COVID-19 and the Digital Transformation of Education: What we are learning in South Africa

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Abstract

The study sought to gauge the impact of COVID-19 pandemic in unleashing digital transformation in the education sector in South Africa. In order to gauge the impact, the study tracked the rate at which the 4IR tools were used by various institutions during the COVID-19 lockdown. Data were obtained from secondary sources, mainly newspaper articles, magazines and peer-reviewed journals. The findings are that, in South Africa, during the lockdown, a variety of 4IR tools were unleashed from primary education to higher and tertiary education where educational activities switched to remote learning (online learning). These observations point to the fact that South Africa generally has, some pockets of excellence to drive the education sector into the 4IR, which has the potential to increase access. Access to education, particularly at a higher education level, has always been a challenge due to a limited number of spaces available. Much as this pandemic has brought with it massive human suffering across the globe, there is an opportunity to assess successes and failures of deployed technologies, costs associated with them, and scaling these technologies to improve access.

Key Words: COVID-19, Digital Transformation, Education, 4IR, South Africa

1. INTRODUCTION AND BACKGROUND

According to Sansa (2020), COVID-19 is the novel coronavirus which goes with the name severe respiratory syndrome coronavirus-2 (SARS-COV-2). Scientists have associated this virus with the disease referred to as COVID-19, and it was first identified in China at the end of 2019 in Wuhan City (Sansa, 2020:1). Prior to the outbreak of COVID-19 pandemic the world was dealing with learning crisis, evidenced by high levels of learning poverty (World Bank, 2020a:1). The spread of COVID-19 among a number of disruptions to normal life necessitated more than 160 countries to effect temporary closure of schools. The World Bank (2020a) estimates that the closure of schools has left 1.6 billion children and youth out of school. Here in South Africa, government was forces to effect the lockdown which meant that there was closure of all schools, including universities causing a total halt of the learning process. There is concern among some in the society that the wide spread school closures would not lead to loss of learning, but also further loss of in human capital and diminished economic opportunities in the long run (World Bank, 2020b).

Across the world, governments have brought forth some mitigating effects such as utilizing remote learning to manage and cope with the crisis (World Bank, 2020a). Accordingly, the

World Bank is working effectively with many countries to offer support to the efforts currently being implemented by many Ministries of Education to offer remote learning to opportunities while schools are closed (World Bank, 2020a).

Further, many organizations are partnering with the World Bank to provide mechanisms of offering remote learning using various information communication tools. These organisations include, among others:

- mEducation Alliance,
- UNESCO,
- Learning Keeps Going US consortium, and
- Inter-*Agency Network for Education in Emergencies and Commonwealth of learning* (World Bank, 2020c).

Since COVID-19 is a new occurrence, there hasn't been work that has investigated the roll-out and adoption of on-line learning platforms. As such, the question 'what is the effect of COVID-19 in speeding up digital revolution for the purpose of education?' With this article, authors investigate the influence of COVID-19 in speeding up the use of the Fourth Industrial Revolution (4IR) tools as a platform for providing learning.. The paper is organized as follows: The first section will provide a background of the 4IR and, the tools available for use in the education sector. A brief description of the education sector in South Africa will follow. This is followed by the literature review and a background of COVID-19. The next section will outline the methodology then result, discussion and policy recommendation.

2. THE FOURTH INDUSTRIAL REVOLUTION

4IR is described by Schwab (2016) as 'the advent of cyber-physical systems involving entirely new capabilities for people and machines'. Accordingly, Schwab (2016) observes that while these capabilities are reliant on the technologies and infrastructure of the third industrial revolution, 4IR represents entirely new ways in which technology becomes embedded within societies and even our human bodies (Schwab, 2016, Shava & Hofisi, 2017). It is on this regard that the 4IR definition makes references to the blurring of lines between the infotech and the biotech.Given this blurring of lines, 4IR is defined as 'the fusion of technologies that is blurring the lines between the physical, digital, and biological worlds (Schwab, 2016, Deloitte, 2018). 4IR is affecting almost every facet of our daily life, impacting how individuals relate with technology and changing how and where work is done (Deloitte, 2018; Schwab, 2019a, Schwab, 2019b). This revolution builds on the third industrial revolution, but it puts together technologies from the digital, physical and biological worlds (Schwab, 2016).

With the changes brought forth by 4IR, the World Economic Forum (WEF) estimated that 65% of children entering primary schools today will end up working in entirely new occupations or jobs that do not exist now (Schwab, 2016b). In most cases, 4IR has been viewed as a threat to jobs as well as the ordinary way of doing things. Some had gone to the extent that they would argue that organizations' were not ready for 4IR.. With the emergence of the COVID-19 pandemic, many organizations were forced to completely shut down or to reconsider the use of 4IR tools.Various technologies power the 4IR concept. These technologies include among others; Artificial intelligence and robotics, Ubiquitous linked sensors, Virtual and augmented realities, Additive manufacturing, Blockchain and distributed ledger technology, Advanced materials and nanomaterials, Energy capture, storage and transmission, New computing

technologies, Biotechnologies, Geoengineering, Neurotechnology, Space technologies (Schwab, 2016).

There are collection of technologies driving the fourth industrial revolution today. Below is a list of some of these technologies as explained by Schwab (2016). Another way to appreciate the fourth industrial revolution is to know the technologies driving this revolution. The tools include but not limited to the following: Artificial intelligence and robotics, ubiquitous linked sensors, virtual and augmented realities, additive manufacturing, blockchain and distributed ledger technology, advanced materials and nanomaterials among many others (Schwab, 2016). 4IR is at a nascent stage. Therefore, it is expected that some organizations' may not have adopted it. There will be universities as well as schools that would have totally shut down with the lockdown because there was no preparation for such an event. This is expected to be a common feature in the African continent due to infrastructural challenges, broadband and the cost of data. In South Africa, the lockdown would be expected to affect the majority of public schools, particularly those that are in the townships and rural areas of the country.

3. THE EDUCATION SECTOR IN SOUTH AFRICA

The education sector in South Africa governed by two national departments, namely the Department of Basic Education (DBE), which is responsible for primary and secondary schools, and the Department of Higher Education and Training (DHET), which is responsible for tertiary education and vocational training. Before 2009, these two departments were represented in a single Department of Education. The DBE department is responsible for public schools, private schools (also referred to by the department as independent schools), early childhood development (ECD) centres, and special needs schools. Public schools and private schools are collectively known as ordinary schools and comprise roughly 97% of schools in South Africa. The DHET for further education and training (FET) colleges, adult basic education and training (ABET) centres, and higher education (HE) institutions (DBE, 2015).

South Africa has nine provinces, namely; the Free State Province, Limpopo Province, KwaZulu Natal Province, the Eastern Cape Province, the Western Cape Province, the Northern Cape Province and the Gauteng Province, Mpumalanga Province and the North West Province. These nine provinces have the provincial education departments that are responsible for implementing the policies of the national department, as well as dealing with local issues.

4. COVID-19 IN SOUTH AFRICA

As outlined in the introduction, COVID-19 was first identified in the Hubei Province, City of Wuhan, China in the latter part of 2019. Soon, this diseased wreaked havoc and the devastating effect of the pandemic forced the World Health Organisation (WHO) to declare it as a global pandemic. In South Africa, the first confirmed case of COVID-19 was recorded on 5 March 2020. The fear that the rate at which the pandemic was to infect people motivated the South African government to declare this pandemic a national state of disaster in terms of the Disaster Management Act (Government of South Africa, 2020). The national state of disaster declared on 15 March 2020 by the President of South Africa, President Cyril Ramaphosa initially containedpartial travel ban, travel advisories, discouraging public transport, the closing of schools, and prohibiting gatherings of more than 100 people. Subsequently, on 23 March 2020, President Ramaphosa issued a national lockdown that would last for 21 days from 26 March 2020 to 16 April 2020 (Government of South Africa, 2020). The lockdown meant that among other organizations that would immediately close was schools and all institutions of higher

learning. On the 9th of April 2020, the President of South Africa announced that the lockdown would be extended by a further 14 days (Government of South Africa, 2020).

With the national lockdown, it would mean that the academic calendar for the year 2020 would be affected. In order to reduce the extent of academic disruptions, several learning institutions responded by moving some of the courses to their online platforms. For basic education, some Non-Governmental Organizations made learning material available.

5.   BRIEF REVIEW OF LITERATURE ON COVID-19

The evidence provided in the literature indicates that the source of the COVID-19 is animals and the virus spread from human to human transmission (Sansa, 2020). Sansa (2020) went on to state that the COVID-19 virus the virus is transmitted through respiratory droplets that human beings sneeze, cough, or exhale. Literature on its influence on the use of 4IR tools is still limited.

McKibbin (2020) in the article*, the global macroeconomic impacts of COVID-19: Seven scenarios* argued that the evolution of COVID-19 is uncertain and making it difficult for policymakers for policymakers to formulate an appropriate macroeconomic policy response. In a way to understand possible economic outcomes, McKibbin, (2020) explored seven different scenarios of how COVID-19 might evolve in the coming year using a modelling technique. It examines the impacts of different scenarios on macroeconomic outcomes and financial markets in a global hybrid DSGE/CGE general equilibrium model. The study finds that even though the pandemic is contained, it could significantly impact the global economy in the short run. These scenarios demonstrate the scale of costs that might be avoided by greater investment in public health systems in all economies but particularly in less developed economies where health care systems are less developed, and population density is high.

Baldwin (2020) also discovered COVID-19 has both supply-side shocks and demand shocks. They went on to argue that both aspects will have an impact on international trade in goods and servicesAtkeson (2020) in the study, '*What Will Be the economic impact of COVID-19 in the US?'* introduced a simple SIR model to economists of progression of COVID-19 in the United States over the next 12-18 months. The model was built on the SIR model of Markov model of the spread of an epidemic in a population in which the total population is divided into categories of being susceptible to the disease (S), actively infected with the disease (I), and recovered (or dead) and no longer contagious (R). In the model how an epidemic plays out over time is determined by the transition rates between these three states. The model allowed for quantitative statements regarding the trade-off between the severity and timing of suppression of the disease through social distancing and the progression of the disease in the population.

In their work Wenham et al. (2020) found that, 'there was gender analysis of the outbreak by global health institutions or governments in affected countries or in preparedness phases'. . Wenham et al. (2020) went further to argue that *the closure of schools to control COVID-19 transmission in China, Hong Kong, Italy, South Korea, and beyond might have a differential effect on women, who provide most of the informal care within families, with the consequence of limiting their work and economic opportunities.*

6. METHODOLOGY

The study was chiefly based on the review of secondary data sources; mainly newspaper articles, magazines and peer-reviewed journals. The study benefited for recently published journals, policy and reports from national and international organizations. The conceptual

nature of the article presents a particular limit due to the limited nature of data and the fact that both the 4IR and the COVID-19 are current events.

7. THE IMPACT OF COVID-19 ON DIGITAL TRANSFORMATION TOWARDS THE 4IR

The outbreak of COVID-19 came as a wake-up call to the education sector in South Africa, from primary, secondary and tertiary education., We argue that it will be difficult for the education sector to go back to the old ways of teaching as the issues of social distancing will remain active to avoid the spread of the virus. Discussions around online learning, use of television, and radio for revision began to occupy the corridors of the education sector immediately after the reality of lockdown. As such, several responses have been mounted by various organizations' to mitigate against the loss of time because of the lockdown. We are of the view that this pandemic has acted as a driving force towards digital transformation in the education sector. In this regard, to determine how the sector has responded to the pandemic as a mitigation that ensures that learning continues, we have extracted some of the the tools used by the sector during the lockdown.

Figure 1: Table of the 4IR tools used during the lockdown

Virtual learning tools during lockdown					
Tools Used	*Description*	*Connectivity*	*Platform*	*Conditions of Use*	*Target Group*
Television (SABC, DSTV ,E.tv,)	*Teachers delivering lessons live to learners on TV*	*Offline*	*Television desktop*	*Free (lockdown)*	*Primary Secondary*
Radio (SABC)	*Teachers deliver lessons live to learners*	*Offline*	*Television desktop*	*Free (lockdown)*	*Primary Secondary*
Use of free zero-rated applications and educational websites					
Mobile Platforms and applications(Vodacom , Cell C, MTN)	*Learners access learning material from educational and informational (reference) websites*	*Online*	*Desktop laptop mobile*	*Free (lockdown)*	*Primary Secondary Tertiary*
STEM lockdown digital school(Sasol Foundation(SF), African Teen Greek)					

Internet (website),(Ms Zora, SF, Siyavula, DBE)	*Teachers in public and private schools offer classes through a live stream*	*Online*	*Desktop laptop mobile*	*Free (Lockdown)*	*Primary Secondary*
Facebook(Ms Zora)	*Teachers in public and private schools offer classes through a live stream*	*Online*	*Desktop Laptop mobile*	*Free (lockdown)*	*Primary Secondary*
Twitter(Ms Zora)	*Teachers in public and private schools offer classes through a live stream*	*Online*	*Desktop Laptop mobile*	*Free (lockdown)*	*Primary Secondary*
Remote Learning (Online learning)					
Internet (Websites) YouTube(Mostly all universities)	*Leaners Learn on their own at home*	*Online*	*Desktop Laptop mobile*	*All rights reserved*	*Tertiary Primary Secondary*
Microsoft Teams(University of Johannesburg)	*Used mainly by staff and learners in tertiary institutions to hold discussions*	*Online*	*Desktop Laptop mobile*	*Freemium*	*Tertiary*
Skype	*Used mainly by staff and learners in tertiary institutions to hold discussions*	*Online*	*Desktop Laptop mobile*	*All rights reserved*	*Tertiary*
WhatsApp groups	*Used mainly by staff and learners in tertiary institutions to hold discussions*	*Online*	*Desktop Laptop mobile*	*All rights reserved*	*Tertiary*
Zoom	*Group discussions*	*Online*	*Desktop Laptop*	*Freemium*	*Tertiary*

Source: Authors' Analysis

The table above demonstrate the 4IR technologies used in South Africa during the lockdown. These technologies were used in various platforms created by various private institutions in partnership with the government of South Africa in a way to combat the effects of COVID-19

on education. The following section is explaining the programs where 4IR technologies were used during the lockdown period in South Africa.

7.1 Digital transformation towards 4IR in the education sector in South Africa during lockdown

7.1.1 Virtual learning during lockdown

As presented by the government of South Africa and various sections of the media of South Africa made some provisions for virtual learning. The initiative was led by the ministry of the communication and digital technologies through the minister where the announcement was made that the departments of communications and digital technologies and basic education have joined forces, to ensure virtual learning is a reality during the nation-wide lockdown (Itweb, 2020). This move necessitated by the closure of schools during the lock down and to mitigate the impact of COVID-19 on the education sector. The other reason is that the country was not prepared for the disruption as a result, bringing in virtual classes was a way to find possible ways technology could help address the disruption as a result of COVID-19 (Itweb, 2020b).

In this initiative, the public broadcaster, the South African Broadcasting Corporation (SABC) and DSTV channel 180 availed channels entirely dedicated to education (Government of South Africa, 2020). In addition to that, the national broadcaster added two studios where the broadcast of the virtual classrooms would take place. In these studios, teachers deliver lessons live to learners, not pre-recorded lessons. This was done through virtual classrooms, teaching children as they would be in a classroom. The government also indicated that 'E.tv has allocated a dedicated channel for 3 months on the open view platform' (Government of South Africa, 2020).

Further to the initiatives above, the government availed, broadcast of lessons on community radio stations around the country. The use of radio and television to introduce virtual classes necessitated by COVID-19 in South Africa demonstrate that South Africa is capable of transforming the education sector towards the 4IR.

7.1.2 Use of free zero-rated applications and educational websites

The other platform used to ensure that learning progressed smoothly were zero-rated applications and websites. The government of South Africa indicated that electronic readers available via all platforms in partnership with major cellphone networks in South Africa i.e. Vodacom, MTN, Telkom and Cell-C as well as 2Enable App as a freely downloadable educational platform with more than 2000 electronic readers in the indigenous languages (Government of South Africa, 2020). In addition, the Tec financials (2020) reported that in the days after the state President's first announcement of measures to combat the spread of the coronavirus on the 15th of March 2020, many schools had successfully taken the curricular online. As such, for many students, it wasback to school on that week, albeit from home.

In-order to successfully execute the task at hand, Tec financials (2020) indicate that teachers created lesson plans, activities and assignments to complete; to ensure that students do not miss out on crucial learning during the lockdown. These materials were available and accessed online. In addition to that, South Africa's mobile networks gave room to students across the educational divide to access teaching materials through zero-rated educational and informational (reference) websites (Tech Financial, 2020). The government also indicated that

they would also promote the African Storybook series through the 2Enable App (Government of South Africa, 2020).

It interesting to note that few days into the lockdown in South Africa, data traffic surged between 35% and 60%, as reported in almost all local networks (Itweb, 2020b, Tech Financials, 2020). Mobile networks dropped data costs; however, due to poverty, which limits access, some pupils were still not able to have access. The introduction of electronic readers for pupils via on-line platforms in partnership with Vodacom, MTN, Telkom and Cell C made it possible for pupils to have access (Government of South Africa, 2020). Pupils were also gaining free access to Siyavula Maths and Science support in partnership with MTN, according to the department of education (DBE) (Government of South Africa, 2020). Government noted with concern that even though mobile network operators in the country had started to drop data costs, some in the country were unable to access the rich content that's been made available, due to issues of broadband access or network capacity. We see the extensive use of zero-rated applications and websites during the lockdown as building block towards pushing the education towards 4IR.

7.1.3 Launching of STEM Lockdown Digital School

The COVID-19 pandemic took the education sector by surprise. Even though the department had been implementing digital technology in the department of basic education, the process was slow. However, immediately after the lockdown, the Department of Basic Education launched a stem lockdown digital school in partnership with the of the non-profit coding organisation Africa Teen Geeks. On the other hand, the Sasol Foundation has introduced a free science, technology, engineering and mathematics (STEM) Lockdown Digital School, through the artificial-intelligence-based educational platform, Ms Zora (African Teen Geeks, 2020, City Press, 2020).

The programmes took more than 34 teachers who work in both public and private schools to offer classes through a live stream on Africa Teen Geeks' social media pages, Facebook, Twitter, Ms Zora and its and its website (IOL, 2020, Polity, 2020). The lecturer at the University of Witwatersrand's Department of Occupational Therapy Amanda Calitz, supervises the programme (City Press, 2020, Government of South Africa, 2020, ILO, 2020). The programme offered lessons from grade R up to grade 12. The good part of the programmes were that, these programmes were being offered at no cost and the sessions were being recorded and posted on the DBE Website so that students will have access all the time. With this programme, pupils were able to access lessons on websites, and on social media for free. However, the greatest challenge remained the targeting of learners in rural areas, especially those without access to the internet. Even with the challenges, we are of the view that the introduction of this stem lockdown digital classroom in a way improved the digitalisation of the education sector. The important aspect is for the system to continue even after the lockdown. This could be done done following the exensive analysis of the performance of these programmes after the lock down.

7.1.4 Switching to remote learning on-line learning

The reality of the lockdown has forced many institutions of higher learning to switch to on-line learning. Several universities in South Africa switched to on-line learning even though they are yet to officially announce the move. For instance, the University of Johannesburg,the University of Cape Town and the University of Pretoria announced to their students that they would conduct learning on-line in their second semester to ensure social distance (Universities

South Africa, 2020). We see this change as the begining of the process that will move education to 4IR where learning will be digital with a few occasions of face to face engagements.

Apart from what the Universities are doing with regards to the on-line learning, the Department of Basic Education has also published study material including *textbooks, worksheets, revision booklets, and study guides on their website*. In Cape Town organisations joined the effort to offer free on-line learning for school pupils during the lockdown. Organisations such as Worksheet Cloud, together with My School My Village My Planet provided funding for this programme (ILO, 2020).

The lesson called Worksheet Cloud Live Lessons, are free and are being offered to grades 3, 4, 5, 6 and 7. The lessons were for mathematics, English and natural science. In these lessons, students are enjoying unlimited and free access to live live-streamed on-line classroom everyday. The lessons offered are free, where parents can easily have access for their kids. There were other many useful sights for students where they were able to study online, for instance, Vodacom e-school, Department of Basic Education website, Olico Maths education, Gauteng department of education and IXL (ILO,2020). Efforts to intensify on-line learning were there in the education sector in South Africa.

In October 2019, the Gauteng Department of Education (GDE) officially launched its digital content and on-line assessment platform. The platform aims to increase access to digital content as well as enhance opportunities for continuous assessment activities to support curriculum delivery in ICT-enabled schools. However, the process was changed with the the pandemic and the GDE enhanced this further to reach partnership agreements with DStv, Vodacom and Telkom, to broadcast various school lessons during the lockdown period. The GDE improved on-line learning through various mechanisms which include, the DStv partnership where mind-set on channel 318, which will carry most grades except grade four to nine, and a pop-up channel on 317 that will carry content for grades four to nine.

In reality, we are of the view that the COVID-19 has transformed the mode of teaching in the education sector. Tertiary institutions are nowintensifying their offering towards providing learning on-line using Youtube, Microsoft teams, Zoom, Skype, WhatsApp, and DStv. This study shows that COVI-19 has had a great influence to the education sector to use various 4IR tools.

8. CONCLUSION AND POLICY RECOMMENDATIONS

In this study a secondary research was done to understand the impact of COVID-19 in influencing the digital transformation in the education sector. In essence, the study investigated the how the education sector adopted the use of 4IR tools during the COVID-19 lockdown period. The study was based on the reviewing of secondary data sources; mainly newspaper articles, magazines, peer-reviewed journals and recently published journals and policy reports from national and international organisations. Our finding is that in South Africa, during the lockdown, the education sector massively adopted different 4IR tools (digital transformation) from primary education to higher and tertiary education. The lockdown motivated the creation of virtual learning, the use of free zero-rated applications and educational websites, launching of STEM lockdown digital school and finally, the sector generally switched to remote learning (online learning). This suggest that during the lockdown, a variety of 4IR tools were unleashed from primary education to higher and tertiary education where educational activities switched to remote learning (online learning).

These observations point to the fact that, South Africa generally has, some pockets of excellence to drive the education sector into the 4IR which has a potential to increase education

access. Access to education, particularly at a higher education level has always been a challenge due to a limited number of spaces available. Much as this pandemic has been brought massive human suffering across the globe, this present an opportunity to assess successes and failures of deployed systems, costs associated with them, and scaling this to improve access.

As a result, the government of South Africa should propose mechanisms of fiscal expansion to try and provide funding to move some aspects of education online and promote the adoption of the 4IR. An in depth analysis of the strengths and weaknesses of the systems put in place during the lockdown should be conducted. This could be accompanies by a cost-benefit scenario analysis of each technology adopted as a stop-gap measure during the lockdown

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