

Critical Skills for a New Revolution

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INTRODUCTION

Threats and opportunities are evident in each revolution. Technology has made our lives easier but how great is the threat to employment and how will education need to adapt to this new world?

Britain's economic development occurred during 1760 to 1840 where the term Industrial Revolution was first popularised by English economic historian, Arnold Toynbee. Henry Ford is thought to have been the forerunner of the second industrial revolution early in the 20th century as he ushered in the age of mass production with a moving assembly line. Robots removed the tedium of working in a factory and people generally were more prosperous. However, urbanisation and pollution were two of the challenges arising from these revolutions. Automation made work tasks easier, but gradually machines replaced people. In the digital age instructions are sent via computer to machines who then cut, weld, pick up etc. But, with the use of robots, androids and AI software, a quantum leap forward in technology has occurred, with physicists such as Stephen Hawking saying that when AI becomes clever enough for robots to reinvent themselves, we are in a lot of trouble.



A Watt steam engine. The steam engine that propelled the Industrial Revolution in Britain and the world.

Jobs for robots

Automation has gone further as we now see robots in jobs such as meet and greet persons, secretaries, tour guides, taxi cab drivers and others. Prof. Nadia Thalmann from the Nanyang Technological University, Singapore has an android receptionist called Nadine. Nadine is a brunette with soft, white skin and has been said to be the most human-like of robots in functionality. She smiles, shakes hands, and makes eye contact when answering you, (Burns 2016). Ms Thuman who developed the software predicts that socially-intelligent robots such as what we saw in *Star Wars* as C-3PO, the golden droid, who had knowledge of language and etiquette, will lead to friendships between humans and machines in the not too distant future. We learn in the same article that the renowned roboticist, Hiroshi Ishiguro, is able to create lifelike humanoids capable of displaying emotion and other human-like traits.

Abdullah (2016) reported that Singapore launched driverless taxis and is the first country to use this technology. nuTonomy executive, Doug Parker, whose company partnered with the Singapore government on the project, envisages that 100 taxis would be working commercially in the Southeast Asian city state by 2018.

Thrun, Benezit, Burgard, Cremers, Dellaert, Fox, H'ahnel, Rosenberg, Roy, Schulte, Schulz (1999) from the School of Computer Science at the Carnegie Mellon University Pittsburgh and the Computer Science Department III University of Bonn Germany headed the research of a mobile robot, known as Minerva, whose job would be to educate and entertain people in public places. Minerva guided people through the Smithsonian's National Museum of American History moving at a speed of 44 km during a two week trial run in 1998 in an exhibition hosted by its Lemelson Center for Invention and Innovation. Although this event took place 18 years ago it sets the scene for what is to come.

The Japanese lead the robot revolution, according to McCurry (2015) who comments that Professor Hiroshi Ishiguro, from Osaka University's Intelligent Robotics Laboratory, insists that Erica is the most beautiful and intelligent humanoid robot in the world. Professor Ishiguro is the group's leader of a collaborative effort between Osaka and Kyoto universities, and the Advanced Telecommunications Research Institute International (ATR). McCurry tells of a hotel at the Huis Ten Bosch theme park near Nagasaki which was staffed almost entirely by receptionists, concierges and cloakroom robots. Human colleagues were on hand to deal with any teething problems.

Should we be worried? David Meads, from Cisco Africa, feels there are many opportunities for Africa in the 4th Industrial Revolution. He stressed the importance, though, of digital skills and that industries participate in a growing digital economy. The biggest threat, of course, is digital security. Strong IT skills can be acquired, according to Meads (2017) through programmes available from Vodacom Foundation e-Learning, Telkom Futuremakers, and Cisco Networking Academy, and apparently there are many more. At a World Economic Forum conference held in Durban in May 2017 Meads advised that Cisco, in collaboration with the World Economic Forum Africa, Ericsson, and the Boston Consulting Group, support the Northern Corridor Integration Projects. In 2013, the presidents of Uganda, Rwanda, Kenya and South Sudan decided to include ICT as one of the strategic areas for facilitating integration within the region (Meads 2017).

Predictions from WEF and futurists

Futurist and author, Alvin Toffler, first wrote about lifestyle changes and job locations in *Future Shock*. A short definition for this term is a personal perception of "*too much change in too short a period of time*". Considering he wrote this book in 1970, exponential change has led to more people being interested in the views of futurists.

Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, has been at the centre of global affairs for over four decades. He is convinced that we are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another, which he explores in his new book, *The Fourth Industrial Revolution*. Professor Klaus Schwab (2016) points to real evidence that technologies are having a major impact on businesses and roles as robots replace people. One technology which has become accessible to anyone is the 3D printer which replaces those employees formerly in the production / assembly line.

In WEF's (2015) Global Competitiveness Report statistics on South Africa's performance are highlighted, the most worrisome being the quality of education (120th) and health (128th). Surprisingly "*South Africa also hosts the continent's most efficient financial market (12th)*" – perhaps there has been a change in perception of late.

In a WEF online article (2017), Erik Brynjolfsson, director at the MIT Initiative on the Digital Economy commented that, "*The future is not preordained by machines. It's created by humans.*" Stephen Hawking, rated as one of the greatest physicists alive, and whose views on the future of the world are highly regarded, would disagree. He once commented in an interview with *Wired* that robots could, with the help of AI, supersede humanity. Brynjolfsson does however say that it would be best to not compete with machines, but rather do things they can't do well. He believes that creativity in schools is being stamped out and schools should be considering investing in this skill. Other "soft skills" he mentions are leadership, teamwork and interpersonal skills.

The WEF created the following infographic, which illustrates jobs expected to be in demand and those expected to decline.

Employment outlook across job families jobs change in thousands, 2015-2020



Across major economies - see report for full list.

Source: Future of Jobs Report, World Economic Forum

The role of education in the 4th Industrial Revolution

In our fast-changing world, what is taught will soon become obsolete, and in order to address this, inter and multi-disciplinary learning opportunities should be made available at tertiary level. As Hattingh (2016) comments, there has always been an obsession with training for credits according to the National Qualifications Framework (NQF) to the detriment of the development of skills leading to innovative ideas and problem solving. The development of creative skills is useful in careers that are expected to be complex, fragmented, ever-evolving and collaborative.

The South African Qualifications Authority (SAQA) defines critical cross-field outcomes as “those generic outcomes that inform all teaching and learning”. According to SAQA, CCFOs ‘are those outcomes deemed critical for the development of the capacity for life-long learning’. It is compulsory for standard-setters to incorporate some of the critical outcomes into standards as they are developed, and qualifications must contain all the critical outcomes at the appropriate level on the National Qualifications Framework. Therefore, these skills are not simply “nice-to-have”, but essential to prepare students for their future roles in a fast-changing environment. Hattingh (2016) believes that the Sector Education and Training Authorities (SETAs), the government, and other policymakers need to plan ahead for the eventuality of changes arising from the 4th Industrial Revolution. No education system can keep up with these changes and the curricula needs to be reformulated to include topics such as creativity, problem formulation (rather than problem solving), economic citizenship, emotional intelligence (empathy, intercultural sensitivity etc.) and the ability to adapt.

Teachers are not spared from being replaced as according to George Dvorsky (2017) the host of MOOCs, apps, and computer-aided instruction, will eliminate teaching positions in the near future. He mentions the cost of public education and South Africa’s #Fees Must Fall public drive which has led to Vice Chancellors and other stakeholders having to spend time with the government to discuss how this initiative could be brought into effect. Professor Nico Cloete of the University of the Western Cape commented on this concern recently by saying, “The real issue is that vast numbers of people don’t qualify for university and many struggle when they get there, which is revealed in the high drop-out rate.”

Career counsellors play an important role and the Further Education and Training (FET) colleges should not be at the back of the queue when funding becomes available. These counsellors need to know what jobs will be in demand in the future and what multidisciplinary opportunities are available.

Webber-Youngman (2017) lists the ten skills highlighted by the World Economic Forum (2016) and other than those previously mentioned in this article, emotional intelligence, service orientation, negotiating, and judgement/decision making, feature. He feels that inquiry-based learning (IBL) is a crucial component in getting projects completed on a mine, which is his context. IBL emphasises constructivist learning, first put forward by David Kolb (1984), who introduced experiential learning from a constructivist viewpoint. Essentially this means “learn by doing”, to learn from people, incidents and resources, reflect on this learning, and build on prior knowledge.

Experiential Learning at UKZN

The following examples are the direct experience of the author whilst in employment at UKZN.

The Department of Anaesthetics at the University of KwaZulu-Natal uses expensive (in excess of R1 million), technology to teach students about anaesthetics. Naren Bhimsan gave me a tour of the SMART Centre (Simulated Modules in Anaesthesia and Resuscitation Training) Research Centre at Inkosi Albert Luthuli Hospital. A robot lay on a table (the one in the picture) and the controls were in a separate room. A similar one of a child is also used. The following is extracted from their website.

The SMART* Centre located in the Department of Anaesthetics at Inkosi Albert Luthuli Hospital has the latest in the state of the art hi-fidelity human patient simulators. The centre is currently used in the training of medical students, physicians, nurses and other allied health professionals at our institution. Airway management, complex anaesthetic scenarios, advanced life support as well as ultra sound workshops are some of the exciting programmes currently being offered. High-fidelity patient simulation is an effective way to replicate real-life clinical scenarios. It is an excellent tool to evaluate the response of trainees to a wide array of programmed clinical scenarios. This method of teaching brings back the excitement of working on "real patients" without the risk of death or injury. In addition, the centre is actively involved in research into training and assessment methods. (<http://chs.ukzn.ac.za/research/ResearchCentres.aspx>)



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In other words the demonstrations take into consideration lifestyle, eating habits, stress levels, age, gender etc., and they can simulate a heart attack based on these factors and the prescribed medication. If the “patient dies” the equipment is restarted again.

The Property Development programme has always encouraged students to visit building sites, confer with construction managers, take photographs, and reflect on this learning by recording this information in an academic diary, which forms part of their summative marks for the year. This experiential constructivism approach to learning has proved effective with students more inclined to remembering what they learnt on site. Computer Aided Drafting (CAD) skills have now become essential so that they can be informed when they need to liaise with architects, engineers, quantity surveyors and other property professionals. In fact CAD is so sophisticated now as it allows the simultaneous access of the same file showing layers which reveal brickwork, electrical works, plumbing, etc., at all stages of construction. Technology is therefore highly focussed as IT skills are essential to employment.

At an Architecture Vision Workshop in 2012 one of the author’s suggestions was that students work with regional communities to produce tangible, innovative solutions for the creation of a sustainable society. Innovative architectural creation should continue, but with a culturally responsive teaching approach. Computer Literacy is naturally crucial for students as they are unlikely to obtain employment without it. CAD software is collaborative and cloud-based and is now extremely intuitive, making the process of producing professional drawings that much easier. However, they need to have the theory to

back up their decisions. Before students start the Master's programme they have to spend at least one year in the field and have acquired at least 60% at third year level.

Guaranteed basic income

George Dvorsky (2017) cautions that the stock of robots will quadruple by 2025. Apparently there are currently about 1.75 industrial robots per 1,000 workers in the US. He says that according to an analysis done by the International Data Corporation virtually no job is safe, with managers being the exception. So strong leadership skills will still be in demand.

According to Dvorsky (2017), there is a solution. The guaranteed basic income, also referred to as unconditional or universal basic income, would be a social welfare grant to provide a comfortable living whether the person chooses to work or not. According to Dvorsky (2017), a number of countries are considering this initiative; they include Switzerland, Canada, Germany and Brazil.

Maybe this will even lead to a utopian society as we enjoy more free time to enjoy life while the robots run things. He says there have been a number of developed and developing nations that have considered a guaranteed basic income payable to everyone regardless of status, and provided by the state, in addition to income from other sources. Martin Luther's 1967 speech, *Where do we go from here*, alluded to this concept by saying he was convinced this was the solution to poverty. Esteemed economists, Friedrich Hayek and Milton Friedman support this idea and Friedman advised that it could be handled as a "negative income tax".

CONCLUSION

What this article has neglected to mention is how this robotic technology may be useful in populating other planets. The environments are extreme and would require terraforming in order to make them habitable. Robots would need to withstand extreme weather conditions. US Billionaire and entrepreneurial technologist, Elon Musk believes that by 2060 a million people will live on Mars. The rest of us... we will either be fixing the robots or enjoying a life of leisure with the social grant.

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