities, offering guidance for institutions as they navigate the process of digitalisation (European Commission, 2020).

The United Arab Emirates (UAE) has invested significantly in educational technology infrastructure, ensuring widespread access to digital resources and tools in schools and universities. Initiatives like the Mohammed Bin Rashid Initiative for Global Prosperity include innovation hubs and challenges that encourage students to develop solutions for real-world problems, fostering an entrepreneurial mindset and focusing on the availability of digital resources for all (Making Prosperity, 2022). South Korea has embraced flexible learning models, including blended learning and online education platforms. This approach accommodates diverse learning styles and preferences. The country places a strong emphasis on innovation, encouraging students to engage in creative problem-solving and entrepreneurial activities (Ministry of Education, 2023). Canada actively engages in global collaboration initiatives, fostering partnerships and exchange programmes with institutions worldwide. This approach enriches the educational experience for students and promotes cross-cultural understanding. Canadian provinces often involve local communities in shaping educational policies, ensuring that the broader public is informed and supportive of educational transformations (Government of Canada, 2022). Many other initiatives exist worldwide, with the most robust ones in developed countries, but these examples from small-population countries illustrate diverse strategies employed by them to align their education systems with the principles of ED4.0. In large-population countries, these initiatives become more complex. It is important to note that educational initiatives are dynamic and subject to ongoing developments, and new initiatives will emerge with time.

The BRICS countries have been working on various initiatives to integrate ED4.0 principles into their education systems. These initiatives aim to leverage technology, foster innovation, and align education with the demands of the 4IR and 5IR. In Brazil, the digital transformation of its education system has been emphasised in a fragmented way. Each HEI defines its initiatives in relation to the digitalisation process. Initiatives include integrating technology into classrooms, promoting online learning platforms, and providing digital resources for students and teachers. Brazil has seen the emergence of start-ups and innovation hubs focused on educational technology. These hubs aim to incubate and support tech-driven solutions that enhance education, aligning with the principles of ED4.0. As an example, Chao and Chao (2019) highlight the rapid evolution of telecommunications and computing, transforming daily interactions through mobile devices. To keep pace with this digital shift, education and healthcare must innovate. The Telemedicine Discipline at the University of São Paulo Medical School, in Brazil, established in 1997, leads in transcending geographical barriers, fostering connected education with cutting-edge resources like the Metacognitive Interactive ED4.0 model. This model integrates innovative health education methodologies and exclusive teaching resources, including digital microscopy, dynamic communication in computer graphics, 3D printing, and various interactive tools (Chao and Chao, 2019).

Russia's National Technology Initiative (NTI) includes a focus on education, aiming to prepare students for the challenges of the digital age. It encourages the development of innovative educational technologies, emphasising STEM (Science, Technology, Engineering, and Mathematics) education. Russia has been investing in online learning platforms and digital resources to enhance access to education. This includes the development of digital content, interactive tools, and virtual classrooms (Shukshina *et al.*, 2018). India's National Education Policy (NEP) (2020) emphasises the integration of technology in education. It promotes online and digital learning, the use of AI, and the development of e-content to enhance the learning experience. The broader Digital India initiative aims to digitise education, improve digital infrastructure in schools and colleges, and promote the use of technology for skill development. Although the policy does not explicitly address ED4.0, it considers all its aspects (NEP, 2020). China's Education Modernisation 2035 plan, issued by the Central Government of China in February 2019, demonstrates China's leadership in incorporating AI into education. Initiatives include using AI for personalised learning, adaptive learning systems, and intelligent tutoring systems to cater to individual student needs. China has made significant investments in creating smart classrooms and promoting online learning platforms. This includes integrating educational technology to enhance the overall learning environment (Zhu, 2019).

In 2004, South Africa introduced the White Paper on Information Communication Technology (ICT), in which the government encouraged educational institutions to adopt it to avoid significant digital disruptions in teaching and learning (Department of Education [DoE], 2004). The importance of this White Paper stemmed from the government's goal to support technological innovation in teaching and learning after 1994. COVID-19, on the other hand, accelerated the pace of ICT beyond this level (DoE, 2004). This shows the South African government's interest to transform the economy and education through technology post-apartheid. However, there are challenges that exist. For example, not all institutions have the same level of ability and capacity to implement digital technologies, nor do they have the same level of funding. Online learning platforms are evident in South Africa; however, while some institutions are far ahead in incorporating AI into their curriculum, others are just

beginning to invest in smart classrooms (DoE, 2004). These initiatives reflect the commitment of BRICS countries to adapt their education systems to the challenges and opportunities presented by ED4.0. Research indicates that every BRICS country is taking steps to align with the trends of ED4.0, but China and Russia exhibit superior organisation compared to the others, and even outperform certain developed nations. Nevertheless, it is essential to stay updated on the latest developments, as the field of educational technology is dynamic and constantly evolving (Mukul and Büyüközkan, 2023). The "ex ante" literature on ED4.0 and digitalisation predominantly underscore both the advantageous aspects and challenges inherent in its implementation. Digitalisation in ED4.0 yields considerable benefits, notably an enhanced accessibility to information through online resources, fostering self-directed learning, and reducing reliance on traditional textbooks. Adaptive technologies contribute to personalised learning experiences, adapting content to individual student needs and accommodating diverse learning styles (Sanjeev and Natrajan, 2021).

Moreover, digital tools facilitate global collaboration, connecting students and educators worldwide, thereby fostering a more interconnected and culturally diverse educational experience. Innovative teaching methods, such as gamification and virtual reality, have proven to be effective in engaging students, thereby making the learning process more enjoyable and impactful. Concurrently, digitalisation streamlines administrative tasks, resulting in time and resource efficiencies for educators and institutions. It also prepares students for the demands of a digital society, where proficiency in digital literacy is paramount. The increasing pace of technological innovation necessitates continuous skill updates for the workforce to adapt to evolving roles influenced by new digital technologies and ID4.0 job creation (Batić, 2021). The list of advantages goes beyond those mentioned. The trend towards ED4.0 is well established worldwide, but the threats and challenges must be considered on this path (Costan *et al.*, 2021). Challenges emerge in the discourse on digitalisation in ED4.0. The digital divide exacerbates existing inequalities as not all students have equal access to technology and the internet, resulting in a disadvantage for some (Making Prosperity, 2022). Privacy concerns arise due to the collection and use of extensive student data, prompting inquiries into security and potential misuse. There is a discernible risk of excessive reliance on technology, potentially marginalising the importance of face-to-face interactions and traditional teaching methods. Significant cybersecurity threats, including data breaches and ransomware attacks, loom over educational institutions, necessitating the implementation of robust security measures (Safonov *et al.*, 2022). Teacher training and resistance to technological adoption may hinder successful integration, and the phenomenon of information overload challenges students to navigate the digital information landscape with enhanced critical thinking skills. Attempts from powerful media institutions to impose alien beliefs and values on vulnerable communities, eroding these communities' identities, is a concern for educators (Kravchenko, 2022). Considering digitalisation as an integral facet of globalisation elucidates the observed trend of a swifter expansion of literature on the subject in Global South countries compared to their Global North counterparts (Dao *et al.*, 2023).

Researchers universally acknowledge the pivotal role of digitalisation in fostering sustainable development; however, the Global South faces challenges in implementing changes within their educational systems. Consequently, it is natural that scholars from the Global South are contributing more research in this domain (Li *et al.*, 2023). Nevertheless, this does not imply a greater advancement in digitalisation compared to the Global North. Despite considerable internal disparities within the European Union, the bloc has demonstrated tangible strides in embracing ED4.0, supported by explicit guidelines for member states. Furthermore, small-population, high-income countries also exhibit progress in this direction, as exemplified by the United Arab Emirates, underscoring the influence of financial resources in propelling initiatives towards ED4.0. Chang *et al.* (2018) reveal an intricate relationship between education and economic progress in BRICS countries. While they recognise the importance of ED4.0 for their development, three countries (Brazil, India, and South Africa) clearly prioritise addressing inequality and eliminating illiteracy in their education policies. The internal differences within these countries make education and research management very difficult. On the one hand, they cannot afford to fall behind in the new ED4.0 trend, but on the other hand, they must also address the gaps in basic education. Russia, however, aligns with the initiatives from developed countries in the Global North, despite its cultural differences. Kravchenko (2022) analysed the ambivalences of digitalisation, which changes the factors that ensure the sustainable development of society and nature. The author argues that the rational-formal model of digitalisation, as emerged in the West and imposed on the rest of the world, is dominated by trends of chaos and dehumanisation. Its inherent trait is a "cancel culture" towards the values of other nations. The author proposes a national and cultural model of digitalisation that governs the content and characteristic features of digitalisation processes.

Conclusions

The discussions on ED4.0 and digitalisation underscore the transformative advantages and challenges shaping the global educational landscape. The benefits are evident in improved access to information, personalised learning experiences, and streamlined administrative tasks, which prepare students for the demands of a digital society. However, challenges such as the digital divide, privacy concerns, and cybersecurity threats highlight the need for cautious implementation. The exploration of ED4.0 in the HEIs of emerging countries demonstrates the diverse trends and considerations within this paradigm. These nations grapple with the challenge of integrating technology into their education systems, addressing the digital divide, and fostering global collaboration. Despite differing implementation approaches, the common goals include personalised learning, skill development aligned with industry needs, and the cultivation of a global mindset. The importance of ED4.0 for BRICS countries becomes evident in their initiatives. Each member, whether Brazil, Russia, India, China, or South Africa, demonstrates a commitment to leveraging technology for educational transformation. Noteworthy initiatives include Brazil's emphasis on digital transformation, Russia's focus on STEM education, India's NEP promoting technology integration, China's leading position in AI-driven education, and South Africa's efforts on digitalisation. These initiatives collectively reflect the BRICS nations' acknowledgement of the need to align education with the demands of the 4IR. BRICS countries demonstrate diverse approaches to ED4.0. Brazil, India, and South Africa prioritise addressing inequality and illiteracy, reflecting internal challenges. Russia aligns with Global North initiatives but seeks a national and cultural model of digitalisation. China, with its unique leadership style, incorporates ED4.0 without compromising its cultural identity, serving as an example for global initiatives. Each BRICS country should call for a national and cultural model that considers its unique features.

The trajectory towards ED4.0 requires a careful balance between embracing technological advancements and preserving cultural identities. The challenges posed by digitalisation necessitate strategic planning, global collaboration, and a commitment to inclusivity. As BRICS countries navigate this complex landscape, the emphasis on national and cultural models, as demonstrated by China and supported by scholars such as Kravchenko (2022), offers a valuable framework for the sustainable integration of ED4.0. During the 2023 BRICS summit in South Africa, six new countries were invited to join the expanded BRICS Plus: Argentina, Egypt, Ethiopia, United Arab Emirates, Saudi Arabia, and Iran. Their participation was scheduled to begin in January 2024, however, Argentina declined the invitation in early 2024. Despite this, the inclusion of these countries broadens the scope of action for the group of emerging economies and increases their global presence, although aligning their goals may prove more challenging. The question now is: how will the new configuration of BRICS Plus manage the trend towards ED4.0? In conclusion, the trajectory towards ED4.0 for BRICS countries is filled with both promise and challenges. Achieving the right balance between embracing technological progress and preserving cultural integrity will be crucial for navigating this complex educational transformation. Ongoing research, policy development, and international collaboration will be essential in unlocking the full potential of ED4.0, ultimately contributing to the sustainable development of these emerging economies in the digital age.

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