



# Digital Transformation Inequality in South African Secondary Schools Affecting the Implementation of 4IR Era Relevant Curriculum

Rachel Tholakele Khoza

University of Johannesburg, Department of Commercial Accounting, Soweto Campus,  
Republic of South Africa

## Abstract

*The process of changing how work is organized in response to the advent of cutting-edge digital technology and business models is referred to as "digital transformation." Digital transformation includes aligning digital technology, organizational elements, and human aspects rather than only implementing a technological solution. Major technology advancements and a reliance on digital platforms for business have defined the 21st century. This study examines the effects of digitization on South African secondary school education, particularly considering the country's high inequality and exclusion rates, as well as its poor funding, lack of adequate staffing, lack of adequate skills, and lack of a clear comprehensive national strategy from the Department of Basic Education. The study maps the challenges faced by South African secondary schools regarding digital transformation and how inequality affects the implementation of curriculum that is relevant to the 4IR ERA. The paper relied on desktop research which comprises the review of the relevant literature and policy documents pertaining to the implementation of curriculum that is relevant to the 4IR Era. The study provides insight into the extent of digital transformation inequalities in South African secondary schools and their impact on the implementation of 4IR era relevant curriculum. The key challenges identified include, limited infrastructure, lack of teacher training, and disparities in digital skills. The study concludes that these challenges require concerted efforts from policymakers, educators, and other stakeholders to bridge the gap and ensure equitable access to digital resources and opportunities for all students, especially those in the rural areas.*

**Keywords:** *Digital Transformation, Inequality, Curriculum Development, 4IR, Department of Education, Secondary Schools*

## 1. Introduction

The Fourth Industrial Revolution (4IR) is characterized by the fusion of digital technologies, transforming various aspects of society, including education [1]. It is reshaping industries and societies, emphasizing the importance of equipping students with skills necessary for the future [1,2]. Digital transformation has become a significant global trend in education, offering numerous opportunities for improved learning outcomes. To keep up with the worldwide digital technology advancement, there is an urgent need to transform school curricula in South Africa (SA) in accordance with 4IR adaptations [3,4,5,6]. Schools can play an integral role in preparing learners for this era by incorporating the skills such as coding, robotics, and data analysis needed for 4IR in the curriculum [1,5].

Some of the secondary school graduates are not exposed to the new technologies because of limited resources and lack of infrastructure [6,7]. In the SA context, digital transformation in education has the potential to address various challenges and improve educational outcomes [3]. Like many other nations, SA is utilizing digital technology to increase access to high-quality education, advance inclusive learning spaces, and encourage innovation in teaching and learning [7,8,9]. It is in this context that, the current study maps the challenges faced by SA secondary schools regarding the relevancy of the current education curriculum as well as its effectiveness on current practices focusing on the skills that were brought by the 4IR era.

## 2. Review of related literature

### 2.1. 4IR overview

4IR refers to technologies that are led by the emergence of artificial intelligence (AI), robotics, the internet of things, autonomous vehicles, bio and nanotechnology, 3D printing, material science, quantum computing and energy storage [1,5]. 4IR technologies will make a significant impact on our lives and will demand a change in current employment and education, including changes to the way we live and work, how the economy works and how we are governed [1,5]. Educational outcomes, for example, can be enhanced by providing children with the critical thinking abilities they will need in a technologically advanced environment.



## **2.2. Digital transformation in education**

Digital transformation in education refers to the integration of digital technologies and tools into teaching and learning processes [2]. It encompasses the use of computers, the internet, software applications, and other digital resources to enhance educational experiences and outcomes. The evolving technological landscape demands that students be more prepared for the digital age and it's driving a global movement in education called the digital transformation. However, global implementation of digital transformation, is not without challenges. The major challenge pertains to the digital divide, which includes inequities in access and infrastructure [6,7,10]. This divide is especially noticeable in developing countries like SA, where efforts to implement digital transformation are hampered by scarce resources and unequal distribution [10].

## **2.3. Digital inequality in education**

Digital inequality refers to the disparities in access to and utilization of digital technologies [12]. SA experiences considerable inequalities in digital infrastructure and access to resources [3,4,12]. Many secondary schools in rural and underprivileged areas lack basic digital resources, in contrast to some secondary schools in urban areas that have access to well-equipped computer labs and dependable internet connectivity [12].

Since 2019, due to the Covid 19 pandemic several societies have adopted the practice of distance education through internet communication channels, which has altered the educational experience for millions of youngsters [10]. This has made digital inequalities more evident in societies, especially in disadvantaged communities and are mirrored in education [13,14]. Some indicators of inequality in South African education that are discussed in this paper are accessibility of various resources, school literacy levels among others.

### **2.3.1. The accessibility of various resources**

Some studies have noted that, teachers with limited access to technology have a challenge in delivering engaging and interactive lessons that foster digital literacy and critical thinking [15]. Furthermore, it is challenging to integrate cutting-edge technology, such as robots and artificial intelligence into the curriculum due to a lack of digital infrastructure, which limits students' exposure to these important ideas. The accessibility of resources such as education, healthcare, clean water, electricity, and transportation plays a significant role in the well-being of a country. However, ensuring equal access to these resources remains a challenge due to inequalities, geographic disparities, and socio-economic factors in SA [16].

### **2.3.2. Literacy levels**

Literacy has never just meant being able to read; it also means being able to read with comprehension and meaning. Digital literacy is the phrase used to describe literacy as it relates to technology. Digital literacy goes beyond digital competences and skills [15] and the phrase "digital literacy" is frequently used to refer to a set of abilities that encompasses digital skills [17]. Some academic writers have argued that, creating equitable digital distribution is a challenge because of the digital divide and initiatives to foster digital literacy would be ineffective until the issue of unequal access to digital technologies and the internet is addressed [9,14].

## **3. Research methodology**

This study sought to map the implementation of curriculum that is relevant to the 4IR ERA and identify the challenges faced by South African secondary schools regarding digital transformation. The research also aimed to address the gaps in the existing data requiring further research. Desk research was employed to address the research aims. Desk research refers to "the process of gathering information available in published form, rather than obtaining the data directly" [18] For this study, information from Government publications and other relevant studies relating to initiatives that deal with digital inequality was used. Governments usually publish data related to social, financial, educational, and economical aspects of society. Also, some of the challenges that affect implementation of government initiatives were discussed.

## **4. Discussion and findings**

Since the election of the first democratic government in 1994, one of the major tasks have been to transform the inequitable political, economic, and social system of the apartheid era. Some of the developments since 1994 are shown in Table 1 below:



Table 1. Developments by Government to deal with Inequality

Year	Developments
1994	Section 34(1) of the South African Schools Act 84 of 1996 was developed. It states that, “to redress past inequalities in education provision, and to ensure the proper exercise of the rights of learners to education, the state must fund public schools from public revenue on an equal basis” (Republic of South Africa, 1996:24). To achieve this, The National Norms and Standards for School Funding (Republic of South Africa, 2012:3) was created which aimed at making funding of school education fair by ranking schools into five quintiles based on unemployment rate and the literacy rate of the community where the school is located, with quintile 1 ranking indicating the poor schools and quintile 5 ranking indicating a wealthier school.
Mid-2000	By the middle of the 2000s, South Africa's three main problems—poverty, unemployment, and inequality—were still present. In response, the government assembled a group of specialists to identify the causes of South Africa's ongoing problems. The expert committee examined both the shortcomings and the gains made since 1994 in its diagnostic report. The following nine major problems were noted: The level of education received by black students in South Africa's schools was poor; country's infrastructure was inconveniently situated; insufficient, and poorly maintained; spatial divides hobbled inclusive development; the economy was unsustainably resource intensive; the public health system cannot meet demand or sustain quality; public services are uneven and often of poor quality; corruption levels were high; and south Africa remains a divided society.
2011	The government released the National Development Plan (NDP) – Vision 2030
2018	The Presidential Commission on the Fourth Industrial Revolution (PC4IR) was established by President Cyril Ramaphosa. The objective of the PC4IR was to review South Africa's position and ensure the country stays competitive in the global 4IR economy.

Source: ( authors' own work)

Table 2: Reports and documents showing South African government initiatives

Initiative	Focus
South Africa Connect: Creating Opportunities, Ensuring Inclusion - South Africa's National Broadband Policy (2013). Accessed from: <a href="https://www.gov.za/south-africas-broadband-policy-south-africa-connect-creating-opportunities-ensuring-inclusion-yunus">https://www.gov.za/south-africas-broadband-policy-south-africa-connect-creating-opportunities-ensuring-inclusion-yunus</a> .	This policy document outlines the South African government's strategy to connect all citizens to affordable broadband services. It emphasizes the importance of digital infrastructure development, universal access, and digital skills training to bridge the digital divide. The South Africa Connect national broadband policy of 2013 aims to ensure that the country achieves universal internet access by 2030, thereby fostering digital skills development.
South Africa's National Integrated ICT Policy White Paper (2016) Accessed from: <a href="https://www.gov.za/documents/electronic-communications-act-national-integrated-ict-policy-white-paper-3-oct-2016-0000">https://www.gov.za/documents/electronic-communications-act-national-integrated-ict-policy-white-paper-3-oct-2016-0000</a> .	The National Integrated ICT Policy White Paper presents a comprehensive framework for South Africa's digital transformation. It outlines policy measures to address digital inequality, including initiatives to expand broadband access, promote digital skills development, and ensure affordable digital services
Presidential Commission on the Fourth Industrial Revolution (4IR) (2019) Accessed from: <a href="https://www.gov.za/documents/presidential-commission-fourth-industrial-revolution-members-and-terms-reference-9-apr">https://www.gov.za/documents/presidential-commission-fourth-industrial-revolution-members-and-terms-reference-9-apr</a> .	Established by the South African President, the Presidential Commission on the 4IR focuses on harnessing digital technologies to drive inclusive socioeconomic development. The commission aims to address digital inequality by formulating policies and recommendations to ensure that no one is left behind in the digital era.
Department of Communications and Digital Technologies (DCDT) Accessed from: <a href="https://nationalgovernment.co.za/units/view/428/department-of-communications-and-digital-technologies-dcdt">https://nationalgovernment.co.za/units/view/428/department-of-communications-and-digital-technologies-dcdt</a> .	The DCDT is the government department responsible for developing and implementing policies related to communications and digital technologies in South Africa. The department's website provides information on various initiatives, programs, and policies aimed at bridging the digital divide and promoting digital inclusion
Smart Schools Network, Digital Classroom Initiative and Teacher Professional Development: initiative led by the Department of Basic Education in collaboration with various partners. Department of Communication and Digital Technologies. Accessed from: <a href="https://www.dtps.gov.za/">https://www.dtps.gov.za/</a> .	It focuses on equipping schools with the necessary infrastructure, digital tools, and training to enhance teaching and learning through technology

Source: ( authors' own work)



Table 3: Selected studies proving inequality still a challenge in South Africa

Study	Focus
<p>ETDP-SETA (2021) The Fourth Industrial Revolution <a href="https://www.etdpseta.org.za/etd/sites/default/files/2022-12/The%20Fourth%20Industrial%20Revolution%20in%20the%20ETD%20sector%202021.pdf">https://www.etdpseta.org.za/etd/sites/default/files/2022-12/The%20Fourth%20Industrial%20Revolution%20in%20the%20ETD%20sector%202021.pdf</a>.</p> <p>Authority (ETDP-SETA) requested the University of Johannesburg to gauge the readiness of education and training industry to deliver the skills required for the fourth industrial revolution.</p>	<p>The study sought to determine the needs of the ETD sector, given the changes brought about by the rapid advances in technology due to the fourth industrial revolution. The researchers interviewed key stakeholders to determine the readiness of their institutions to operate in the environment characterised by rapid advances in technology. The study found that, the schooling sector in South Africa is not geared for the 4th industrial revolution, and schools lack basic computing infrastructure, accompanied by a lack of training on use of technologies for teaching and learning purposes. The results highlight a digital divide among the learners/schools in rural areas and urban areas in South Africa. This means that learners in rural areas are left behind in relation to uptake 26 of fourth industrial revolution skills, leading them to have problems when they reach the diploma or degree level. Some learners will lack skills such as critical thinking, creative thinking and even the basic computer skills.</p>
<p>Chigona, W., Chigona, A., &amp; Walji, S. (2017). Understanding the Digital Divide in South African Schools: Towards a Capability Approach. <i>Information Technology for Development</i>, 23(4), 646-667.</p>	<p>This article explores the digital divide in South African schools using a capability approach. It highlights the inequalities in digital resources, teacher capacity, and infrastructure, providing insights into the challenges faced by secondary schools in implementing digital transformation</p>
<p>Nzimakwe, T. I., &amp; Chigona, A. (2021). The Role of Digital Technologies in the Fourth Industrial Revolution: Implications for Curriculum Delivery in South African Secondary Schools. <i>International Journal of Education and Development using Information and Communication Technology</i>, 17(2), 125-140.</p>	<p>This article explores the implications of digital technologies in the 4IR era for curriculum delivery in South African secondary schools. It highlights the importance of digital transformation in preparing students for the future world of work and identifies the challenges hindering the integration of 4IR-relevant curriculum.</p>
<p>Magagula, Z., &amp; Condy, J. (2020). Digital Skills and Readiness in South African Secondary Schools: Implications for 4IR Curriculum Implementation. <i>South African Journal of Education</i>, 40(4), 1-14.</p>	<p>This study investigates digital skills and readiness in South African secondary schools and their implications for implementing 4IR curriculum. It examines the existing digital transformation inequalities and their impact on the successful adoption of 4IR-related subjects.</p>

Source: (authors' own work)

As shown in Table 2, the South African government partnering with other stakeholders has implemented various initiatives to address digital inequality in education. Despite government interventions, Table 3 shows the studies that indicate that SA is still facing a significant digital divide, with unequal access to technology and digital resources among schools. Many schools, particularly those in disadvantaged areas, lack the necessary infrastructure, hardware, and connectivity to support effective digital learning.

Over and above digital inequality, SA is facing some of the challenges that are discussed in Table 4 below:

Table 4. Over an above digital inequality, South Africa is facing some of the challenges

Challenge	Consequences
Power Supply and Infrastructure Stability	Frequent power outages and unreliable infrastructure can disrupt internet connectivity, particularly in areas with limited access to stable electricity. In South Africa power outages can be up 10 hours a day.
Corruption	Corruption in the education sector can manifest in various forms, such as misappropriation of funds meant for infrastructure development, procurement irregularities, or favoritism in resource allocation. While there may not be specific references linking corruption directly to the combination of digital transformation inequality and 4IR curriculum implementation in South African secondary schools, it is essential to address corruption in education to ensure fair resource distribution and effective implementation of educational initiatives
High Unemployment	High employment rate that makes affordably a challenge especially to the disadvantaged communities. They cant afford data even when provided with infrastructures
Lack of physical infrastructure	Many rural and underserved areas lack the necessary physical infrastructure, such as fiber-optic cables and network towers, to provide reliable and high-speed internet connectivity.
Lack of digital skills	Many individuals, especially in marginalized communities, lack the necessary digital skills to fully participate in the digital economy. This skills gap hinders their ability to leverage digital technologies and services effectively.
Limited awareness and relevance	Some individuals may be unaware of the benefits of digital access or may not see its relevance in their daily lives. This lack of awareness and perceived relevance can contribute to a lower demand for digital services and a reduced incentive for infrastructure development.

Source: ( authors' own work)

## 5. Recommendations

Over and above initiatives that are implemented by government and other stakeholders to reduce inequality, recommendations are discussed in Table 5 below.



Table 5. Recommendations

Recommendation	Plan of Action
Infrastructure development	Investments should be made in improving internet connectivity, providing devices such as computers or tablets, and ensuring reliable power supply in all schools in the disadvantaged communities.
Teacher training and capability building	Teachers should receive comprehensive training in digital literacy, technology integration, and 4IR skills to effectively deliver a relevant curriculum.
Public-private partnerships	Collaboration between the government, private sector organizations, and NGOs can pool resources, expertise, and funding to bridge the digital divide.
Curriculum adaptation	The curriculum should be revised to incorporate digital literacy, coding, data literacy, and other 4IR skills, ensuring it is relevant to the changing technological landscape.

## 6. Conclusion

Inequality in digital transformation poses a significant challenge to the implementation of 4IR era relevant curriculum in South African secondary schools. Limited digital infrastructure, lack of access to technology, and inadequate teacher training contribute to this inequality. Addressing these challenges requires concerted efforts from policymakers, educators, and stakeholders to bridge the gap and ensure equitable access to digital resources and opportunities for all students including the students in the rural areas.

## References

- [1] Moloi, T., & Mhlanga, D. (2021). Key features of the fourth industrial revolution in South Africa's basic education system. *Journal of Management Information and Decision Sciences*, 24(5).
- [2] Mhlanga, D., Denhere, V., & Moloi, T. (2022). COVID-19 and the Key Digital Transformation Lessons for Higher Education Institutions in South Africa. *Education Sciences*, 12(7), 464.
- [3] Magagula, Z., & Condy, J. (2020). Digital Skills and Readiness in South African Secondary Schools: Implications for 4IR Curriculum Implementation. *South African Journal of Education*, 40(4), 1-14.
- [4] Bosch, T. E., & De Beer, L. T. (2020). An Investigation into the Integration of Digital Technology in South African Schools: A Comparative Study. *British Journal of Educational Technology*, 51(5), 1770-1788.
- [5] Khoza, R. T., Masehela, K. F., & Mbhalati, L. (2022, July). Effective Education that Will Be Relevant in 4ir ERA: A Case Study for South African Secondary Schools. In *Conference Proceedings. The Future of Education 2022*.
- [6] Rambe, P. (2019). Digital divides in South African education: The quality of pre-service teacher education. *South African Journal of Education*, 39(4), 1-11.
- [7] Nkosi, Z., & Mkhwanazi, N. (2020). Challenges Experienced by South African Schools in Implementing the Fourth Industrial Revolution Curriculum. *South African Journal of Education*, 40(2), 1-10.
- [8] Mpungose, C. B., & Magongo, B. E. (2021). Barriers to the Integration of 4IR Technologies in the South African Education System. *International Journal of Emerging Technologies in Learning*, 16(5), 119-136.
- [9] Department of Basic Education, South Africa. (2019). The National Intergrated Information and Communication Technology Policy white Paper for South African Education. Available from: <https://www.education.gov.za/Portals/0/Documents/Policies/Education%20Sector%20ICT%20Policy%202018.pdf>.
- [10] UNESCO, G. (2020). Education: From disruption to recovery. *UNESCO Building peace in the minds of men and women*. <https://en.unesco.org/news/covid-19-educational-disruption-and-response>.
- [11] Warschauer, M. (2004). *Technology and social inclusion: Rethinking the digital divide*. MIT press.
- [12] Kamal, R. (2020). Digital inequality in developing countries: A case study of South Africa. *Information Development*, 36(4), 771-781.
- [13] Muller, H., & Mutula, S. (2019). Barriers to digital inclusion in South African secondary schools. *Information Technology for Development*, 25(3), 410-435.
- [14] Masuku, M., & Van Biljon, J. (2020). A review of digital inequality and digital divide in South Africa. In *IST-Africa Week Conference*, 1-12. IEEE
- [15] Martin, A., Grudziecki, J (2006).: DigEuLit: Concepts and Tools for Digital Literacy Development. *ITALICS: Innovations in Teaching & Learning in Information & Computer Sciences* 5, 246–264.
- [16] United Nations Development Programme. (2019). Human Development Indices and Indicators: 2019 Statistical Update. Retrieved from <https://hdr.undp.org/content/human-development-report-2019>.
- [17] Seker, J (2018). The Trouble with Terminology in Reedy, K and Parker J. *Digital Lietracy Unpacked*. Facet Publishing: London, 3-16
- [18] Woolley, M. (1992), "Using statistics for desk research", *Aslib Proceedings*, Vol. 44 No. 5, 227-233.