

# The Impact of the Fourth Industrial Revolution on Education in South Africa

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## Introduction

The 4IR is not something that is being predicted – it is happening right now, here in South Africa and across the globe. Even if there are aspects not happening locally, globalisation will ensure that significant changes over which we have no control will influence such diverse activities as manufacturing processes, service industries, energy development, medical procedures and weapons production. This will result in disruptions to areas such as the economy and labour markets, producing positive outcomes

for some, and very negative outcomes for others.

The 4IR pushes us to question what it means to be human in the 21st century. This question demands a firm response, not just from economists and business leaders, but also from schools and education authorities. Students at universities and other higher education institutions will graduate in the midst of the 4IR, and they need to be prepared for what this will entail. The 4IR must be humanised. UJ, for instance, has begun to address the issues of large classes by offering more online courses and hybrid courses, so

that disadvantaged students have access to university education.

**Can technology enhance learning and teaching?**

Universities can do several things when it comes to the 4IR. They can teach about the 4IR in their Science, Technology, Engineering, Arts and Mathematics (STEAM) classes. Students need to understand what is happening in the world around them, how it is happening and why it is happening. The 4IR is not a mystery, and its basic processes can be the subject of investigation, questioning and interrogation. As shown in the collection of subjects above, the 4IR is not just about technology, but also about the arts, and this includes social sciences, philosophy and the rest of humanities.

The 4IR technologies have significant social implications related to job creation, employment opportunities, equality, racialisation and the ongoing development of a fair and just society. Of course, students should be taught to understand the scientific basis of these new technologies, but equally, they should also learn about the social impacts that these will have. Students themselves should be taught to be innovative and creative when it comes to new technologies, but they should also be able to question the underlying values and what is right and wrong in the use of such technologies. Gene editing, roboticised workforces, and 3D-printed automatic weapons are examples of technological advances, but they also raise important questions about human values and how they might be preserved, in this brave new world.

Universities can also teach using 4IR technologies. Social robots have already been shown to be useful adjuncts in the teaching of students with certain special needs. A recent study identified over 300 academic papers that have explored the issue of robots in the classroom and educational contexts. AI can create databases of assessment items that can provide feedback to students on their learning progress. What is more, based on student responses, computers can generate new items that respond to a student's level of learning. 3D printers are already being used in some university systems, requiring design skills of a very high order to create new and innovative products. It is not too much to say that 3D printing

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has turned design education on its head.

Virtual Reality has been shown to work throughout different levels of academic learning, heightening subject engagement, enlivening teaching and facilitating learning. It can provide for independent and personalised learning, even in the context of a common curriculum, as students can dictate their own pace to move towards desired outcomes. Together, these 4IR technologies revolutionise what is meant by university education – providing opportunities to make it not only engaging, but also relevant and linked to the real world.

Universities also have an important role in preparing students for the 4IR. The key skills and values of creativity, critical thinking and problem solving have been widely endorsed and there should be nothing in the university curriculum that does not facilitate these skills and values. If computer coding can lead to innovative, creative and critical thinking in students, then it has a role to play in university education; if it is only about the routine application of rules, then it does not. A robot can apply rules – and therefore computer coding must contain elements that use human skills as well as technical skills. This raises a key issue. Along with the skills and values referred to above, there must be one other key component: the curriculum must teach students what it means to be human. It is essential to question and understand what makes humans human, and how to be more so: this is an essential complement to being a creative, critical problem solver.

**How are we to get there?**

Nineteenth-century universities cannot prepare students for the 21st century. Academics need to be equipped with new teaching methods and approaches, and new resources and funding are needed to transform education so that it can meet

the needs of the 4IR. Businesses and the South African government cannot plead poverty when it comes to equipping universities for this kind of education. The absence of resources will impede progress, and this will be to the detriment of the whole of society. In particular, it will affect the most vulnerable in society and those for whom universities are the only social safety net for 4IR-readiness. A key driver in 4IR-education is the social media revolution, embodied by platforms such as Facebook, Twitter, WhatsApp and Tencent. These platforms have revolutionised the way we communicate instantly across continents. Currently, more than 30% of people in the world use social media services to communicate and stay abreast of world events.

These innovations can create a true global village, bringing billions of more people into the global economy. They can bring access to products and services to entirely new markets. They can give people opportunities to learn and earn in new ways, and they can give people new identities as they see potential for themselves that was not previously available. These are important conversations, but in our context how do we ensure employment and improved livelihoods for the young people in South Africa begging at traffic lights? It may be useful to turn to other countries for examples – in China, for instance, an introverted newlywed uploads videos of hilarious antics onto social media. Thousands of Chinese people, young and old, view these videos, which act as a stress-reliever after a demanding work day. Young people are able to generate an income through uploading videos such as these, which improves their lives, as well as those of their extended families. South Africa's unemployed youth are talented, as evidenced – for instance – in the mimed shows that we see at traffic lights. These involve using Emotional Intelligence (EQ), more than AI, as the performers must predict what their audience will appreciate.

China's President, Xi Jinping, told a graduating class that EQ is "more important than IQ" and is a competence that should be pursued in the educational milieu (China Daily, 2013). The news made the front page of Chinese newspapers. It goes without saying that IQ also matters in achieving success at university. This argument applies to AI as well. We can describe AI as "stoic" – it does not vary in its performance, and

therefore is unlikely to be outstanding or below par. This feature of AI can be seen in the Google maps voice guide: while the voice is comforting, especially when driving at night, it is stripped of any emotion. Artificial intelligence requires human intervention and control, and this is when EQ is especially valuable.

The advent of the printing press allowed writers to produce their literature in mass quantities in a short amount of time, as opposed to writing each document by hand. Much like the printing press once did, the internet and social media have changed the face of journalism, film, television and the Humanities forever. In the past, the sharing of information always entailed some delay between the time an event happened and the time the information was presented to the consumer. Prior to the advent of television, we received the news through the newspaper. This form of journalism caused an approximate 24-hour delay, as it required writing the article, printing the newspaper and eventually delivering it to the consumer the next day. Social media ensures that a news article is received on a smartphone about as fast as the author can write it. The use of smartphones and social media has ushered in a new era of journalism, as net citizens play a bigger role in the process of news making. Through platforms like Twitter and YouTube, citizens can produce and circulate their own news stories, which are then often picked up by traditional news sources. Large news corporations used to have immense power over citizens, as they controlled the spread of information which they could use to influence the population. Nowadays, the internet allows citizens to share information amongst themselves more easily, which has led to a decline in the consumption of traditional news media. Social media has given power back to the people. Artificial intelligence, robotics, bioengineering,

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The workplace competencies that independent studies have identified as distinguishing outstanding performers and leaders from the average person are largely based on EQ, particularly as you go higher up the organisational ladder. Online shopping and delivery services—including by drone—are already redefining convenience and the retail experience. Students are experimenting with designing and building drones, which would expand their entrepreneurial competencies. Ease of delivery can transform communities, even in rural areas, and boost the economies of small or remote areas. Digital technology can liberate workers from automatable tasks, allowing them to concentrate on addressing more complex business issues and giving them more autonomy. It can also provide students with radically new tools and insights to design more creative solutions to previously overwhelming problems.

**What is the commitment of the South African government?**

A Presidential Commission, chaired by President Cyril Ramaphosa, will assist the South African government to take advantage of the opportunities presented by the 4IR. Relevant policies, approaches and action plans will be designed, placing South Africa as a viable global player. A recent summit marked the consummation of a partnership between the newly-renamed Department of Communications and Digital Technologies (DCDT) and 4IR South Africa (4IRSA), which is an alliance between Telkom, Deloitte and the universities of the Witwatersrand, Johannesburg and Fort Hare. The partnership has extended to include global technology giant Huawei and local mobile communications company Vodacom.

Digital devices are now ubiquitous in modern societies, even though there is a significant digital divide both within and across societies. Those who have access to smartphones, computers and portable/wearable devices of different kinds have engaged with the 4IR, and daily living is constructed around these devices. Smartphones include cameras, platforms for multiple applications including banking services, games, access to e-mail, social media and methods of payment.

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**What must we be wary about in the 4IR?**

Social media can erase borders and bring people together, but it can also intensify the social divide. Cyber-bullying, hate speech and the circulating of false news are some examples of the negative aspects of social media. We have to decide what kind of social media rules we want to establish. We also have to accept that social media is remodelling what we value and how we generate and deploy those rules. The 4IR may have the power to change the world positively, but we have to be aware that the technologies can have negative results if we do not think about how they can change us. We build what we value. This means we need to be cognisant of our values as we create with these new technologies. If we value money above family time, we can build technologies that help us make money at the expense of family time. In turn, these technologies can create incentives that make it harder to change that underlying value. Our intricate relationship with technology means that the technological devices we develop are how we create our world, and we have to develop them with care. More than ever, it is important that we begin right.

**“We have to win this race between the growing power of the technology, and the growing wisdom with which we manage it. We do not want to learn from mistakes.” — Max Tegmark**

Biotechnology can lead to controversial advances such as designer babies, gene drives (changing the inherited traits of an entire species), or implants being required for people to become competitive candidates for schools or jobs. Innovations in robotics and automation can lead to lost jobs, or at least to jobs that are very different and value different skills. In addition, being constantly connected can turn into a liability,

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with no respite from the continuous overload of data and connections. The lessons of previous industrial revolutions include the realisation that technology and its wealth generation can serve the interests of small, powerful groups above the rest. New technologies built on global digital networks can be used to keep societies under undue surveillance, while cyberattacks make us vulnerable to physical and verbal abuse. These are some of the challenges we face in our attempts to ensure that technology and politics do not create disparities that hinder people.

According to the World Economic Forum Global Risks Report 2017, the 4IR has the potential to raise income levels and improve quality of life for all people. In the context of South Africa, these promises are reminiscent of electioneering slogans. Against a backdrop of load shedding, rampant poverty and erratic connectivity, we recognise that the improving of lives in the 4IR will be slow. In South Africa, the economic benefits of the 4IR are becoming concentrated among a small group. This increasing inequality can lead to political polarisation, social fragmentation, and a lack of trust in institutions. To address these challenges, leaders in the public and private sectors need to have a deeper commitment to more inclusive development and equitable growth that lifts up all people. The “digital revolution” has already changed people’s lives in many ways, with technological devices supporting and supplementing basic human functions. However, even though phone companies continue to upgrade and refine their products – with better cameras, better wearable devices and larger processing capacities catering for what often seems like an infinite number of applications – this is often product enhancement, rather than innovation.

The 4IR, on the other hand, is much more than

the production of powerful devices. Like the digital revolution, the 4IR relies on technologies, yet these technologies have the capacity to perform what have until now been considered human tasks. These might be robots capable of giving directions at a railway station, or assisting with medical procedures, or interacting with autistic children in classrooms. It could be 3D printers capable of producing body parts, weapons or even houses. It might be driverless cars. It might be computers that do not need to be continuously programmed, because they can re-programme themselves based on the data they collect. This big data can make predictions about anything, from identifying the optimal marketing strategy to who will win an election.

### Conclusion

Many people in South Africa are ambivalent about the technological implications of the 4IR. Films like *I, Robot*, *Star Wars* and the like only exacerbate this fear. Kathleen Fitzpatrick explains that techno-pessimism arises out of a blindness “to signs of literary culture’s continued proliferation, including the increasing number of devices, platforms, and services through which we read today” (2012). She further avers that this kind of apprehension about technology is nothing new. The Greek philosopher Plato maintained that writing would produce forgetfulness – if you can write things down, there is no need to remember them – while the English poet Alexander Pope described the invention of printing as a “scourge for the sins of the learned” (Fitzpatrick, 2012). The 4IR is changing our educational environment, and we need to embrace this change and evolve.

This argument relies on an analysis by Kerry J Kennedy – “Another Industrial Revolution: what schools need to know” – first published in the Daily Maverick on 25<sup>th</sup> February 2019. ■

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