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# The Fourth Industrial Revolution in South Africa's basic education: a search for cogent curriculum justice

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This study sought to examine how the Fourth Industrial Revolution (4IR) has promulgated curriculum (in) justices within basic education contexts in South Africa. Utilizing qualitative methods, we interviewed fifteen students and three teachers from three selected schools and one ICT district manager representing the Gauteng Education Zone in Johannesburg. We also deployed critical interpretivism to analyze the documents and the responses from the research subjects in order to explain how the ideologies related to use of 4IR and its roles in education had helped create and sustain curriculum (in) justices in South Africa. We mainly used Ideal Utilitarianism by George Moore, Justice as Fairness by John Rawls, and the Technology Acceptance Model by Fred Davis as key theoretical frameworks for analyzing 4IR within educational contexts. Key findings showed that 4IR has hugely sorted, stratified and unequalized rural-poor students more than it has done with the rich students especially at the basic education level. Essentially, the benefits highlighted by some respondents, particularly teachers, could not help offset the injustices and damages 4IR had unleashed upon the marginalized groups of students at this level. While acknowledging that 4IR was irreversible at this point – since it was now part of human life – we recommended that DBE should judiciously revisit the 4IR policy governing the Operation Phakisa Initiative (OPI), by instituting different support systems that will ensure provision of an equitable and just 4IR aided education for everybody. One such supports, but not limited to that, was provision of consistent capacity building trainings for the schools and society.

## KEYWORDS

social justice, 4IR education, education inequalities, curriculum injustices, social stratification, e-Learning, e-Teaching, Google generation

## Introduction

Policymakers, educators and researchers have all recognized 4IR in education as one of the best approaches for preparing students for the future world of work (Scalzo, 2022). As Schwab (2020) argues, the interaction of modern technologies across the physical, digital and biological spaces have all made 4IR look different from all the previous revolutions. For Uleanya and Ke (2019), it is the development of the Internet of Things (IoT), robotics, Virtual Reality (VR), Artificial Intelligence (AI) and a host of novelty technologies, which have immensely changed the way human beings relate with each other whenever executing their daily activities. These developments have eventually forced many governments to incorporate 4IR in their education systems as a means of offering instruction to students. This then has given rise to different forms

of delivering education such as e-Learning, online learning, blended learning, virtual learning, lifelong learning and so on (see [Zozie and Chawinga 2018](#) and [Chibambo and Divala, 2022](#)). On the benefits of 4IR in education, [Frezzo \(2017\)](#), [South \(2017\)](#), [United States Office of Educational Technologies \(USoET\) \(2017\)](#), [Zozie and Chawinga \(2018\)](#), and [Scalzo \(2022\)](#) have all claimed that educational technologies cannot be ignored because human life is now governed by technological principles. They further claim that educational technologies optimize engagement, collaboration and interaction among students, teachers and administrators within and outside the classrooms. Precisely, [Scalzo \(2022\)](#) adds that 4IR provides personalised learning experiences for individuals since they can access educational content everywhere, anywhere, anytime and anyhow (ubiquitous learning) hence enhancing democracy in education. Scalzo further claims that 4IR improves students discipline and attention which is usually missing during face-to-face (f2f) sessions. She also insinuates that 4IR improves teachers' efficiency since they can manipulate their pedagogical methods to suit different teaching contexts and needs. Likewise, [United States Office of Educational Technologies \(USoET\) \(2017\)](#) contends that data analytics have indeed helped educators easily track students learning experiences and performance through algorithms and metrics hence providing feedback to students timeously while also evaluating their own pedagogies.

Since these myths have been consistently spread through oral narratives, the social media, popular media, and pro-technology research disseminations, many governments including South Africa have indubitably perceived 4IR as a tool for offering education [[Department of Basic Education \(DBE\), 2004](#)]. For example, the [Department of Basic Education \(DBE\) \(2015\)](#), in its White Paper Number Seven on E-Education, has often cited the much touted magical abilities residing in 4IR such as those cited in the above studies, and these essentially informed South Africa's e-Learning educational policy called Operation Phakisa Initiative (OPI). Specifically, the White Paper Seven – as commonly called – has argued that schools should engage in new modes of information gathering, processing, and analyzing through 4IR since it is the only way to improve administration, leaning and teaching capabilities of the schools. However, [Meyer and Gent \(2016, p. 2\)](#) cautions that NGOs, Provincial and National Governments, and researchers should collaborate to ensure that necessary resources are equitably provided to schools if digital divide and curriculum injustices are to be avoided.

Buying into these claims, South Africa began digitizing its schools commensurate with the Department of Basic Education (DBE) through a number of projects. Thus, the Gauteng Online Project (GOP); the Khanya Project; School Net Project (SNP); Intel Tech Educational Program (ITEP); the Google Education Project (GEP), ICT4RED Project, and the Microsoft Partnership Learning (MPL) were all introduced to digitize the schools (see [Pholotho and Mtsweni, 2016](#)). Although most of these projects demonstrated governments' political will to digitize education, there were so many policy-framework shortfalls which ruined such efforts. Such shortfalls led to the creation of the Operation Phakisa Online Initiative (OPI) as a new policy-framework for guiding 4IR in education. It has however remained unclear if the designers of OPI had indeed tactfully reviewed policy flaws that botched previous digitalization efforts. It is also not clear if indeed the DBE had done adequate feasibility studies to establish sustainability of 4IR in basic education, and how it would

respond to questions of curriculum justice given the existing socio-economic disparities in South Africa. Accordingly, this study sought to establish how the inclusion of 4IR in basic education had promulgated curriculum (in) justices in South Africa. We thus attempted to answer the following main research question: to what extent does the inclusion of 4IR in basic education promulgate curriculum (in) justices in the Gauteng region of South Africa?

## Problem statement

In South Africa, many black people have been excluded from accessing quality and dignifying education due to socio-economic inequalities. Thus, the DBE sought to mitigate this problem through a project called the Operation Phakisa Online Initiative in education (OPI). Even then, South African schools have continued to lack necessary resources hence constraining access to quality and equitable education ([Ford et al., 2014](#)). Moreover, South Africa utilizes the Quintile System of resourcing schools which is based on Justice as Fairness and the Difference Principles ([Rawls, 1985](#)) as rural-poor schools are given more resources than those in urban areas in order to equalize them. This arrangement suggests that schools under Quintiles one to three are categorized as disadvantaged hence deserving more while those in Quintiles four and five are rich hence deserving little. Despite using Rawlsian principles as bases for equalizing South Africans, inequalities have persisted in the rural schools (see [Hoadley and Jansen, 2009](#); [Sedibe, 2011](#); [du Plooy and Zilindile, 2014](#)). These realities raise questions regarding the effectiveness and sustainability of these policies in South Africa. Such concerns made us re-examine 4IR policies on their contributions towards curriculum (in) justices in basic education contexts of South Africa. Key questions such as, has 4IR really provided genuine curriculum justice in South Africa? If not, how best can 4IR help address questions of curriculum inequalities in South Africa's educational context? It should be noted that basic education in South Africa covers both primary and secondary schools.

## Literature review

### Fourth Industrial Revolution (4IR) in education and its perceived benefits

Since 4IR in basic education was initially experimented through OPI project in South Africa, this study utilized the terms 4IR, ICTs and OPI interchangeably to mean educational technologies. Precisely, OPI was a result-driven project that aimed to digitalize education in South Africa at all levels, commensurate with the basic education level before spreading to tertiary education. Furthermore, OPI was expected to bring on board different stakeholders in order to strengthen the resourcing and financing streams. Originally, OPI started in the UK, US, Malaysia and then Tanzania before South Africa adopted it as problem-solving lab methodology of education. Thus, the main aim of OPI was to fast-track digitization of education in the schools as part of globalization [[Department of Basic Education \(DBE\), 2015](#)].

According to [Planning, Monitoring and Evaluation Republic of South Africa \(PMSAR\) \(2014\)](#) as cited in [Kwet \(2017\)](#), the DBE

launched OPI in 2015 arguing that 4IR had the potential to improve access to quality and equitable education. This was also in response to the White Paper Seven on e-Education which had recommended fast-tracking of 4IR in education as the means for increasing access to education and globalization. According to [Mabila et al. \(2016; p. 1\)](#), the White Paper Seven initially recommended blending print and electronic media since the country had high levels of digi-nomic divide; poor electricity distribution; uneven internet connectivity, unreliable mobile devices, and expensive internet data among others (Also see [Chibambo and Divala, 2020, 2022](#)). While acknowledging these issues, the DBE still insisted that 4IR should be introduced in primary schools because it will build the capabilities of the users; that it will create some digitized and information literate society which will be ready for the world of work, and that such society will easily meet the demands of globalization and the National Treatment Plan 2030 (see [National Planning Commission, 2011](#)).

To achieve its goals, OPI was divided into five main blocks, which included (i) connectivity, (ii) devices, (iii) continuous professional development (CPD), (iv) digital content development, and (v) distribution and e-administration (see [Mabila et al., 2016](#)). Despite this roadmap, there had been concerns regarding limited feasibility studies on how 4IR could work in basic education without exposing young learners to curriculum harms. As [South \(2017; p. 6\)](#) contended, policymakers need to make inclusive and reflective decisions whenever introducing instructional media in education if such tools are to be transformative and just. Many studies have also demonstrated that imposition of instructional media in education may create curriculum inequalities within the schools (see [Feenberg, 1999, 2005; Higgins and Wang, 2006; Selwyn, 2007; Friesen, 2008; Simpson, 2015; Chibambo and Divala, 2019, 2022](#)). In this regard, we sought to examine how OPI could potentially promulgate curriculum (in) justices in South Africa's basic education context. Since this study concerns 4IR, as a relatively novelty and agile construct, we have dedicated the coming sections to its genealogy, and how it has made its way into education.

## From the first to the fourth industrial revolutions

According to [Schwab \(2020\)](#) and [Stearns \(2018\)](#), industrial revolutions may refer to abrupt transformations from manual age to machine age. The First Industrial Revolution (Industry 1.0) for example, began in Britain before it extended to Germany, France and North America, and it happened abruptly without any planning. During this revolution, the steam engine helped increase production of textiles and fabric, and that marked the first shift from manual to mechanized labour ([Rothblatt et al., 1988](#)). That time, education was mainly for enlightenment purposes, and the inventions did not really affect it. Later, the Second Industrial Revolution (Industry 2.0) emerged between 1860 and 1914 in the USA during which migrations of people from rural to urban areas in search for factory jobs had increased ([Mohajan, 2019](#)). Key inventions included the telephone, television and radio, which also began to be used for distance education purposes ([Rothblatt et al., 1988; Holmberg, 2005](#)). Employers began to look for workers who could read, write and/or do basic mathematics in order to understand plant manuals and sales figures. The Third Industrial Revolution (Industry 3.0) began around 1969, the same time computers emerged, and improved telephones

and televisions became popular ([Schwab, 2020](#)), and mechanization of labour had exponentially increased. As [Troxler \(2013; p. 2\)](#) observes, Industry 3.0 is yet to happen in some poor countries, and such countries have not yet experienced cogent digital revolution. Unique to Industry 3.0 was the re-emergence of neoliberal movements such as Education for All (EFA), Education Reform Movement (ERM), Transformation into Digitally Supported Education (TDSE) and E-Learning for Society (EFS) among others all of which emphasized the use of e-Learning to support increased access to education as a human right ([UNESCO, 2000; Selwyn, 2007; South, 2017; United States Office of Educational Technologies \(USoET\), 2017; Zozie, 2020; Chibambo, 2023; Ngobeni et al., 2023](#)).

The above arguments hold considering that in many developing countries, the common available technologies resemble those of Industry 3.0 more than those of 4IR such as robotics and AI which are little known among selected university professors and engineers. As [Schwab \(2020\)](#) claims, 4IR is indeed an improved version of Industry 3.0 since most technologies used today are upgraded versions of the past technologies although some sophisticated technologies have diminished the physical, digital and biological gaps. [Schafer \(2018\)](#) equally spots big-data, block-chains, VR, IoT, laser sensors and others as unique 4IR technologies that have radically transformed the very modes of human existence as they can think better than human beings do. Accordingly, many governments are now investing in 4IR for education, environmental, medical, security and communication purposes among others.

Conversely, [Dewey \(1966\)](#) and [Biesta \(2015, 2017\)](#) had contended that education should perpetuate society through transmission of social-cultural norms and values. The fear nevertheless is that if policymakers are attracted by these claims and then irrationally decide to include 4IR in education, chances are high that students from poor backgrounds may find themselves out of cultural reality which can eventually create Symbolic Violence ([Bourdieu, 1984](#)) and cognitive injustices ([Friesen, 2008; Leibowitz, 2017](#)). Similarly, [Freire \(2005\)](#) believed that social transformative education may be realised through consistent dialogue between students and their teachers within real-time schooling contexts and as an act of modelling for a humanized and democratized space (also see [Nouri and Sajjadi, 2014; Biesta, 2017](#)). This means over-trusting 4IR to take human roles in education may have serious implications on possibilities for dialogue, humanization and democratization processes, hence deflating the arguments raised by 4IR proponents ([South, 2017; United States Office of Educational Technologies \(USoET\), 2017; Zozie, 2020; Scalzo, 2022](#)).

## Benefits of 4IR in education: some reflections

Several studies have reported various benefits of using 4IR in education. For example, [Wani \(2013\), Kwet \(2017\), South \(2017\), United States Office of Educational Technologies \(USoET\) \(2017\), Zozie and Chawinga \(2018\), Scalzo \(2022\), and Zozie \(2020\)](#) have argued that 4IR in education is non-negotiable since we now live in the digital age where human life is determined by digital principles. Similarly, [Simpson \(2015\)](#) reports that proponents of 4IR believe that modern youths are Digital Natives (Dig-Nats) and/or Google Generation (Google-Gen) ([Garcia et al., 2013](#)) hence they easily find

every technology exciting and acceptable in every context. Others have also argued that 4IR optimizes interaction among students and educators within and outside schooling contexts (South, 2017; Zozie, 2020). For Scalzo (2022), 4IR helps teachers personalize teaching since students' access e-resources ubiquitously from different databases and at their own convenience. Equally, South (2017) and Zozie and Chawinga (2018) claim that 4IR increases students' engagement during teaching more than f2f teaching contexts. They further claim that 4IR assist teachers manipulate educational instruction to suit different learners under different contexts. They further praise data analytics for specifically helping educators track students' tastes, behavior, learning experiences and performance, which eventually help them provide timeous feedback and support to learners.

Another outrageous claim by Frezzo (2017) insinuates that 4IR can improve deep learning by offering unique collaborative experiences, which in turn lead to deep learning experiences and outcomes. He further argues that students can confidently engage with peers, test-out available models, then manipulate and redesign models, while confidently expressing themselves virtually. Frezzo, citing his research findings, claim that over 65% of students around the globe will find themselves getting jobs that do not exist, and that 90% of the firms studied admitted having limited IT skilled workers. Similarly, 75% of the teachers and students surveyed reported that they lacked necessary IT skills for the current job market, and that they felt 4IR should be taught in schools as it prepared them for future jobs. These are the same benefits the White Paper Seven had reiterated as benchmarks for introducing OPI in basic education. Critical scholars however have questioned the sincerity of these claims especially from the perspectives of human rights and justice (see Feenberg, 1999; Higgins and Wang, 2006; Selwyn, 2007; Friesen, 2008; Vally and Spreen, 2012; Simpson, 2015; Chibambo and Divala, 2019, 2022; Minnaar and Herbig, 2022). Accordingly, the coming section will focus on 4IR and its influence on curriculum (in) justices in education. We therefore flag-out selected educational contexts and their experiences with 4IR in education across the globe.

## The Fourth Industrial Revolution in Africa and curriculum injustices

Use of 4IR in education needs thoughtful and reflective research to avoid disadvantaging poor-rural students within socioeconomically challenged contexts. For example, Simpson (2015) argues that although some educational institutions have adopted e-Learning, as a cost-saving measure, wholesale adoption of technologies have enhanced digital divide among rural-poor students whose access to electricity, internet connectivity and ICT devices is very limited. Similarly, Bichler (2020), Chibambo and Divala (2022), and Chibambo (2023) established that over 82% of Malawians are rural-poor who have no access to reliable electricity, Internet infrastructure and reliable devices hence jeopardising e-Learning efforts.

Equally, in South Africa (see Vurayi, 2021, 2022; Chibambo and Divala, 2022; Chibambo, 2023), e-Learning have increased digital divide and curriculum injustices, especially during the Covid-19 period. The studies recommended that institutions should avoid rushing into wholesale implementation of 4IR until they do thought-provoking research on such projects. The studies however cautioned educators on backtracking from 4IR initiatives since such a move

would kill the existing morale and efforts already made on 4IR investments in education. They then recommended educators to embrace 4IR in education gradually while recognizing that identity formation requires time, nudging and assimilation efforts the same way elephants nudge their claws (Bourdieu, 1984). Likewise, in Zambia, Mvula and Kalumbila (2022) established that while schools adopted ICTs in education during the Covid-19 pandemic, such efforts became unsuccessful due to unreliable electricity, poor internet connectivity, expensive internet data, poor technological and information literacy and lack of reliable devices. These combined contributed towards increased digital divide, non-participation in education and inequalities especially among the poor children.

From Zimbabwe, Matimire (2020) and Vurayi (2022) reported of limited systems support which increased digital divide during the COVID-19 pandemic especially in basic, secondary and tertiary education contexts. The authors further established that school administrators who supported users by providing them with capacity building trainings (CPDs) on ICT had managed to achieve positive results in education. They then concluded that 4IR in education can be possible when accompanied by adequate infrastructural, social, technical and moral supports. Likewise, Kenya and Uganda faced problems of erratic electricity, expensive but poor internet connectivity and limited tech-literacy levels, which increased digital divide in education (Ayere et al., 2010).

Ultimately, these findings demonstrate that 4IR in education has been marred by a hoard of challenges which eventually culminate into curriculum injustices. These findings also unmask the double-aged nature of 4IR, and how its devotees have deliberately withheld some facts regarding its role on curriculum injustices. In fact, 4IR like any neoliberal innovation, has created and sustained digital divide, addiction, cyber-bulling, phishing, health and moral deprivations although its proponents will usually conceal such realities (Higgins and Wang, 2006; Selwyn, 2007; Friesen, 2008; Chibambo and Divala, 2022; Chibambo, 2023).

## The Fourth Industrial Revolution in Oceania and Europe

According to Simpson (2015), 4IR in education across Europe and Oceania has experienced several setbacks which have then forced some universities to rethink their online ambitions. For example, in the UK, Ireland, Germany, and Australia and New Zealand, it has been a mixture of successful and unsuccessful stories. Indeed, a longitudinal research (see Simpson, 2015) sought to uncover what works and what does not work within e-Learning contexts. His main motivation was that, the speed at which universities were adopting 4IR in education was somewhat dangerous resembling the behaviour of his tricycle that had the front tyre located on top of the engine. Although this tricycle was light on fuel, and could beat traffic, it was prawn to fires, which usually ended his trips prematurely. Making a case for education, Simpson argues that 4IR may sound very trendy and cheap but could be prawn to long-term inconveniences to students and teachers. Simpson further questions whether what 4IR does should be classified as e-Learning or e-Teaching or both. He argues that e-Learning is what the students exactly do or the-hoped-for-ends (outcomes), while e-Teaching should be proposed means for achieving the goals (inputs). He argues that there is no such a thing as e-Learning through 4IR but

rather e-Teaching. His argument is that e-Learning as it is known is simply a false ideology emanating from confusion of these two words which resemble what Philosopher Gilbert's Ryle called – a *category-error* befuddling of two things which are essentially different (Simpson, 2015; p. 3 as cited in Chibambo, 2023). Regarding increased access, performance and interaction, Simpson established that, there was no any evidence suggesting that 4IR in education help increase access to education, academic performance, student-teacher interaction, and/or increasing profits through cost-savings as claimed by many 4IR enthusiasts hitherto discussed.

Simpson further cites a more compelling case of the Open University of the UK (OUK), which introduced e-Learning few years before his research. He established that soon after 4IR was introduced, the graduation rates for OUK had considerably dropped down from 40% to 13% (Simpson, 2015). The OUK had further incurred huge debts mostly emanating from infrastructural and support system investments and operations unlike when print media was used. These developments raised serious questions of whether 4IR in education saves any costs or not. It was also reported that the UK government was already struggling to service the 20% population which had no any access to domestic Internet hence making it even difficult for the university to reach all learners equitably. While the issues raised by Simpson may also come from other factors, it is not too early to conclude that wholesale adoption of 4IR had immensely contributed towards reduced access to quality education within the UK context.

Additionally, at the Dublin City University Connected (DCUC), students were offered options of f2f tutorials and/or a mixture. The study revealed that students wanted a mixture of both instructional media. This forced the DCUC to adopt both f2f and 4IR for purposes of maximizing interaction and cohort socialization among the students and instructors (Simpson, 2015; p. 4). The study also established that e-Learning provided limited space for interaction and dialogue such as that afforded by f2f (Simpson, 2015). Similarly, at the Fern-Universität University in Germany, blended learning (print media, 4IR and f2f) were emphasized. The university made a decision to maintain f2f alongside 4IR to maximise chances for dialogue and interaction (see Simpson, 2015 as cited in Chibambo, 2023). These debates illustrate that even developed countries have struggled to adopt wholesale 4IR in education despite having excellent technological and human resources, while others have simply avoided the temptations to take the 4IR path.

Arguably, if world-class universities have experienced these issues, then what magic would save South Africa, where nearly 92% of the people come from impoverished squatters? This then should serve as caution to our policymakers to rethink rationally, how best they can avoid creating further inequalities within the disadvantaged schools of South Africa.

## The Fourth Industrial Revolution in Asia and curriculum injustices

In Asia, Simpson (2015; p. 3) reports that the Indira Gandhi National Open University (IGNOU) and the Open University of China (OUC), had as of 2015 not yet fully automated their education systems despite being Giga and Mega universities. While these countries have high-class 4IR technologies, they have deliberately avoided adopting wholesale 4IR in education for obvious reasons.

Similarly, the South Korean National Open University (KNOU) had – unlike the OUK – partially introduced e-Learning (Simpson, 2015), although its household internet access was reported to be over 97%, and had broadband speed of about 82 Mbps; thus 17% and 2% more than the access and/or Mbps speed rates of the UK. Even then, KNOU still demanded its students to undertake compulsory f2f teaching during the semester. For example, in its 2014 handbook, KNOU included this clause:

*To overcome the limitations of e-Learning, while encouraging interactions between academics and students, KNOU requires all juniors to take f2f sessions for three courses, and seniors three f2f courses at their regional campuses. Such f2f sessions shall be held consecutively for two or three days in a semester, and there shall be tests at the end of such classes (Simpson, 2015; p. 4).*

It is reported that these f2f sessions became compulsory after series of surveys, which established that many students valued f2f sessions more than e-Teaching due to difficulties in understanding instruction, and that they felt isolated when studying alone online. Moreover, 50% of the students felt that the available f2f sessions were enough, while 40% felt they needed more f2f than provided for purposes of cohort socialization and interaction. These findings contradict the claims often made by 4IR rightists who relentlessly claim that the youths of today are Dig-Nat descendants born and bred within the Google-Gen tradition hence they are inseparable from 4IR (Frezzo, 2017; Zozie and Chawinga, 2018; Zozie, 2020; Scalzo, 2022).

## The Fourth Industrial Revolutions, academic performance, and behavior of the students

According to Simpson (2015) as cited in Chibambo (2023), it still remains unclear if all students are indeed prepared for online contexts. He cautions that Google-Gen or Dig-Nat claims (see Bennett et al., 2008; Foss et al., 2013; Garcia et al., 2013; Zozie, 2020) might serve as venom that would cripple students' participation and flourishing in education. For example, the UK Joint Information System Committee (UKJISC) (as cited in Rowlands et al., 2008; Simpson, 2015) established that while children showed easiness with some basic search engines, they still lacked critical skills for evaluating online information. The report also revealed that children have often lacked patience when searching for online information, just like lecturers and old professors do. These traits are often counterproductive for quality research and academic success in general. Equally so, in New Zealand (see McNally and Rutland, 2009), 4IR in education had helped increase digital divide and socio-cultural inequalities among the Aborigines. This demonstrates that 4IR is not just an issue of age and technical-know-how but also that it has something to do with culture, tastes, dispositions, habits, labor and capital (see Bourdieu, 1984).

The above studies have provided us with some insights on the role of 4IR in education, and its challenges especially on curriculum justice. The inclusion of case studies from Europe, Oceania, Asia and Africa has immensely opened a can of worms regarding 4IR in education, and exposed how wholesale implementation can contribute towards curriculum (in) justices in South Africa. Importantly, some possible solutions to these issues have been presented by the various studies. Thus the theoretical frameworks alongside the empirical

findings from this study will help us reimagine 4IR inclusion in education that is informed by epistemologically just policy-frameworks within the context of South Africa.

## Theoretical frameworks

The study utilized Modern Utilitarian on the understanding that most government policies are guided by consequentialist assumptions. As argued by Ward (2020) and Tardi (2021) many neoliberal governments claim that their policies are usually meant to serve the interests of the public. Ideally, Classical Utilitarianism had assumed that what matters in every action are the consequences not the processes (consequentialism). It also claims that an action may be good if it pleases the largest number of people (majoritarianism) (see Driver, 2014). These views were originally advanced by Stuart Mill and Jeremy Bentham as pioneers, which of course, received harsh criticism from various moral scholars due to their egoism and hedonism. A revision of these ideas was done by George Moore who sought to correct these shortcomings as he qualified the notions of pleasure, pain and good. Moore believed that pleasure and the good can be measured quantitatively and qualitatively instead of leaving it open to abuse. His argument was that pleasure and the good could be measured as short-term and long term as well as positive and negative. For example, if a student decides to leave a party for studying in the library that action should be considered as the highest or positive good because of the long-term benefits attached to schooling and academic qualifications. If another student decides to leave studying for a brothel, then that should be considered as lowest or short-term pleasure and good, but cannot be the right basis for deciding wrongness or rightness of an action or indeed public policies. Since all forms of utilitarianisms have retained the original maxims albeit some modifications, we adopted the maxims of majoritarianism, consequentialism, impartiality and transferability as key lenses for understanding the role of 4IR on curriculum (in) justices in South Africa. We understand that 4IR is believed to increase access to quality and equitable education framed within the conception of the good. We also acknowledge the concerns regarding the omission of justice for the minority within Classical Utilitarianism, hence our shift to Modern Utilitarianism which denounces hedonism, egoism, subjectivism and partiality when deciding public policies (Driver, 2014; Ward, 2020).

Alongside Modern Utilitarianisms, we employed the theory of Justice as Fairness (Rawls, 1985) to examine how South Africa has managed to equalize the schools through quintile resource system, while ignoring the Capabilities Approach (Sen, 1999). Rawls argued that if people are to be duly equalized, then give more resources to those who have little (Difference Principle), and that when everything is equal then treat them equally irrespective of their status (Justice as Fairness).

Since this topic concerns 4IR, we have also employed the theory of Reasoned Action (TRA) to examine how 4IR users adopt and accept technologies within educational contexts. TRA aims to explain the relationship between attitudes and behaviours within human action. It argues that individuals' decisions to engage in certain acts may be based on the outcomes they expect from that action (Fishbein and Ajzen, 1975). Since critics have questioned TRA for failing to prove the complexities of human behaviour, it was revised to the

Theory of Planned Behaviour (TPB) and Reasoned Action Approach (RAA), which were also used in communication. As Zozie (2020) had argued, TRA aimed to understand individuals' voluntary actions by examining their underlying motives. We have also utilized the Technology Acceptance Model (TAM) by Davis (1989) and Rogers (2003) which contends that there are two factors that determine individuals' ability to adopt technologies, which are *perceived usefulness*, and *perceived easiness of use*. And, as Kumashiro (2000) had argued, dealing with educational inequalities demands that researchers should include marginalized theories that are not popular within the domain of education because modern education is being challenged by complex issues. Accordingly, this theoretical bouquet helped us examine educational technologies and inequalities prudently in our quest to reconstruct epistemologically just 4IR aided education within the context of South Africa.

## Research methodology

We employed qualitative research approaches as suggested by Cresswell (2014), Johnson and Christensen (2016), and Cropley (2022) who argued that since education involves human behaviors and perceptions, qualitative methods could serve best under such circumstances. We thus used Critical Interpretive paradigm to analyze 4IR education policies and practices, and explain how they promulgate curriculum (in) justices in basic education. We also utilized the transformative paradigm as it demands that human practices and lived experiences should be understood within their social contexts if genuine social change and transformation are to be achieved (Cohen, 2012). We therefore interviewed three ICT teacher coordinators, fifteen learners and one District Manager responsible for the three schools located in the Johannesburg East D9, of Gauteng Department of Basic Education in South Africa. These participants were sampled because of their involvement in the OPI 4IR project, and their experiences working with 4IR in education.

## Demographic profiling of the subjects

In this study, 67% of the ICT teacher coordinators were male, while 32% were female although this did not have any significant influence on the findings. Out of the three coordinators, only one had a seven-year teaching experience using 4IR in education, while the rest had less than that. Various studies have argued that differentiated 4IR work experience levels might have huge influence on the attitude, conduct and performance of the teachers, which can eventually influence learners' experience (Davis, 1989; Rogers, 2003; Zozie, 2020). We finally developed three sets of semi-structured interview guides specific for the learners; for the ICT teacher coordinators, and for the District ICT Manager since each group played different roles within the OPI project.

## Sampling techniques and analysis tools

According to Cresswell (2014) and Cropley (2022), in qualitative research, purposeful sampling helps researchers to understand the essential phenomenon by intentionally selecting individuals and/or

sites which can provide the study with the right information. On this basis, we used purposive sampling techniques by grouping learners based on their level of study to obtain relevant information on OPI. We also purposefully selected ICT teachers based on their availability and experience with OPI so that they should provide us with necessary data. We then analyzed the data for common themes emerging from the different groups as proposed by [Alhojailan \(2012\)](#). Since thematic analysis is used to analyze classifications, and present themes that relate to the data, we had to draw interpretations about the role of 4IR on students' access to equitable education in South Africa, and the factors that contributed to the successes and failures of OPI in the Gauteng Education District. As argued by [Alhojailan \(2012; p.10\)](#) thematic analysis is appropriate for any study that seeks to obtain meaningful interpretations about phenomena as well as helping one deeply understand the potential of an issue. Precisely, thematic analysis helped us analyze the data from both the interviews and the literature reviews which were later reinterpreted using the theoretical lenses.

## Main research question

This study sought to answer this main question: How does 4IR in education promulgate curriculum (in) justices in the context of South Africa's basic education?

To answer this main question, we asked the following sub-questions:

1. What are the perceived benefits of 4IR in education in basic education in South Africa?
2. How does use of 4IR in education promulgate curriculum (in) justices and (in) equalities in South Africa?
3. What approaches has OPI 4IR project used to ensure quality and equality in education in South Africa?
4. How can the DBE in South Africa ensure that schools and students access equitable and quality education through use of 4IR?

## Ethical considerations

According to [Cropley \(2022\)](#) any study that involves human subjects require ethical clearance. Accordingly, this study sought Ethical Clearance from the University of Johannesburg (EREC) to allow us interview the teachers and the students on matters of 4IR in education. Primarily, the questions mainly concerned teachers and students' experiences regarding the use of 4IR in education as a means of instruction; whether they felt the policies and practices therein were fair and just for them, and what they perceived as working well and/or challenging under such conditions.

In terms of confidentiality and security, participants were informed that their participation was voluntary, and that they could withdraw at any time without any consequences ([Cresswell, 2014](#)). Other than signing consent forms, they were also assured that their responses would be treated with utmost secrecy; that no names would be attached to their responses serve pseudonyms; that the information would solely be used for this study and that thereafter, it would be kept in a computer protected by pin-codes. Participants were also assured

that their responses were purely based on their knowledge as knowledgeable agents not really as students or employees of the DBE hence did not represent any employment contract with them. For purposes of reliability (see [Cohen, 2012](#)), the responses were represented as provided by the subjects, and that any contradictions were immediately verified through follow-up Focus Group Discussions (FGDs) alongside the literature reviews documents.

## Presentation and discussion of the findings

We conducted interviews in the three OPI 4IR pilot schools in Gauteng Province in South Africa to understand how education technologies can promulgate curriculum (in) justices within the schools and society. A group of fifteen students, three ICT teacher coordinators, and one District ICT manager were selected and interviewed. We firstly wanted to know about the existence of OPI 4IR in education project, and its role amongst the users. All the three teacher coordinators indicated that they knew this project from their schools and that they were working under it. They for example echoed:

*Yes, it is an initiative from the DBE. Uh it's been providing smart-boards and tablets for teaching purposes. We received these devices some five years ago, but since then, they have stopped. At the beginning of this year, they issued out some more tablets again to grade tens...*

Likewise, the District Manager also reported that issuing of tablets had been stopped some four years ago due to technical glitches. He however indicated that there were some plans by the DBE to make all schools in Gauteng 100% ICT by providing devices to all the remaining schools and classes.

According to the [Department of Basic Education \(DBE\) \(2015; p. 17\)](#), the OPI project sought to integrate education technologies into the classrooms since it was believed that it could improve access to quality and equitable education in South Africa. Accordingly, this study sought to establish the benefits of 4IR in education in these schools. From the responses by the Teacher Coordinators and the District Manager, it was evident that 4IR in basic education was unpopular among the teachers and students. This might be the reason it was not yet extended to the remaining schools following the many social and technical glitches. Similarly, all the three Teacher Coordinators reported that 4IR was indeed not very popular in their schools. They reported that OPI was facing many challenges some of which were beyond the control of the schools. This response replicated the findings from Europe, Asia, Oceania and Africa (see [Feenberg, 1999, 2005](#); [Higgins and Wang, 2006](#); [Selwyn, 2007](#); [Simpson, 2015](#); [Bichler, 2020](#); [Vurayi, 2021, 2022](#); [Chibambo and Divala, 2022](#); [Mvula and Kalumbila, 2022](#); [Chibambo, 2023](#)) who also established that 4IR in education had more complex issues than the usual technical issues often cited by techno-enthusiasts. Although this question did not demand them to give specific examples of limitations since such a question would come later, it was clear from their tone that there were more issues than met the eyes relative to OPI in Gauteng.

Other scholars have claimed that 4IR improves learning and engagement among the youths since they belong to Google-Gen and/or Dig-Nat generation ([Foss et al., 2013](#); [Gastrow, 2018](#); [Zozie, 2020](#)). But as [Rowlands et al. \(2008\)](#) and [Simpson \(2015\)](#) had

established, there is limited evidence suggesting that modern children find it easy working within different 4IR contexts for education purposes. They established that students, lecturers and professors have all demonstrated impatience; poor tech-literacy, and loss of concentration due to internet obstructions when working online. These findings contradict those by [Frezzo \(2017\)](#), [South \(2017\)](#), [Zozie and Chawinga \(2018\)](#), [Zozie \(2020\)](#), and [Scalzo \(2022\)](#) who claimed that ICTs improve interaction, engagement and attention among students more than f2f sessions. As [Simpson \(2015\)](#) reported, at the OUK, graduation rates had dropped from 40 to 13% when e-Learning was wholesale adopted raising doubts over the ability of technologies to increase access to quality and equitable education (also see [Chibambo, 2023](#)). Similarly, in Germany, Spain, Ireland, New Zealand, South Korea, China and India, most of the students surveyed indicated that they preferred f2f over e-Learning, while 40% preferred a blended learning citing lack of cohort socialization, interaction and comprehension of instruction when taught online (see [Garcia et al., 2013](#)).

Importantly, teachers from the three schools stressed that OPI was not yet embraced by many schools due to resource constraints, social-cultural resistance, device malfunctioning, electricity loadshedding and internet flaws. As [Rawls \(1985; p. 43\)](#) had argued, “it is fair that all social primary goods should be equitably distributed unless unequal distribution of any or all these goods is to the advantage of the least favored groups.” This implies that, while all primary schools were earmarked for OPI, the DBE did not resource the schools equitably. It seems that Rawls principles of Justice as Fairness, and Difference were not effectively utilized when rolling-out this project. While ICT teacher coordinators from schools B and C reported that tablets distribution was based on the White Paper recommendations, this paper was also trashed for being obsolete and outdated (see [Kwet, 2017](#)). This study established that differentiated resourcing lacked justification as all the schools lied within similar quintiles hence contravening Rawls Justice as Fairness, and Difference Principles. Even when utilitarianism is called into question (see [Driver, 2014; Ward, 2020; Tardi, 2021](#)), it is obvious that the DBE utilized Classical Utilitarianism but not Modern Utilitarianism by George Moore which demands that good and just policies should be based on the Principles of Transferability and Impartiality in order to achieve the highest good.

According to [Edwards et al. \(2001; p. 418\)](#) “social exclusion has the potential to punish human beings for nothing; deny them their fundamental rights, and alongside socio-economic differentiation, could lead to marginalization, hence deepening inequalities in society.” Accordingly, we asked the students regarding their perceptions on the supports they get from OPI. The majority of them indicated that DBE and the schools did little to avail critical supports for them to easily use the available opportunities. For example, some said these:

“Aah! We do not have good laboratories, and personal computers are mostly used by those who applied for them, otherwise they are not just available for everyone...” (Students 1, 2, 3, 4, 5, 9 & 10)

“...If you do not apply, you are not even allowed to go into the computer labs and that keeps us struggling for education...” (Students 6, 7, 8, 11, 12 & 13)

“Yes, we have some ICT gadgets in the labs, and we sometimes use them. The school also sometimes helps us, but you see? You need to have good Wi-Fi near you and data even at home...” (Student 3, 14 & 15)

Other learners reported that they do use the available ICT facilities provided by OPI project office, and said:

In the subjects I am taking, 4IR is there. For example, we did introduction to ICT applications this term. Of course, 4IR has got some benefits in our lives, especially because it involves modern technologies. We are able to type our work and make learning a little easy. Mmm... that's all we know about 4IR (Laughs) (Students 1, 6 & 7).

... I also learnt about computer application technologies... So they introduced us to ICT in term one. They told us how it impacts our everyday lives and education, and that we are living in a digital world, you know... now because of ICT... You know... (Students 5, 6, 7 & 8).

From these accounts, it is clear that not all the students are participating in OPI in Gauteng, and that those who participated have often faced many limitations. Furthermore, many students appear to know basic benefits of 4IR in education such as typing and copying although others were simply reproducing what their teachers had told them about 4IR. The fact that OPI had some limited inclusion criteria, tells us that this project followed Classical Utilitarian policies in which inclusion is adjudged based on numbers not overall equality. As [Driver \(2014\)](#) contended, Classical Utilitarianism has often emphasized pleasure and majoritarianism over impartiality hence indirectly promoting hedonism and egoism. We thus argue that while 4IR could propel pleasure among the youth, it does not necessary translates into the highest good since such learners cannot rationally discern the good from the bad. And, the inclusion of neoliberal access criteria suggests that disadvantaged students did not count within 4IR educational contexts, hence reinforcing Symbolic Violence and curriculum injustices ([Bourdieu, 1984; Chibambo, 2023; Ngobeni et al., 2023](#)).

The study further sought to establish the roles played by teachers within OPI 4IR in education contexts, and they said:

My role is to promote use of ICT in education, and encourage teachers to do simple things such as typing, retrieving information from the internet... I think it is quicker that way... Also I help them capture records of tests and assignments on Excel sheets. I can also assist teachers whenever their laptops are giving problems (ICT coordinator A).

...Uh as an ICT coordinator, I make sure that teaching and learning happens through technologies though this is limited to grades 11 and 12 where it is available. If they want me to connect their laptops to smart boards, I also do that (School coordinator B).

...Yes, I help learners and teachers when they have challenges with their gadgets. We also have old teachers who are only used to chalkboards. So whenever they have problems with 4IR, I help them. I also help them install anti-viruses and ensure that only



*educational content is saved on the machines (School coordinator C).*

Primarily, all the coordinators demonstrated some positive attitude towards 4IR, although many of them did not have any formal qualification in ICTs. This finding seems to agree with the results by Davis (1989) and Zozie (2020) who argued that people who have experiences in technologies have high chances of adopting and accepting technologies. It was also reported that DBE had not adequately supported OPI users, but rather left suppliers to manage post-supply chain. As reported by some students, the suppliers were inconsistent and mostly responded very late in times of need. Similar findings were also established by Vurayi (2021, 2022) and Mvula and Kalumbila (2022) who observed that lack of support systems annihilated the success of 4IR in Zimbabwe, Zambia and Kenya. Likewise, Davis (1989) and Rogers (2003) argued that 4IR can only be adopted if users perceive it as being user-friendly and useful. Thus, complaints on lack of support and service inaccessibility might have contributed towards user dissatisfaction within Gauteng. If 4IR is perceived to be inaccessible, unaffordable and difficult to use, the users will therefore opt for an option that seems useful, easy and affordable for them, or else they may revert to old methods of doing business. Similar findings were also reported by Miliszewska (2007) and Simpson (2015) who established that students in Asia and Oceania seemed to be more satisfied with f2f sessions than online modules because they perceived them as being difficult to understand and less sociable. While the Asia-Europe-Oceania studies involved universities, hence putting them at an added advantage, it can also be argued that since the current study involved basic education, chances were high that these learners found 4IR in education demanding and less useful given the low levels of technical, creative and critical thinking skills (Rowlands et al., 2008).

As Simpson (2015) had established, the effectiveness of e-Teaching is still under-researched, and that confusing e-Teaching with e-Learning has often raised false hopes among educators regarding the abilities of 4IR. This means it is somewhat easy to measure e-Teaching, but not e-Learning since the latter happens in the learners due to many factors. Similarly, the so-called Dig-Nats (see Bennett et al., 2008) have also proved to lack familiarity with new 4IR contexts, as well as lacking essential skills for generating and evaluating credible online data. The issue here is that, claims that 4IR can help improve learning experiences because students belong to the Google generation (see Foss et al., 2013), are simply unfounded myths, which only serves the interests of the elite and their children. Similar results were also reported by Garcia et al. (2012, 2013) in Spain, who established that even students who had 4IR skills, they still lacked critical skills for navigating different 4IR platforms. Thus, the claims that 4IR improves creative and critical thinking skills, as the White Paper Seven claimed, were essentially ideological within the basic education context.

While over 79% of South Africans are connected to the internet (see Wondernet, 2022), the general internet speed is still at 18mbps, and that sustaining consistent internet access at family level is very impossible due to electricity load-shedding and high internet costs. What is clear here is that OPI in education had failed due to its overreliance on Classical Utilitarianism and a misconceived application of Justice as Fairness principles (Rawls, 1985). Moreover, ignoring the Capabilities Approach (Sen, 1999), which would ensure that resources were accompanied by necessary support systems that

would help convert the available resources and endowments into right capabilities necessary for driving 4IR education in South Africa (Walker, 2012) was a grievous mistake.

## Maintenance of the electronic devices and inequalities in education

We also sought to establish the challenges and level of supports schools got from DBE. Both students and teachers reported that OPI devices lacked reliable maintenance mechanisms; took long time to be repaired, and sometimes schools used their own resources to repair them. These delays helped increase inequalities among schools and individuals. As Gonzalez et al. (2016) and González-Sanmamed et al. (2017) had established, maintenance expenses of 4IR tools may become a burden to the users if not adequately provided for by educational institutions. Indeed, students indicated that any loss of these devices were usually charged on them. This implied that those who accessed these technologies were mainly those who had the socio-economic capital and currency as they would afford the operational costs (see Bourdieu, 1984). And, when poor people are denied access to necessary resources that can help them contribute towards their social and national development, then that constitutes epistemological injustices (Boliver, 2011; Chibambo, 2023). Beyond this, the teachers complained that most devices had stopped working long time ago. As Van Deursen and Van Dijk (2018) and Friesen (2008) observed, although devices can be given to schools, some of them may not be efficient for e-Learning purposes. This means that maintenance planning should include consistent timing, energy and repairing costs and service costs (Graham and Thrift, 2007) to avoid inconveniencing students. Similar findings were also reported in Zimbabwe, Malawi and Kenya who found that poor children failed to repair their devices unlike rich children hence increasing digital injustices (Bichler, 2020; Matimaira, 2020; Zozie, 2020; Vurayi, 2022). On this, the coordinators added:

*The gadgets sometimes do not function very well; they are usually flickering. Sometimes they cannot be charged. If we ask for help, they sometimes don't even come. Remember, the time you just arrived here, you saw that parent, she came to complain that her child had sent the tablet to the Technology company since January, and that the sponsors didn't bring it back to her up to now... you see that?"*

In general, responses from the students, teachers and the Manager demonstrated that OPI had failed to support the users diligently. As argued hitherto, when costs for 4IR are not shouldered by the schools, then they will be shouldered by the students hence keeping them out of the educational system for long, which is a curriculum injustice (Van Deursen and Van Dijk, 2018; Vurayi, 2021, 2022).

## Exploring how 4IR can provide a viable educational option for South Africa

Education has been perceived as a public good and a right for everyone (see Apple, 2001; Moriaty, 2019; Chibambo, 2023; Ngobeni et al., 2023). What still remains unclear is whether 4IR can still help maintain education as a public good worth the salt. Accordingly, this

study sought to establish why some schools were not yet 100% 4IR aided even when they were in similar quintiles. One school coordinator indicated that their school was built for ICTs unlike other schools.

*Aaaa....OPI cannot give us the best educational option, because of electricity loadshadings and many issues. Most people here are socio-economically challenged, and in townships electricity disappears for weeks-on-end, yet crime rates are very high, which often make learners lose their devices, while risking their lives before robbers. Actually, some teachers don't even have any ICT qualification, yet you want them to teach using 4IR.*

These statements agree with [Zozie \(2020\)](#), [Mvula and Kalumbila \(2022\)](#), and [Chibambo \(2023\)](#) who argued that tech-literacy skills may influence one's use of 4IR in education. Similarly, [Hoadley \(2008\)](#) and [Ngobeni et al. \(2023\)](#) contended that what makes education systems successful are not just resources but also socioeconomic, cultural and material asserts. The authors agree that in certain cultures such as as India, North Korea, Russia and Uganda women and children have limited access to the internet for national security, cultural and social control reasons (see [Feenberg, 2005](#); [Chibambo and Divala, 2022](#); [Chibambo, 2023](#)). In the US, children can only watch TV according to state regulated number of hours ([Higgins and Wang, 2006](#); [Friesen, 2008](#)). This implies that ICTs can limit children study hours, which can also infringe on their right to information, autonomy and creativity. As [Giroux \(2015\)](#) contends, equality and justice require that students have equal access to powerful knowledge, which is possible if we have freedom and democratised education spaces. Since 4IR deploys technical-control management systems ([Feenberg, 1999, 2005](#)), then it clearly promotes objectification and subjugation among the users, which contradicts the very notions of freedoms and democracy.

These findings have so far demonstrated that 4IR in education still has many obstacles to overcome if it is to succeed. It has several issues that affect the users which include navigation; stress, anxieties, and mixing of manhours with deadhours as was the case during the Covid-19 period (see [Chibambo and Divala, 2022](#); [Vurayi, 2022](#)). Devices malfunctioning, online traffic, increased cyber-bullying, internet costs, and low net-speed ([Friesen, 2008](#)) have also been reported as bottlenecks limiting the success of 4IR in education ([Bichler, 2020](#); [Mvula and Kalumbila, 2022](#)). Digital divide has also been evident in schools in Africa, and many students have dropped out of school ([Simpson, 2015](#); [Vurayi, 2021, 2022](#)). The question of social-economic and cultural capital alongside capabilities still remain relevant when deciding the adoption of 4IR education policies ([Sen, 1999](#); [Walker, 2012](#)).

## Solutions to OPI and curriculum injustices in South Africa

We sought to establish how the problems challenging OPI would be resolved. In this regard, the District Manager indicated that many devices were lost and stolen due to lack of care and irresponsibility among individuals and communities. For example, computer rooms were robbed and vandalized during Covid 19 lockdowns showing that DBE did not adequately plan for the

security of the devices nor did it sensitize communities on the need to own the schools. Similar findings were also observed in Japan where 4IR devices were lost due to poor planning, and lack of capacity building on the users ([Higgins and Wang, 2006](#)). On the other hand, the District Manager said:

*OPI project should have started at the lower levels instead of grades 12 and 11. This shifted use of the devices from learning to social networking. If we had started at a lower level, we would have involved parents to ensure safe keeping of the devices. Children need to be taught how to use educational content, and they slowly get acclimatized to the technologies, and get rightly infused into the new tech-culture.*

The above statement demonstrates that OPI failed to account for cultural and identity change models as it abruptly introduced this project to a wrong age-group. Since identity formation is easy when one is young, introducing 4IR among the early grades would have been effective unlike at grades 11 and 12 where the learners were already adolescents undergoing experimentation periods. This means, 4IR presented them with opportunities for exploring the adult world instead of education. Similarly, teachers reported that students struggled with the English language used in online platforms. As [Bourdieu \(1984\)](#) and [Ngobeni et al. \(2023\)](#) had argued, within monolingual educational contexts, students who identify themselves with the language of instruction may perform better than those who are unfamiliar. Equally, learners who survive in online educational contexts, are mainly those who come from rich families since the tech-culture and its language represents theirs ([Feenberg, 2005](#); [Selwyn, 2007](#); [Friesen, 2008](#)). It could be argued then that within 4IR contexts, the interests of the elite are well represented by their symbolic capital and cultural currency – which in turn – help them survive the academic tornados. This means 4IR can only survive in basic education if the policies balance Justice as Fairness, Modern Utilitarianism and Capabilities Approach principles.

The above points have showed that the DBE in South Africa should not have only focused on resource distribution, but also supported the schools with capacity-building to harness user capabilities ([Sen, 1999](#)). DBE should also have invested in content creation in local languages to evade symbolic violence and epistemi-cide (see [Bourdieu, 1984](#); [Chibambo, 2023](#); [Ngobeni et al., 2023](#)). South African teachers also needed to be trained on how to support online lessons through CPD, since it presented them with new ways of working and thinking (see [Simpson, 2015](#)). And, as [Selwyn \(2007\)](#) had established, 4IR in education requires new roles, pedagogies and approaches to teaching, hence the need for consistent CPD. For [Davis \(1989\)](#), usability and perceived usefulness of ICTs count the most when it comes to adopting and accepting such technologies. We thus add systems support, cultural familiarity and motivation as being required for the adoption and acceptance of 4IR in education in Africa and beyond.

## Conclusion and recommendations

[Glaserfeld and Steffe \(1991\)](#) claimed that knowledge should always be functional, and evaluated by its capacity to accomplish something new though this does not mean discrediting historical truths. The common denominator for education is the belief that

knowledge and knowing can be improved to bring change for the betterment of society (see [Arrove et al., 1992](#): 1). While many respondents questioned 4IR in education, a few approved it based on hearsays but not facts. There were major concerns raised by all users on perceived challenges which were both technical, political and social in nature (also [Chibambo and Divala, 2022](#); [Chibambo, 2023](#)). The study established that OPI devices were not repaired in time, hence creating perceived uneasiness and uselessness among the users ([Davis, 1989](#)). Similarly, the suppliers were not willing to repair the devices timeously due to lack of payment from DBE, hence schools and individuals had to dig deep into their pockets. When schools fail to shoulder maintenance costs for 4IR, such costs are usually transferred to the learners hence creating perceived uselessness and uneasiness among them (see [Davis, 1989](#)). This study has further established that 4IR in education had tried to support teaching but not learning, interaction, engagement and cost-savings as some 4IR devotees would want to make us believe (see [Frezzo, 2017](#); [South, 2017](#); [Zozie, 2020](#); [Scalzo, 2022](#)). Importantly, our findings are consistent with those by various critical scholars who have often faulted 4IR in education for its negligence on curriculum justice while according it an esoteric status as if the only truth is what is claimed about these technologies ([Feenberg, 2005](#); [Higgins and Wang, 2006](#); [Selwyn, 2007](#); [Friesen, 2008](#); [Simpson, 2015](#); [Chibambo and Divala, 2022](#)). On support systems, [Van Deursen and Van Dijk \(2018\)](#), [Bichler \(2020\)](#), and [Vurayi \(2021, 2022\)](#) have reported that 4IR should include maintenance costs to avoid budrening poor students. And, lack of affordable parts and technicians have equally had high chances of killing e-Learning projects in countries such as Kenya, Ethiopia, Zambia, Zimbabwe and Malawi as reported by [Nepad \(see Chibambo, 2023\)](#). There were also cases of unreliable gadgets which mostly crushed, and repairs were often prohibitive and scarce. As [Sen \(1999\)](#) and [Walker \(2012\)](#) had contended, schools can be equally resourced, but that does not automatically mean they will achieve similar results due to unequal capabilities. OPI had essentially confused resource distribution for the Capabilities Approach Principles. The study further established that OPI lacked prudent feasibility studies to guide its implementation, growth and sustainability, since the White Paper Seven was already marked obsolete and antideluvian (see [Kwet, 2017](#)). The study also established that OPI had increased inequalities amongst different schools due to poor roll-out plans and existing socioeconomic realities. These results agree with those by [Chibambo and Divala \(2022\)](#) and [Vurayi \(2022\)](#) who established that ICTs in education may simply increase digital divide and curriculum injustices. Thus, introducing 4IR in grades 11 and 12 was a time-ticking bomb since such students were in the middle of their adolescence struggles during which experimentation was expected hence abuse of the devices. Perhaps, introducing it at the earliest grades would have been best as young children submit to parental instructions, hence enculturating them easily. For [Sedibe \(2011\)](#), South Africa had underestimated the digital divide, which eventually bred Symbolic Violence. There was need for reconsidering diversity of the users through inclusive language and content and systems support if OPI was to reclaim its glory. Indeed learners whose language was not English were excluded as they met a new language while also grappling with new online content, search engines and semantics ([Attewell and Battle, 1999](#)). Since debates on mode of instruction and language are ongoing, there is need for further research. And, since teachers' role is important

within 4IR contexts, regular CPD should be provided to update their online skills ([Chibambo and Divala, 2022](#); [Mvula and Kalumbila, 2022](#)).

Precisely, these findings have revealed that the implementation of OPI in basic education in South Africa, had created room for inequalities contrary to the common assumptions regarding ready-made benefits of 4IR. OPI had failed to account for basic human rights such as promoting increased access to quality and equitable education as well as increasing participation as promoted by various democratic instruments and policies ([South African Constitution, 1996](#); [UNESCO, 2000](#); [Moriarty, 2019](#)). Essentially, any form of exclusion, be it withholding of educational resources or lack of CPD may end up licensing marginalization and sorting in society. This was equally evident from the responses of both the teachers and learners in this study. The study also demonstrated that disadvantaged schools in Gauteng continue to be unequalized despite some empty cacophonies by governments and its agents regarding equality and justice in modern society. The sampled schools had further demonstrated huge disparities in terms of resources and support systems. Some schools had adequate OPI resources, while others were visibly pathetic and impoverished wretches. These inequalities pointed to OPI 4IR policy lapses that had conspicuously ignored the capabilities approaches alongside Rawlsian arguments, yet not all is lost.

## Limitations of the study

Main limitations concern failure to include as many learners and schools as possible to allow them narrate their views regarding OPI and its status. We also focused on the teachers facilitating OPI classes leaving out others as if they had no narratives. Involving teachers outside OPI project would have helped us widen the information scope regarding 4IR in education. We also failed to examine the role of 4IR on academic performance although this was beyond our scope. While use of three schools may suggest that these findings cannot be generalized to other contexts unless they have similar characteristics (see [Gall et al., 1996](#)), we are certain that these can be replicated elsewhere given the robust global literature reviews and the theories adopted (see [Cresswell, 2014](#)).

## Final recommendations

Equality in every society needs to be upheld with diligence by ensuring that learners are provided with equal access to quality and equitable education. While South Africa has advocated for equal access to quality education through many instruments, OPI has presented us with a gloomy picture. It has been recommended that teachers should be given enough CPD for them to be able to effectively function within the dynamic 4IR contexts. This will help motivate both teachers and learners to begin to value 4IR in education. There is also a need for collaborative efforts to ensure security of the learners and the devices through community mobilization and sensitization. Schools should be seen as belonging to the communities not the government. There is also a need for urgently revising OPI 4IR policy as it is based on obsolete tools, skewed theories, and it is just in the wrong alley.

## Areas that need further research

The current study has only focused on the role of 4IR in promulgating curriculum (in) justices in South African basic education. There is therefore need for another longitudinal study to focus on how to improve 4IR in other educational contexts such as higher education contexts. There is also a need to analyze how 4IR in education can improve critical thinking skills and academic performance among learners in basic education and higher education too. Further research should also focus on learners' motivation behind the use of 4IR over f2f within different educational contexts.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by the University of Johannesburg Education Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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## Author contributions

NS did all the groundwork including developing the research instruments, conducting the interviews, and data analysis. MC worked on the literature reviews, primary editing and reference profiling. JD worked on general supervision, guidance and sourcing funding for the project including secondary and final editing. All authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer MA declared a shared affiliation with the author to the handling editor at time of review.

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