THE SOUTH AFRICAN QUALIFICATIONS AUTHORITY

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The South African National Qualifications Framework and the Fourth Industrial Revolution

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DISCLAIMER
The views expressed in this publication are not necessarily those of the South African Qualifications Authority (SAQA).

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KEYWORDS
National Qualifications Framework (NQF), Fourth Industrial Revolution (4IR), Post-School Education and Training (PSET), Quality Assurance (QA), Professional Bodies, Entrepreneurship, Higher Education, Technology, Artificial Intelligence (AI), Learning and Work

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FOREWORD

SAQA continues to deepen and expand its understanding of the Fourth Industrial Revolution (4IR) and its implications for the South African National Qualifications Framework (NQF) and the broader education and training landscape in South Africa. As the custodian of the NQF and being responsible for its further development and implementation, SAQA's commitment resonates with its overarching vision, which is to have a world-class NQF that works for the people in South Africa. A SAQA Bulletin that focuses on *The NQF and the 4IR* is a key step towards engaging with good practices and innovations in education, training and the workplace.

SAQA has embraced technology in its systems and work. As elaborated in the Introduction to the Bulletin, key innovations include providing qualification holders with 'digital seals' and electronic SAQA Certificates of Evaluation (e-SCoE). Furthermore, SAQA's focus for the 2020/25 Planning Cycle is on streamlining and automating its processes to become more efficient in its service provision. SAQA also participates in key events and processes towards shaping how digitisation is used in the education and training sector. More recently, SAQA has become a partner in the Higher Education Reform Experts South Africa (HERE-SA) initiative, a collaborative multi-country, multi-partner project of the Technology Higher Education Network South Africa (THENSA). It is an example of the development of a virtual community for technological advancements in teaching and learning in the context of the 4IR.

SAQA Bulletin 2020(1) contains a spread of richly textured innovations in and beyond South Africa. In order to spread the knowledge and insights from these initiatives, SAQA will host some events to engage with the ideas towards learning, re-learning and upskilling for the digital economy and workspace. In so doing, SAQA continues to share with education and training stakeholders, new knowledge, good practice and innovations that are responsive to the needs of society and the economy. It is hoped that readers of the Bulletin will consider and engage around the insights presented, and that this involvement will enable the sector to harness and use its resources efficiently and effectively for the benefit of all.

DR JULIE REDDY
Chief Executive Officer, SAQA

INTRODUCTION TO THIS BULLETIN
Setting the scene for SAQA Bulletin 2020 (1) on the National Qualifications Framework (NQF) and the Fourth Industrial Revolution (4IR)

Ms Yuraisha Chetty

The publication of this Bulletin occurs within the context of the harsh realities of the Coronavirus (Covid-19) pandemic and its devastating impact across the world on the political, economic, environmental and social fabric of society. For the first time in the history of the South African Qualifications Authority (SAQA) Bulletins, the writing of papers and the production phases of the Bulletin materialised within the context of a global pandemic. SAQA commends authors for their constructive engagement with the Bulletin process and their exceptionally valuable papers, some of which integrate insights around the impact of Covid-19. This Bulletin would not have been possible without the exemplary commitment of contributing authors, despite the physical and psychological toll of Covid-19 on people and work environments. The Covid-19 pandemic ironically acted as a key catalyst for engaging with the need to advance technological developments across sectors, underpinned by the notions of adaptability and system flexibility and agility.

Why focus on the National Qualifications Framework and the Fourth Industrial Revolution?

The Fourth Industrial Revolution (4IR) has become a topical area of discussion and engagement across various sectors, including education and training, and developments have gained momentum under Covid-19. As the custodian of the NQF, responsible for its further development and implementation, SAQA is committed to continuing to deepen and enrich its understanding of the 4IR and the implications of the 4IR for the education and training sector. This commitment resonates with the overarching vision of SAQA, which is to have a world-class National Qualifications Framework (NQF) that works for the people in South Africa. In working towards achieving its vision, SAQA works closely with other NQF entities such as the Department of Higher Education and Training (DHET), the Department of Basic Education (DBE), and the three Quality Councils, namely, the Council on Higher Education (CHE), the Quality Council for Trades and Occupations (QCTO), and the Council for Quality Assurance in General and Further Education and Training (Umalusi). A key outcome statement in SAQA's Strategic Plan for 2020/2021-2024/2025 is "a dynamic NQF that is responsive, adapts to, and supports the changing needs of lifelong learning" (2019:17). This statement points to the need for relevant and responsive qualifications and part-qualifications and professional development – and increasingly, technological advancements and related 4IR discourses may begin to shape the type of qualifications, part-qualifications and professional designations that are developed and offered.

Legislative and policy developments provide further impetus for SAQA's engagement with the 4IR. The NQF Act 2008, as amended, and the requirements thereof, such as having separate registers for misrepresented qualifications and part-qualifications, fraudulent qualifications and part-qualifications and professional designations, amongst other things, will require SAQA to seek technological solutions where necessary, to enhance efficiencies. On the policy front, the White Paper for Post-School Education and Training (WPPSET) (2014) sets out a vision for a post-school education and training system that enriches lives, promotes social justice and overcomes historical inequalities. The National Plan for Post-School Education and Training (NPPSET) (2019) gives effect to the vision of the White Paper, and it is evident that Goal 3 of this plan is particularly relevant for SAQA. Goal 3 is concerned with having a responsive post-school education and training system with the objective of providing qualifications, programmes and curricula that are responsive to the needs of the world of work, society and students (2019: 9). Within a 4IR context, SAQA would need to play a role, together with all NQF entities and stakeholders, in determining the relevance, flexibility and responsiveness of qualifications and part-qualifications for lifelong learning.

This introductory chapter provides a sketch of the context for the papers in this Bulletin. In doing so, it draws from a recent SAQA paper: *"SAQA and the NQF in the context of the 4th Industrial Revolution: Realities and Implications"*, published on SAQA's website (Chetty, 2019a). It also draws from various related events that SAQA participated in and reported on, as well as from other sources. This chapter defines the 4IR in the context of this Bulletin including its advantages and drawbacks, provides global insights, sketches the national context for 4IR, and describes the 4IR in the context of education and training. It also discusses how SAQA has engaged with the 4IR towards the further development and implementation of the NQF and includes statistics, based on data from SAQA's National Learners' Records Database (NLRD), linking various 4IR concepts to the qualifications and part-qualifications registered on the NQF – this to sketch very broadly the extent to which

SAQA has registered 4IR-related qualifications and part-qualifications. The chapter closes by touching on the theme for this volume, and outlines the sequencing of the papers.

What is the Fourth Industrial Revolution (4IR) and what are its advantages and drawbacks? Global Insights

The 4IR was first introduced by Klaus Schwab, the founder and executive chairman of the World Economic Forum (WEF), to describe what he refers to as the 'digital revolution' that has been underway since the middle of the last century. The 4IR is characterised by the merging of technologies, that is "blurring the lines between the physical, digital and biological spheres" at an unprecedented speed, requiring an "integrated and comprehensive response" by all global stakeholders (Schwab, 2016:2). There are endless possibilities with regards to scores of people being connected by mobile devices with substantial processing power, storage capacity and access to knowledge, and such possibilities will grow through new technological breakthroughs in fields including Artificial Intelligence (AI), robotics, the Internet of Things (IoT), autonomous vehicles, three-dimensional (3-D) printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing (Ibid.). The 4IR represents the inevitable shift from simple digitisation (the Third Industrial Revolution) to innovation based on combinations of technologies (the 4IR) (Ibid.). Machine learning and genomics are also included (Gray, 2016).

The 4IR requires a re-imagining of ideas of what it means to be human and how we interact with different sectors and industries. The possibilities of new technologies include creating and implementing effective and efficient change (Wils, 2019). On one hand, the 4IR has the potential to elevate global income levels and improve the quality of living for global populations (Schwab, 2016). Those who have benefitted from the 4IR thus far have been able to afford and access the digital world. New products and services have improved the efficiency and standards of living in our personal lives (Ibid). On the other hand, the 4IR brings with it various challenges, including the potential to 'disrupt' labour markets, leading to greater inequality (Brynjolfsson and McAfee, as cited in Schwab, 2016). Machines will replace workers, and this displacement might worsen the gap between "returns to capital and returns to labour", while on the other hand, it is also possible that technology will lead to safe and satisfying jobs (Schwab, 2016:3). However, the fear of job losses is seen as 'misplaced' by some. At a Future of Work Forum at the Stanford Graduate School of Business, various scholars and Artificial Intelligence (AI) experts were of the view that while rapid advances in technology will have a significant impact on many areas of the economy, fears of unemployment were exaggerated. Instead, AI will shift work and not replace it (Snyder, 2019). While uncertainty exists, a jobless future is not the outcome, although we should be prepared for “deep structural changes” (Organisation for Economic Cooperation and Development [OECD], 2019:13). The OECD estimates that 14% of jobs are at high-risk of automation, significantly fewer than some researchers have argued (Ibid).

While rapid progress in technological advancements cannot be avoided, the negative and unintended outcomes need to be addressed (Ibid.). Schwab (2016:3) argues that a critical factor of production in the future will be talent, more than capital, resulting in a job market divided into “low-skill/low-pay” and “high-skill/high-pay” parts – the latter leading to increased social tensions. The 4IR also poses a high level of difficulty for policy-makers and regulators in trying to “keep up the rapid pace of change” (Benioff, 2017:2). The nature of the change will depend on the industry itself (Gray, 2016).

It was also acknowledged that concerns about increasing inequality and limited opportunities for many in the workforce were real and well-founded, and needed to be addressed (Snyder, 2016). Prisecaru (2016:60) also points to the challenge of inequality that will be brought upon by the 4IR, and argues that digitalisation will “enhance the great inequality existing now in a world where many states and areas have not even passed through the second and third industrial revolution”. He further argues that robotics and Artificial Intelligence may lead to the dehumanisation of people’s lives, “affecting unique values as empathy, sensitivity, creativity and inspiration” and could pose moral and ethical challenges (Ibid.).

Preparing people for meaningful and safe work in the 4IR is crucial. A WEF (2018) report highlighting the eight futures of work identified a non-exhaustive list of actions that governments, businesses and other actors could take to prepare people for meaningful, fulfilling and safe work. These actions include:

- workforce reskilling;
- educational systems reform;
- enhanced digital access;
- agile safety nets for income security;

- job protection incentives;
- smart job creation incentives;
- supporting mass entrepreneurship;
- governance of online platform work (where skills are offered through online platforms);
- mobility management (e.g. improving accreditation and recognition of skills within countries to support people in navigating the future of work, and with regards to mobility, having common credentials for recognising skills and standardised qualifications for all levels of education across different systems); and last but not least;
- participation incentives (e.g., greater flexibility to vary working hours) (WEF, 2018).

The national context for 4IR

Within the South African context, the 4IR is being engaged with at the highest levels and has become topical across all sectors. President Cyril Ramaphosa's address at the first South African Digital Economy Summit on 5 July 2019, foregrounded the importance of 'harnessing' the opportunities offered by the digital revolution to:

- enhance economic transformation and job creation;
- improve our education outcomes and skills revolution and ensure a healthy nation;
- consolidate the social wage[1] through reliable and quality basic services;
- enhance spatial integration, human settlements and local government;
- advance social cohesion and safe communities;
- create a capable, ethical and developmental state; and
- work for a better Africa and the World.

The criticality of the 4IR to South Africa is evident through the establishment of a Presidential Commission on the 4IR. The Commission is led by Professor Tshilidzi Marwala, an internationally acclaimed researcher in the discipline of AI, and the current Vice-Chancellor of the University of Johannesburg (UJ). One of the key lessons emerging from the work of the Commission, amongst others, is that success in the 4IR will depend on South Africa's ability to "unleash the full scientific, industrial and creative capabilities of South African

[1] Simply put, the social wage refers to free basic services provided by the state.

society" (Commission Report, 2020:15). In envisioning a 4IR future for South Africa, the Commission is mindful that a form of "acceleration" done without due consideration of the existing inequalities, can serve to widen the gap. The Commission plans to continue to build consensus from more sectors of society, and views the 4IR as an opportunity to "more mindfully integrate the majority, who typically live in geographies that lack the appropriate infrastructure for participation" (Commission Report, 2020:17).

Professor Marwala published a book in 2020, *"Closing the Gap: The Fourth Industrial Revolution in Africa"* which, amongst other things, describes and analyses the shifts the 4IR has already made, thus laying the groundwork for the lessons society can learn about how to embrace the ensuing changes and adapt with the required flexibility and agility. Marwala (2020:26) highlights the eight recommendations proposed by the Presidential Commission on the 4IR. Firstly, invest in human capital. Secondly, establish an AI institute. Thirdly, establish a platform for advanced manufacturing and new materials. Fourth, secure and avail data to enable innovation. Fifth, incentivise future industries, platforms and applications of 4IR technologies. Sixth, build 4IR infrastructure. Seventh, review and amend or create policy and legislation. Eighth, establish a 4IR Strategy Implementation Coordination Council in the Presidency.

Another development is that Minister Naledi Pandor has established a task team to advise the Minister of Higher Education, Science and Technology on how to manage the threats and opportunities posed by the 4IR (Kahn, 2019).

South African citizens are among those around the world that will need to understand and adapt to the 4IR. Their self-assessment knowledge of the 4IR was a key feature of in-depth research commissioned by Kagiso Trust to provide insights into the potential, the challenges and the landscape of 4IR in South Africa (Oxford, 2019). This research was discussed at a Critical Thinking Forum hosted on 2 July 2019, by Kagiso Trust in collaboration with the *Mail & Guardian*. The research yielded more than 1000 responses across 20 South African districts and all nine provinces, and found amongst other things, that those who felt they had an average-to-above-average understanding of the 4IR, represented the population with a middle to high socioeconomic status (they had a higher education, an income of more than R6500 per person per month and had access to data). A lack of knowledge on the 4IR was evident, particularly amongst entrepreneurs and the unemployed (Ibid.). The research raised three critical issues.

The first issue raised was the lack of knowledge on the 4IR, with just a quarter (25%) of the pool surveyed having an acceptable level of understanding. This finding highlighted the inequality between the “haves and the have-nots” as “those with a lower socio-economic status or without access to data were those who did not have access to information, news and insights specifically around 4IR” (Oxford, 2019:32).

The second issue pertained to the importance of developing entrepreneurship programmes that use 4IR and ‘upscaling’ education to enable a deeper understanding of technology. The third issue pertained to the perceived threat of the 4IR, particularly with regard to humans competing with machines for jobs and the related resistance to change.

The findings also allowed for some reflection on the opportunities presented by the 4IR. According to Oxford (2019:32), the 4IR could be the key that “unlocks a future that can harness vast natural resources, re-industrialise in alignment with global ideals, and allow for socio-economic growth of a young and vibrant population”. The 4IR was also seen as a ‘driver’ of the future of the African continent, in that it could also potentially “drive Africa forward, enabling innovation and new business models, and the opportunity to leapfrog legacy challenges into a bolder and brighter future” (Ibid:32).

The Kagiso Trust Forum also highlighted the need, in South Africa, for the adequate upskilling of people, legal issues around accessing and handling personal information and privacy laws, and the fact that as much as data is the new ‘currency’ in the 4IR, it was important for the data to reflect social histories and backgrounds (Wils, 2019).

Signalling the opportunities presented by the 4IR in the South African context, Hodge (2019), in a Sunday Times opinion piece, expressed the view that while the technological revolution poses threats to South Africa, for example, the threat to jobs from robotics, AI and digitalisation or the threat of global monopolies such as the FAAGs (Facebook, Amazon, Apple, Google), it also presented many opportunities for new industries, jobs and more competitive and inclusive markets. With regard to jobs, various digital businesses may lead to the highly skilled data analyst positions, but also the less skilled warehouse, delivery and driver jobs. As FAAGs continue to boost online presence, the demand for content will grow, and AI applications will need processed data, videos and images typically and frequently compiled by a human workforce. Data portability and interoperability can open markets to new and innovative businesses, and one can still ensure privacy and the security of personal data (Ibid.).

Marwala (2020:25) discusses South Africa’s readiness for the 4IR and how it fares relative to other countries. He refers to the benchmarking framework of the WEF that assesses the extent to which a country is ‘ready’ for the 4IR, which shows that South Africa is categorised as being in the nascent quadrant, indicating that it is “just beginning to develop”.

Gillward (2019:1) points to the lack of critical engagement with the concept of the 4IR within South Africa – intellectually, politically and especially from a policy perspective. She argues (Ibid.) that what is required is a cross-cutting strategy and adaptive governance framework that can “engage the entire digital ecosystem in all its complexity; in its local and global manifestations”. She furthermore cautions that one should not assume that the current digital development (which is regarded as an intensification of the third industrial revolution) would necessarily translate into wage or productivity growth – not unless South Africa develops ‘complementary’ policies for both government and business. Gillward (2019:2) calls for “targeted, evidence-based policy-interventions” that will do something differently from that done in the past, or the implementation of policies we have failed to – otherwise introducing more advanced technologies could ‘amplify’ current inequalities.

Education and training in the context of the Fourth Industrial Revolution (4IR)

Turning the focus to education and skills specifically, Gray (2016) highlights the ten skills needed to thrive in the 4IR, amongst other things. The ten skills include: complex problem solving; critical thinking; creativity; people management; coordinating with others; emotional intelligence; judgement and decision-making; service orientation, negotiation; and cognitive flexibility.

Not surprisingly, and in relation to ‘hard’ skills, there is an emerging demand for Data Science skills across industries (Ibid.). Data are increasingly seen as an asset and an enabler of innovation in fields such as AI. The increasing demand for data science skills has led to a shortfall in the supply of such skills and strong competition between industry, academia and the public sector for these skills (Ibid.). The WEF's Future of Jobs survey pointed to the relevance of data science jobs and skills. User Entity and Big Data Analytics technologies were the most prioritised across all industries surveyed, and business leaders planned to match the investment in such technologies with the creation of new data science-related positions (WEF Report, 2018).

Chung and Gill (2017) highlight shortfalls in learning standards pertaining to web literacy skills. They point, for example, to the need for web literacy skills such as coding, revision and remixing of digital content, as well as skills such as navigating the web and learning 'open practice' – the latter involving using and contributing resources to the web to keep the web transparent (Ibid.). Chao (2017) argues that in order to educate for the fourth and future industrial revolutions, there will be a need to 'embrace' the technologies that accompany them. He points to the need for flexible education systems, programmes and curricula that allow for students' interests and needs, and cater for unforeseen work and social issues. Qualifications need to be assessed and awarded for learning across formal, non-formal and informal avenues (Ibid.).

Considering the implications of the 4IR in the tertiary education sector, Xing and Marwala (2017:1) state that higher education in the fourth industrial revolution (HE 4.0) is a "complex, dialectical and exciting opportunity which can potentially transform society for the better". They point to the interdisciplinary nature of higher education functions in the future (i.e., functions such as teaching, learning and research) and argue that the convergence between humans and machines will reduce the subject distance between the humanities, social sciences, science and technology, and necessitate significantly more interdisciplinary teaching, research and innovation (Ibid:1). AbuMezied (2019) argues that a fundamental question should be asked regarding how higher education institutes would be affected by the 4IR and how the *delivery* of education will be transformed. She points to the blurring of boundaries between the internet, the physical world and humans, and states that the need for education in general, and higher education in particular, to be 'place-based', is declining. Physical boundaries no longer pose a barrier to education. Higher education has seen an exponential increase in the offering of Massive Open Online Courses (MOOCs), which are a disruptive innovation, and which are increasing the accessibility of education to learners (Ibid.). The Covid-19 pandemic led to innovative online teaching and learning technologies for programmes that were face-to-face; after the pandemic, it is likely that blended learning will become a norm.

Even before the Covid-19 pandemic, Louw (2018) stated that traditional and ‘antiquated’ learning methods still persist in higher education despite thorough discussions about student-centred learning, appropriate learning outcomes, lifelong learning and the use of technology. He explained that higher education institutions need a new understanding of the context within which they function to ensure their relevance, value and sustainability (Ibid.) – “while access to higher education has always been considered a human right, the changes in the nature, characteristics and drivers of the global system demand new practices to enable broader participation in different types of learning that achieve entirely new types of learning outcomes” (Ibid:4). The pandemic has certainly brought the need for new practices into sharper focus.

Specifically with regard to quality assurance and the 4IR in higher education, Keevy (2019) argues that quality assurance will be more about a digital credential and less about a qualification. It will furthermore become commonplace to have new quality dimensions (Commonwealth of Learning, as cited in Keevy, 2019).

On the matter of digital credentials, Keevy and Chakroun (2018) explore how to represent learning outcomes beyond a qualification and offer an outline of the ‘ecosystem’ of digital credentials. Keevy et al (2019) state that various technological and digitisation trends are providing innovative ways of making credentials more transparent, portable and stackable (see Oliver, as cited in Keevy, 2019). Specifically with regard to credentialing *systems*, Barabas and Schmidt (2016) argue in favour of decentralised digital credentialing systems, and put forward two recommendations to enable this – firstly, the development of a flexible standard for digital credentials, and secondly, using Blockchain solutions to issue credentials and record data about how they are used. Regarding the certification of skills in the 4IR, Jackson (2017) references an initiative of IBM to substantially invest in ongoing skills-based learning programmes for employees (e.g. Big Data 101 or Machine Learning 101) and certify these skills with the fairly new concept of ‘digital badges’ – the latter seen as valuable digital transcripts. Badges can, for example, be promoted on résumés and on LinkedIn profiles for employees to see (Ibid.).

The implications of the 4IR for the Technical and Vocational Education and Training (TVET) sector also need to be considered. Tyatya (2019) points out that many of the jobs for which Technical and Vocational Education and Training (TVET) students are being prepared, will no longer exist in 50 years. He cites statistics reported by the then Minister of Higher Education and Training, Dr Naledi Pandor, that only 11 out of 26 South African universities offer course modules in 4IR and related fields of AI and robotics, and that none of the existing 50 public TVET colleges offers any courses related to AI and robotics. He points out that TVET lecturers and students need to be prepared for the 4IR. The aspects that need to be addressed include revisiting pre-service training and industry experience for TVET lecturers, and updating and aligning TVET curricula to industry needs in consultation with students, lecturers and industry. Another aspect that needs to be addressed is the incorporation of 21st-century skills into curricula, including skills such as critical thinking, people management, emotional intelligence, judgement, negotiation and cognitive flexibility (Ibid.).

Within the basic education sector in South Africa, thousands of teachers are being trained in coding. Coding as a subject is due to be piloted in a thousand schools across five provinces (Kekana, 2019). Kekana (2019) reported various views that identified multiple challenges with this initiative, including the rolling out of technology in rural schools (i.e., using technology in teaching and learning and training teachers to use technology), and the view that the implementation of advanced technology will be a burden on already overworked teachers. However, it was also felt that 4IR will be possible in schools with government commitment (Ibid.).

SAQA and the 4IR

SAQA has engaged in a number of technological innovations. SAQA, in its verification and evaluation of foreign qualifications, has embraced the 4IR by providing qualification holders with ‘digital seals’ and electronic SAQA Certificates of Evaluation (e-SCoE). In 2018, SAQA publicly launched the e-SAQA certificate pilot project. Through this project, SAQA is arguably making strides in progressive technological developments that embrace features of the 4IR. The digital seal can potentially contribute to lowering the incidence of qualifications fraud, and furthermore, holders of a digital seal may make it available to potential employers as part of securing employment. Digital seals could also assist the mobility of the skilled workforce across Africa and the rest of the world.

SAQA has also commenced an automation process to fast track the registration of qualifications on the NQF and has piloted this initiative successfully.

Moreover, SAQA has participated in key events and processes towards shaping how digitisation is used in the education and training sector. For example, SAQA participated in a United Nations Educational, Scientific and Cultural Organisation (UNESCO) briefing on the World Reference Levels pilot project, on 26 June 2019. The World Reference Levels project refers to UNESCO's development of an online tool that can be used in the recognition and registration of qualifications as well as in the evaluation of foreign qualifications. In this regard, UNESCO aims to develop a universal and digital tool that can strengthen a common understanding of skills and qualifications and enable people to get their skills recognised across borders and contexts. South Africa, through SAQA, piloted the online tool along with three other countries. UNESCO aims to make the tool available worldwide (Samuels, 2019).

Digitisation also featured in discussions at other events hosted by SAQA to commemorate 21 years of the NQF, and was a cross-cutting issue. One such event was the *International Seminar on Recognition of Prior Learning (RPL) for Professional Qualifications and Professional Designations*, held on 21 June 2019. In painting a picture of the way forward, the keynote address at this event (Chakroun, 2019a) drew attention to the digital economy and related skills, amongst others. Some of the highlighted issues were:

- digitisation in the labour market – the 'digital economy';
- the polarisation of the labour market in OECD[2] countries (very high-level skills and occupations and very low-level skills and occupations, without a sufficient 'middle');
- the importance of focusing on wider sets of skills which are job-specific and transversal and include sustainability and digital skills;
- digital credentials;
- individual pathways supported by Artificial Intelligence;
- digital learners' records;
- privacy and security, the ownership of learners' records and inclusivity; and
- the right to career guidance and counselling.

[2] Organisation for Economic Cooperation and Development.

Another event hosted by SAQA to celebrate 21 years of the NQF was the *International Policy Learning Forum on the Conceptualisation and the Use of Learning Outcomes in South Africa*, held on 24 and 25 June 2019. Within the context of future trends, the future of qualifications was discussed, and the 4IR was one of the key trends discussed, amongst others. The future scenarios include, for example, digital badges, digital learning records, online apprenticeships, and Blockchain (from the registration of qualifications to accreditation, to resulting and certification). A key notion was to move beyond credentials towards having a continually changing profile of a person's learning to support their transitions in work and life (Chakroun, 2019b).

SAQA furthermore participates in national and international events and initiatives that involve technological innovations. For example, SAQA is also one of the first signatories to the Groningen Declaration Network (GDN). The GDN is a global network of like-minded organisations that aims to establish digital student mobility. Underpinning the work of the GDN network is a shared view that individuals should own their own data (e.g., qualifications, professional designations, etc.) and be able to share these digitally, with anyone at any time.

Within its organisation, SAQA initiated a focused exploratory study to consider the positioning of SAQA and the NQF in the context of the 4IR, with a particular lens on the implications of the 4IR for the roles and responsibilities of SAQA, both from a broad organisational perspective as well as in terms of its specific functional areas. The main issues that emerged pertained to the automation of SAQA's work and the role of SAQA in ensuring the relevance of qualifications. The main enablers of success identified regarding 4IR were collaboration, being open to change, funding, ensuring relevant qualifications and skills, and ensuring appropriate Information Technology (IT) infrastructure and the reskilling needed. These aspects, when absent, became barriers to efficient and effective functioning in the 4IR context. The study provided insights into the issues with which SAQA would need to engage, and an initial basis from which further dialogue and engagement could take place.

Harnessing the data in the National Learners' Records Database (NLRD)

As part of its continuing exploratory research and analysis regarding the 4IR, SAQA attempted to link various 4IR concepts to the qualifications and part-qualifications registered on the NQF. The National Learners' Records Database team analysed the relevant qualifications and part-qualifications on the NQF and provided some preliminary insights and trends[3]. The analysis (using data as at October 2020) revealed that 247 qualifications on the NQF could be 'related' to the 4IR. These 247 qualifications were split into five broad areas: **Programming and software development**, **Computer Science**, **Information Technology, Data Science and Biotechnology**. It should be noted that the 4IR concepts, sub-concepts and qualification areas are not exhaustive. Rather, the aim was to use the findings of the exploratory research as a starting point for further analyses. Learner achievements were extracted for each qualification area and graphically represented.

From Figures 1-5 below, it is evident that the NLRD data on learner achievements in the 4IR areas are scant, and in some cases even non-existent for some years, with no clear patterns or trends. The data suggest that 4IR-related qualifications and part-qualifications are still quite new and emerging and may take some time to reflect learner achievements. Nonetheless, some findings to note include that the number of learner achievements in each of the five qualification areas (Programming and Software Development, Computer Science, Information Technology, Data Science and Biotechnology) is the highest in 2018. Further, Information Technology has the highest number of learner achievements when compared to the other four qualification areas, with a generally increasing trend despite some fluctuations, and a total number of learner achievements of 2 604 in 2018. The qualification area of Data Science showed 15 learner achievements in 2018, while Biotechnology and Computer Science showed 120 and 336 learner achievements respectively for the same year.

[3] A special acknowledgement to Ms Omotola Akindolani, Manager: Senior Researcher at SAQA, for her analysis and graphs. Readers should note that this analysis is preliminary and that SAQA will continue to analyse data on the NLRD to provide further insights.

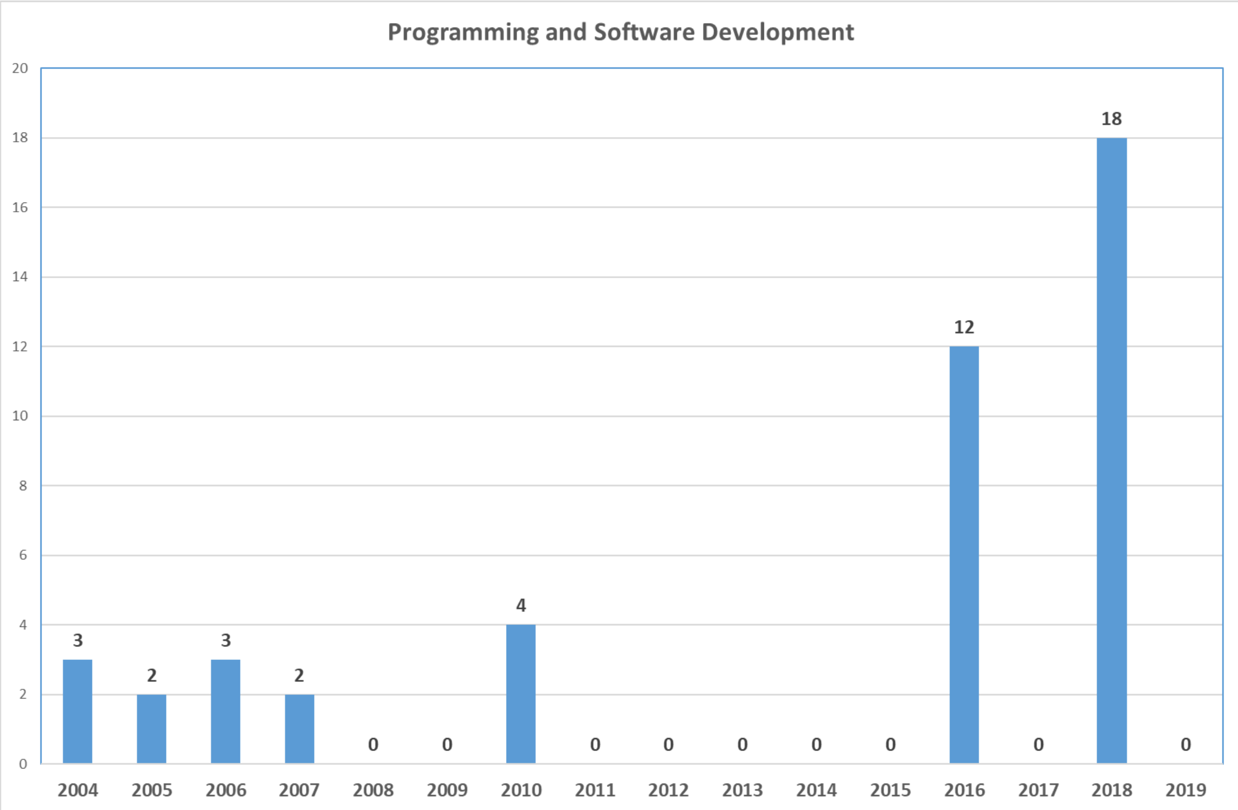

Figure 1: Trends in Programming and Software Development (Learner Achievements)

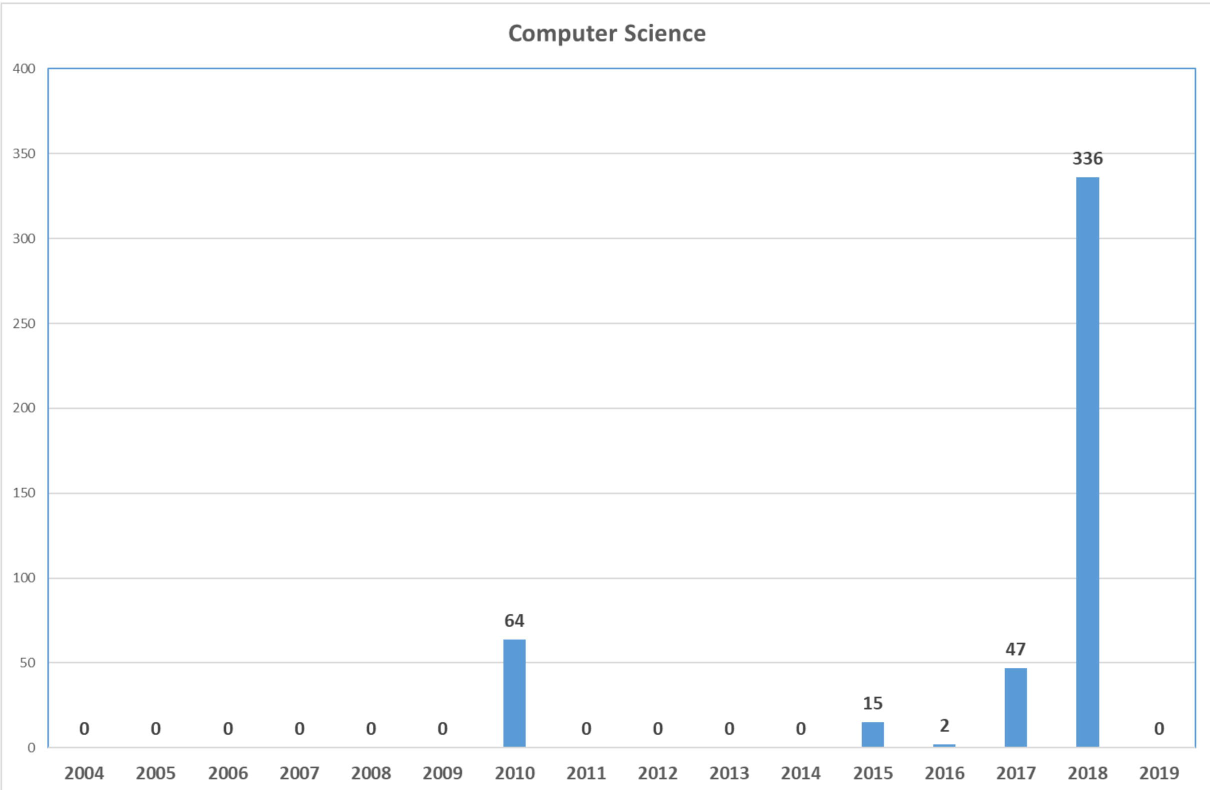

Figure 2: Trends in Computer Science (Learner Achievements)

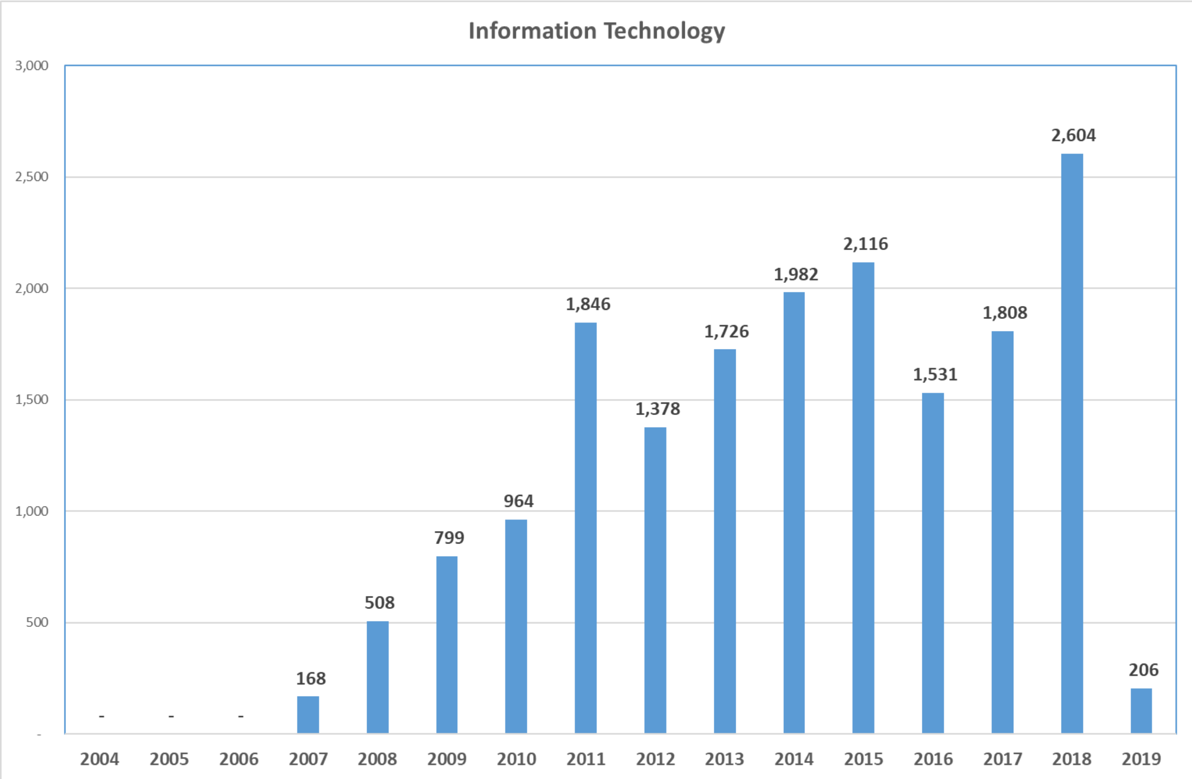

Figure 3: Trends in Information Technology (Learner Achievements)

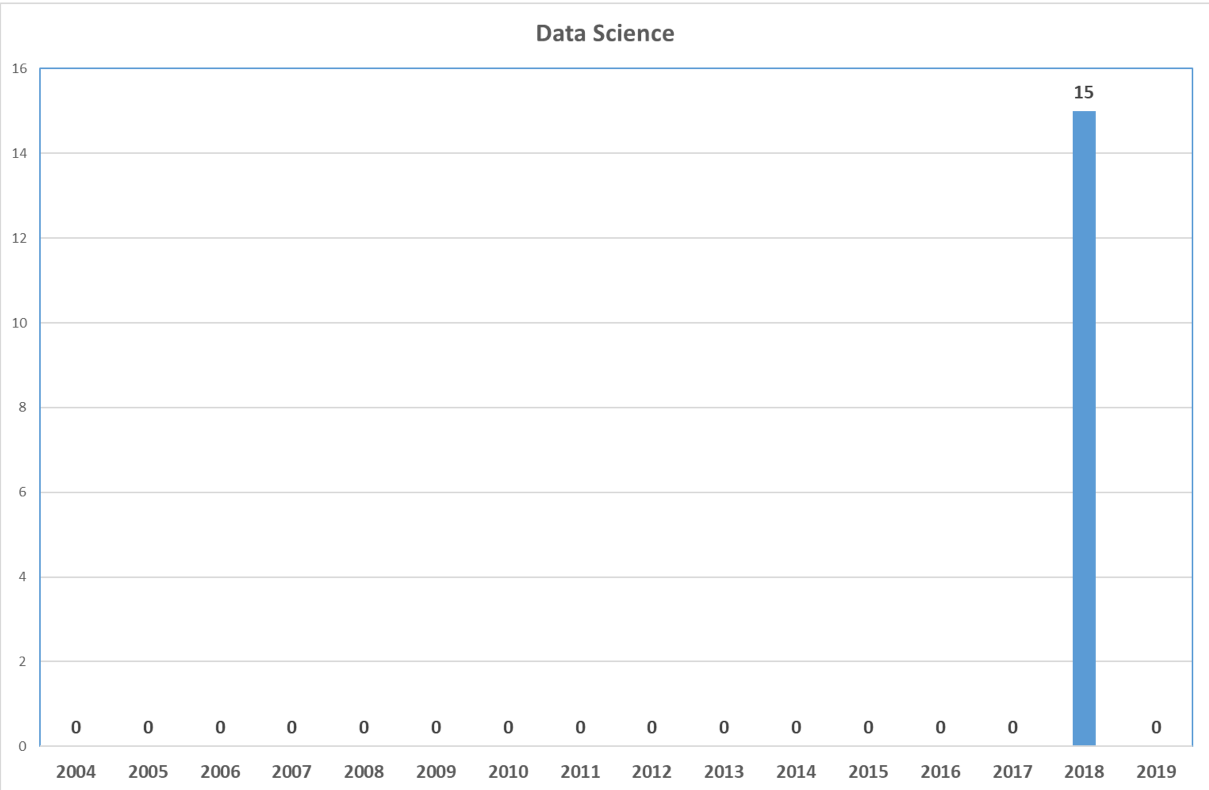

Figure 4: Trends in Data Science (Learner Achievements)

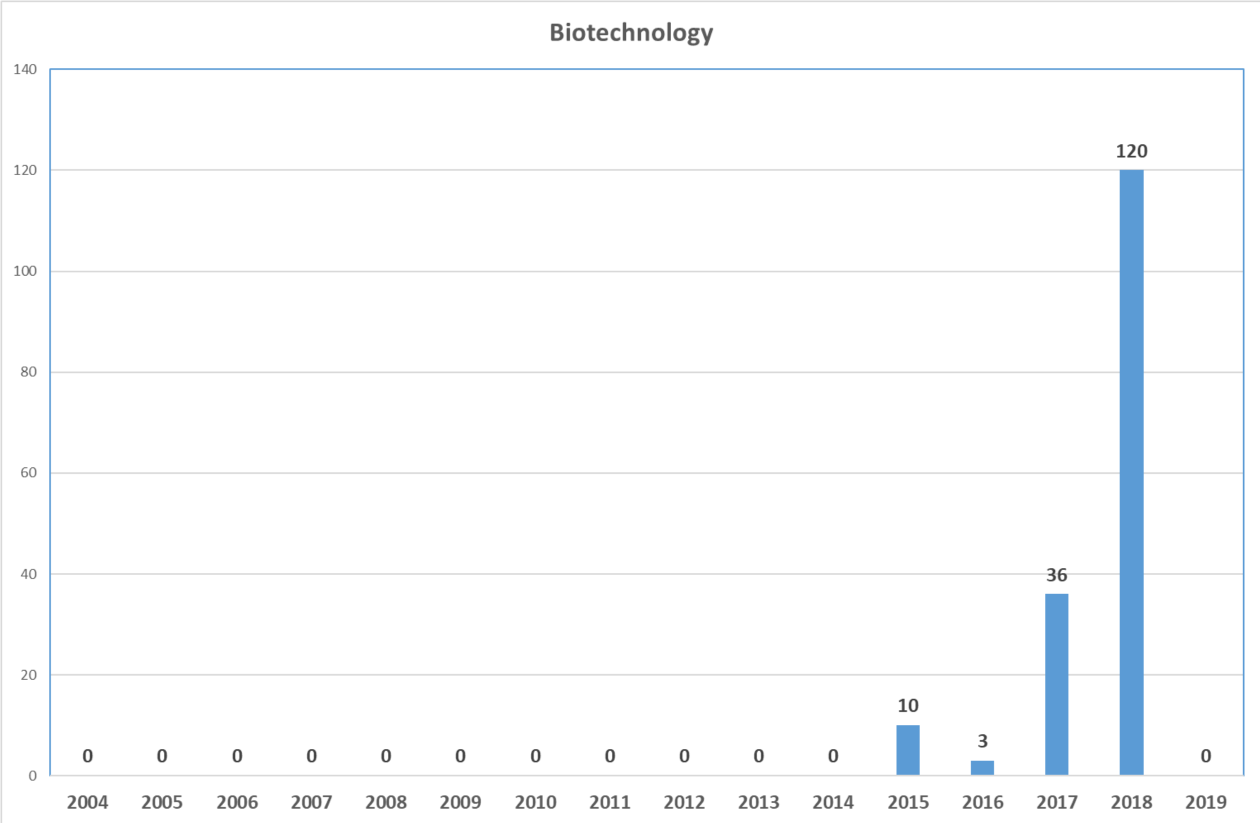

Figure 5: Trends in Biotechnology (Learner Achievements)

Bulletin theme and sequencing of papers

While the literature reveals differentiation between the Third and Fourth Industrial Revolutions, this Bulletin has interpreted the notion of the 4IR more broadly to include technological developments in education and training which may not necessarily be perceived as 4IR per se, but which denote significant technological advancements towards the 4IR. As mentioned earlier, the benchmarking framework of the WEF (see Marwala, 2020:25) places South Africa in the nascent quadrant, indicating that the 4IR is coming into existence in the country and is beginning to display signs of potential. The 4IR, therefore, has yet to have a considerable impact on the education and training sector, and its influence is, in many respects, emerging. Thus, the decision to adopt a broader lens when selecting papers for inclusion into this Bulletin.

The theme of SAQA Bulletin 2020 (1) is ‘The National Qualifications Framework (NQF) and the Fourth Industrial Revolution (4IR)’. The Bulletin focuses on the NQF in the context of the 4IR. The call for papers that was sent to all NQF stakeholders invited contributions with a particular emphasis on initiatives in the following areas:

- enhancing access to education, training, development and work: getting people into the system, enabling progression in learning-and-work pathways, and supporting lifelong learning in general;
- enhancing teaching and learning processes, including learning-at-work; and
- enhancing curriculum development and delivery.

This Bulletin includes 15 papers that focus on empirical and conceptual aspects of the 4IR from a range of sectors within the education and training context. The papers were categorised according to their foci on (1) Higher Education and Quality Assurance; (2) Skills Development, Employment and Entrepreneurship; (3) the Roles of Professional Bodies; (4) Schooling – An Innovative Collaborative Initiative, and (5) International Perspectives.

Each of the papers makes a valuable contribution to understanding education and training in the context of the 4IR. It is hoped that the readers of this Bulletin will be inspired and encouraged to reflect on technological advancements in their respective contexts and engage with the discourses around the 4IR.

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HIGHER EDUCATION, QUALITY ASSURANCE, AND 4IR IN SOUTH AFRICA

PAPER 1

The Preparedness of Master of Architecture Graduates for the Fourth Industrial Revolution (4IR)

Mr Kevin Bingham and Ms Ginny Porter

ABSTRACT

The study investigated the relevance of the current architecture curriculum in the context of the Fourth Industrial Revolution (4IR) and whether the National Qualifications Framework (NQF) Level 9 Master of Architecture (M.Arch.) graduates have the required skills for the future. Artificial intelligence (AI) has impacted many careers, with some employee functions being replaced by automation. Using a mixed research approach, the perspectives of 17 M.Arch. graduates from four educational institutions in South Africa considered whether tertiary education provided a solid foundation for work in the field of architecture. The study showed how, by embracing AI technology and using heuristic techniques for understanding client requirements, the role of the architect in person is still relevant, although radically altered. One key finding was that students are ill-equipped to run architectural practices and more emphasis on the administration and solving of entrepreneurial challenges in architectural practices will address this issue. Critical cross-field outcomes (CCFOs) were revealed as being increasingly important, but the list of outcomes should emphasise creative and entrepreneurial skills. The significance of this study is undisputed as there are extensive debates concerning the 4IR and its influence in all aspects of life. The research will contribute to academic debates and be of value to practising architects and tertiary institutions.

INTRODUCTION

The 4IR has transformed the way we live and work with AI, the Internet of Things (IoT), virtual reality (VR) and robotics, according to a definition by Rouse (2017). The Internet's Big Data has grown exponentially, and the prospect of robots performing many more human jobs is of concern to workers from diverse disciplines. The profession of architecture is not spared. According to Reif (2018), writing for the World Economic Forum (WEF), by 2020 *creative thinking* will be third on the list of the most important skills needed for people to survive and thrive in the 4IR world. Therefore, the discipline of architecture's demise is not foreseen to be imminent for at least another decade. Reassuringly, as reported by David and Cope (2015:2) in *The Guardian*, Michael Osborne, Associate Professor in Machine

Learning at the University of Oxford says, "c*reativity is arguably the most difficult human faculty to automate. Robots are unlikely to be fully creative any time soon*." Nevertheless, academics will be compelled to reformulate numerous curricula and reassess their content to ensure that students obtain employment when they graduate and that their skills are valued.

The South African Architectural Professions context

Taking into account that a Professional Architect[4] has, in most instances, completed eight years of training before practice, and accepting that architects and Architectural Learning Sites (ALS) are validated cyclically by the South African Council for the Architectural Profession (SACAP) and that M.Arch. programmes currently meet the international Canberra Accord (CA) on architecture education standards of substantial equivalency; Professional Architects should be well-equipped for the world of practice.

Introduced in 2008, the CA considers the portability of university degrees amongst the accreditation agencies that signed the Accord. Countries subscribing to the CA include China, Mexico, South Africa, Canada, Korea, the USA and selected universities validated by the Commonwealth Association of Architects (CAA). The Canberra Accord recognises the substantial equivalency of accreditation/validation systems in the architectural education of its signatories. These equivalencies are reviewed cyclically by international validation boards appointed by the CA.

The dawn of the 4IR has been a progressive one for architects. Architectural practice has, for some decades, addressed the computerisation of drawing production and three-dimensional (3D) visualisation through life-like renderings and fly-through animation. More recently, portable viewing devices such as 'goggles', enable viewers to immerse themselves within a computer-generated constructed space and navigate within a representative virtual reality world. Building Information Management (BIM) has also in recent times added to the efficiency of the consultant teams' access to information, with the possibility of simultaneously sharing a computer model at a variety of remote locations. BIM is a collaborative technological tool, which enables multiple stakeholders to work on the design, planning and construction of a building project. As an example, the United Kingdom (UK)

[4] The professional designations of the SACAP are capitalised.

Government mandates that BIM is utilised for all construction contracts from 2016 to deliver more sustainable buildings faster and more efficiently.

The progression to and engagement of architectural practitioners with computer tools is a natural process. A variety of computer graphic programs is introduced to architecture students at most ALS, but with limited tuition. The access to such programmes is determined by the willingness of computer suppliers to offer free or limited licences to students or the ALS, which may also purchase some licences. These software tools require extensive tutorials, and frequently the features are not fully explored, but they are worth the commitment to keep skills at the cutting-edge. As CO Architects' principal, Eyal Perchik, commented in Kilkelly's (2017) article, not everyone can read drawings, but everyone can relate to virtual reality. Exploring a concept model enables architects and clients to experiment with different options before the expense of printing large-scale drawings.

Traditionally, expertise in technology was reserved for the Architectural Technologist, and university studies focused more on the theories of architecture and its implications on design. However, because of the cross-disciplinary opportunities provided by BIM, these technologies are now used by architects, engineers, construction managers, quantity surveyors and project managers.

Figure 1, acquired with permission from SACAP, illustrates the qualifications and professionalisation pathways from NQF Level 5 needed as a draughtsperson, to those at NQF Level 9 needed as a Professional Architect. The requirements for progression are shown. Beyond these levels is the NQF Level 10 for a Doctorate in Architecture.

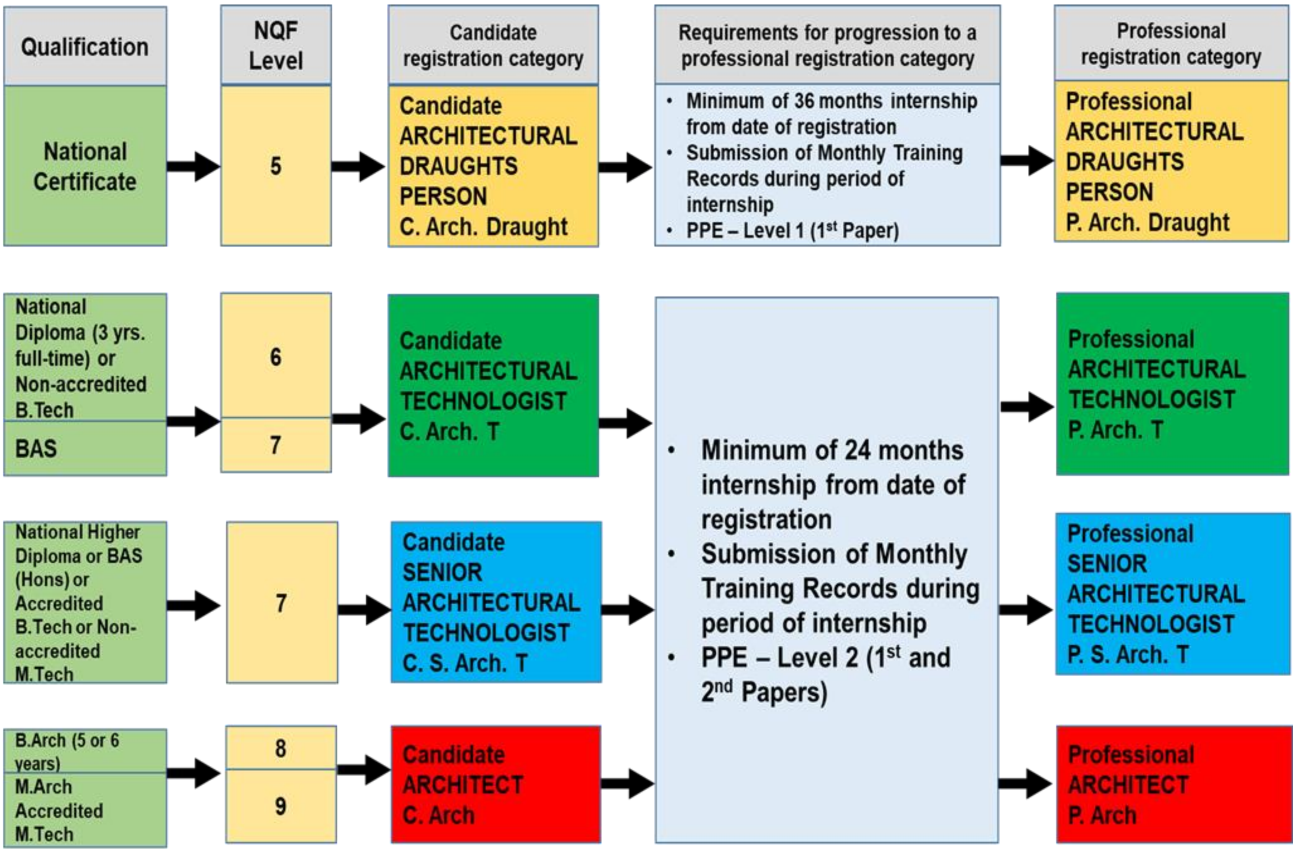

Figure 1: Qualifications and professional development for Architectural Professionals (Source: SACAP, 2020)[5]

A Candidate Architectural Technologist will have studied at a tertiary institution for at least three years at NQF Levels 6 or 7 and will have gained the required competency to practise in the built environment after a supervised internship of two years as specified by SACAP. Those who have completed the fourth year of architectural study, resulting in an accredited Bachelor of Technology (B. Tech) Degree or an Advanced Diploma, will be at NQF Level 7, while the fourth year Honours Degree is set at NQF Level 8. The NQF Level 8 qualification is seen as the stepping-stone to the Master's programme at NQF Level 9. Should the appeal of academia be relevant, students could move up to NQF Level 10 for doctoral studies.

According to Wood (2017:2), Nick Bostrom, an Oxford academic and philosopher, believes that the world is at the cusp of an AI explosion, which will drive the design industry. Wood asks: "*Will the Internet of Things create a socially adaptable and responsive architecture*?" Creating a socially adaptable and responsive architecture would entail considering the population growth and its effect on the environment, as an example. Wood spoke to Michael Bergin from the Computer-Aided Design (CAD) software supplier, *Autodesk*, who suggests

[5] BAS means Bachelor of Architectural Studies and PPE means Professional Practice Examination.

that the architect would be less involved in drawing, and more in specifying and problem-solving. This is a key critical cross-field outcome (CCFO) used daily by practising architects. The Internet of Things (IoT) is an ideal tool to gather information and Mahsa and Mohammed (2017) explain how, by using information received via BIM's connectivity, construction challenges such as crisis management, energy management and disaster prevention can assist in the efficient management of these issues. Wood (2017) comments how 3D printing and AI can offer architects a new aesthetic language and with AI-driven robots on construction sites soon expanding into bricklaying, welding and other tasks, the architect's role will dramatically differ. A paradigm shift in revising the curricula is required to remain relevant in practice.

Peerutin (2019), Chair of the South African Institute of Architects' (SAIA) Practice Committee, cautioned that only a fraction of the power of BIM is utilised due to a lack of expertise and that there will have to be fundamental changes in the course content of the architecture curriculum to take advantage of the offerings of technology such as BIM. Also, he stresses that "… *the importance of developing a BIM strategy (BIM Execution Plan and Employers' Information Requirements) on a project-by-project basis cannot be overstated*" (Peerutin, 2019:5).

Focus of the study

The study on which this paper is based aimed to describe how particular CCFOs are necessary for recently graduated students in architecture during the 4IR. These are important at all NQF levels and include those found in the essential part-qualifications (unit standards) as per the South African Qualifications Authority (SAQA) guidelines. The research proposed suggestions for the development and implementation of an informed architectural pedagogy that will require a paradigm shift if graduates are to compete in the context of the 4IR.

Research objectives

The research objectives, which considered the preparedness for M.Arch. graduates for the 4IR, guided the development of the quantitative questions, headed under issues concerning technology, CCFOs, entrepreneurship, social awareness and cultural responsiveness in the curriculum, and commitment to lifelong learning.

Many academic disciplines in South Africa and abroad address the universal issues raised by Finch and Melvin (2017). These issues have been gleaned from the United Nations Educational, Scientific and Cultural Organisation's (UNESCO's) Sustainable Development Goals (SDGs) (UNESCO, 2019). Particularly relevant is the link between social justice and climate change because of the move to green technologies by architect designers.

LITERATURE REVIEW

Is a machine able to create an iconic masterpiece such as Le Corbusier's *Notre-Dame du Haut* at Ronchamp and evoke feelings of reverence in people from all spiritual backgrounds? Although an old source, this quotation is relevant to the discussion - Cotterill (1989:23) comments, "*I would defy even the most hardened criminal to sit alone in Le Corbusier's masterpiece and not feel the presence of something larger than man."* We ask, in this paper, 'Do polymathic architects need to be developed and encouraged for similar creations to occur*?'*

Cramer (2012), the founding editor of *Design Intelligence* and co-chair of the Design Futures Council, feels that communication skills and business leadership should be taught before graduation. He stresses the importance of keeping the curricula current and enabling interactions with industry professionals. He recommends an experiential, cooperative, educational approach where students learn first-hand about building procedures with on-site supervision and day-to-day project management challenges.

Etherington's (2011) provocative title "*Will architects exist in 2025?"* which was posed at the Royal Institute of British Architects' think tank, *Building Futures*, provided feedback after a year-long study where the key questions of who will design our built environment, how will practices change by 2025, and what role architects will play in these changes, were addressed. Financial literacy and problem-solving were focus areas where the architect was recommended to be client-savvy and see beyond the building. According to Etherington (2011), a time is envisaged when practices will be known as 'spatial agencies' or 'design houses' with the name 'architect' no longer used. Etherington's view omits to consider the full suite of training afforded to the architecture student and its importance in ensuring an environment well suited to human habitation, and the sustainability of the planet.

Historical background

Polymath Sir Christopher Wren (1632–1723) is regarded as one of the greatest English architects in British history (Curl, 2005:742). He was a recognised architect, mathematician-physicist, astronomer, scholar, anatomist, astronomer, and geometer. Wren gained a reputation as an architect through his creation of the Sheldonian Theatre in Oxford. The design is based on the classical design of the Roman Theatre of Marcellus. Wren is best known for his restoration of buildings in London after the Great Fire in 1666 that put paid to his reconstruction of St. Paul's Cathedral in London, which then had to be rebuilt. Wren's English Baroque design, with its distinctive dome, is said to be his greatest achievement (Curl, 2005:742). Wren designed and supervised 51 uniquely different city churches. According to Tinniswood (2001), Wren's success lay in his involvement in each stage of the work. He was pedantic about workmanship, insisting on the finest of materials. A polymath such as Sir Christopher Wren may not be readily available today in many architectural firms but, certainly, soft skills such as problem-solving, communication, project management and systems thinking are essential for Professional Architects today. Also, innovation and creativity, with a solid foundation in theory, will enable graduates to compete in the ever-changing 4IR.

Modern-day polymaths

Dickinson (2018), an architect for more than 45 years, believes that architects should be polymaths and not just specialists. He discusses the work of polymath Michelangelo and believes that, because of the avalanche of technology, which we are compelled to master, we are losing touch with reality because of the 'CAD Monkeys'[6] the architect has to now contend with. He believes a 'Balkanisation' of architecture has emerged with many architects splitting off into areas of specialisation.

There are a number of modern-day polymaths. Gerfen (2018), for example, discusses David Benjamin, and how his architectural practice, *The Living,* blends the topics of biology, computer science, and design, intending to augment architecture. During an interview with Benjamin, Gerfen commented on how the discipline had been defined in academia and in

[6] CAD Monkey is a programme created by an Architect and a Programmer to automate key processes. The 'CAD Monkeys' term used by Dickinson typically refers to people who have gone through years of difficult and strenuous education in engineering, architecture, or a similar field only to end up with a repetitive job where they do one task on a computer drafting program over and over again.

professional practices, which may be outdated, and the increasing pressure to take a more interdisciplinary approach.

It cannot be disputed that world-renowned entrepreneurs such as Elon Musk, Mark Zuckerberg and Bill Gates are polymaths who take full advantage of technology offerings in the 4IR. Further, according to Simons (2018), several research studies have revealed that people who enjoy broad interests are more likely to succeed in life.

Not everyone can become a polymath, but there are opportunities for joint research studies where multi-disciplinary contributions lend a polymathic approach to the study. Simmons (2018) reports how researcher Professor Brian Uzzi from Northwestern University in the United States (US), for instance, examined copious papers going back hundreds of years. He found that when teams collaborated, their output was more impactful and attracted numerous citations. In building construction, people from a variety of disciplines work together as a team, each bringing their skills to the collaborative work. Graduates in architecture are predominantly trained to be generalists within their fields.

The issue of social justice was championed by polymath architect, Michael Sorkin, who recently died of the Covid-19 virus. Smith (2020) explains that Sorkin's forthright manner sometimes caused conflict, but his insights into social justice and the influence of politics in architecture will always be remembered.

Charles Jencks (1939-2019), a prodigious polymath, was known for his skills in 'breathing life into buildings'. He launched a second career in landscape architecture where he incorporated ideas on mythology, cosmology, symbolism and science. He used the land to explore subatomic physics and chaos theory.

Social skills

Reif (2018), President of the Massachusetts Institute of Technology (MIT), advises that to survive in the 4IR, social skills need to be developed and improved. He explains that it is important for people to be proactive in reinventing the future of work.

According to Deming (2015), computers are poor at simulating human interaction and, therefore, communication skills are another key CCFO in the 4IR context. His research found an increasing emphasis on the importance of social skills which technology cannot emulate with ease. This emphasis he said is particularly relevant in high-paying jobs. Deming (2015:1598) explains, “this literature shows a clear link between the computerisation of the labour market and the decline of routine work. Yet the link between the increased variability of workplace tasks, team production, and social skills has not previously been explored.” Deming (2015) cites Heckman and Kautz (2012) who discuss the importance of non-cognitive or soft skills and, in particular, the ability to work with others.

Tucker and Neda (2019), writing for The Architectural Science Association (ANZAScA), explain how they found a clear knowledge gap in terms of the inclusion of teamwork in the curriculum of architecture and related design disciplines. This knowledge gap could be easily addressed by closer interactions with government, academia and practising architects. Osman (2018) feels that cross-disciplinary communities are crucial in the 4IR, and spaces should be created for conversations across community, industry, social and academic precincts.

Soft skills, according to Cimatti (2016), indicate personal transversal competencies like teamwork, communication and language skills, and social aptitudes. A blog team with broad-spectrum skills and commitment to collaboration used the social media platform, LinkedIn to analyse 50,000 professional skills most in demand by employers. The number one skill being sought in 2019 was creativity. LinkedIn indicated that creativity is the single most important skill in the world for all businesses today to master.

Predictions from the World Economic Forum (WEF) and futurists

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

In a WEF online article (2020:1), Erik Brynjolfsson, Director at the Massachusetts Institute of Technology (MIT) Initiative on the Digital Economy, commented that "*The future is not preordained by machines. It's created by humans*." The late Stephen Hawking, rated as one of the world's greatest physicists, and whose views on the future of the world are highly regarded, once commented in an interview with *Wired* that robots could, with the help of AI, supersede humanity. Brynjolfsson (2020) does, however, say that it would be best to not compete with machines, but rather to outdo them. He believes that creativity in schools is being stamped out and that schools should consider investing in this skill. Other 'soft skills' he mentions are leadership, teamwork and interpersonal skills.

Preparedness of architecture graduates for 4IR innovations

The SACAP registers architectural practitioners across four categories *viz.* Professional Draughtsperson, Professional Architectural Technologist, Professional Senior Architectural Technologist and Professional Architect. As shown in Figure 1, to attain registration as a Professional Architect, the current South African model requires five years of full-time tertiary study. This sees the graduate attain a Master's degree (NQF Level 9), and after an additional two years of Internship as well as successful navigation through professional practice examinations, SACAP registration is enabled.

Architecture programmes are offered in traditional universities as well as in Universities of Technology (UoTs) in South Africa. SACAP has annual Continuing Professional Development (CPD) requirements for the Professional Draughtsperson, the Professional Architectural Technologist, the Professional Senior Architectural Technologist as well as the registered Professional Architect. The registered Professional Architect has full licensure to tackle any projects of all complexities. Until the advent of the Covid-19 pandemic, most CPD courses were offered by building suppliers, attempting to promote their wares. The pandemic has brought to life daily online CPD offerings, made available internationally and in some cases, collaboratively. The topics are wide-ranging, including the Sustainable Development Goals and architecture after Covid-19.

The role of education in the 4IR

In the current fast-changing world, what is taught will soon become obsolete, and to address this, inter and multi-disciplinary learning opportunities should be offered at the tertiary level.

The South African Qualifications Authority (SAQA, 2018) in its NQFpedia Glossary of Terms[7] defines CCFOs as “the generic outcomes that inform all teaching and learning” (2017:19). Qualification and part-qualification developers must consider CCFOs in the development of qualifications. Such skills are not simply ‘nice-to-have’, but essential to prepare students for their future roles in fast-changing environments.

Hattingh (2016) believes that the Sector Education and Training Authorities (SETAs)[8], the government, and other policymakers, need to plan for the eventuality of changes arising from the 4IR. No education system can keep up with these changes and curricula need 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. Creative skills are useful in careers that are complex, fragmented, ever-evolving and collaborative and should be a requirement at any NQF level.

Marr (2018:4), who wrote for Forbes, advises that any jobs requiring true creativity are probably safe for the foreseeable future. He commented that,

> Many jobs require additional and very human qualities like communication, empathy, creativity, strategic thinking, questioning, and dreaming. Collectively, we often refer to these qualities as ‘soft skills’, but don’t let the name fool you; these soft skills are going to be hard currency in the job market as AI and technology take over some of the jobs that can be performed without people (Marr, 2018:4).

Webber-Youngman (2017) lists ten skills, other than those previously mentioned in this article, highlighted by the WEF (2017) as namely, emotional intelligence, service orientation, negotiating, and judgement/decision-making.

Educators are not spared from being replaced, as according to Dvorsky (2017), the host of massive open online courses (MOOCs), Apps, and computer-aided instruction will soon eliminate teaching positions. VR technology is useful in the studio environment, where, according to Powers (2001), the constructivism ideology teaches students about built environment challenges without real-world repercussions. Webber-Youngman (2017) feels that Inquiry-based Learning (IBL) is a crucial component in getting projects completed. This

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[7] The NQF*Pedia* was accessed at https://hr.saqa.co.za/glossary/pdf/NQFPedia.pdf#, on 06 August 2021.
[8] The main purpose of a SETA is to improve and develop skills within its sector, to identify skills development needs, and to ensure that national standards are maintained.

theory has the locus of control with the student who is encouraged to ask questions. IBL emphasises constructivist learning, first put forward by David Kolb (1984), who introduced experiential learning from a constructivist viewpoint. Essentially this means 'learning by doing' from people, incidents and resources, reflecting and building on prior knowledge. In the architecture studio environment, the lecturer is the Master, and there is a longstanding tradition of learning-by-doing (Moore, 2001) where the apprenticeship model is in place.

During the third year of the Bachelor of Architecture degree at the University of KwaZulu-Natal (UKZN), students engage with environmental and social influences in architecture, preparing them for their internship year. This concept embraces Vygotsky's (1978) social-cultural theory, which conceives of human learning as a social process. After graduating, what Kolb (1984) refers to as experiential learning in the internship year takes effect where environmental factors, cognition and experiences influence the learning process, better-preparing students for their Master's degrees. During the Honours and Master's programmes, urban design and community engagement are emphasised and therefore, should their experiential learning have been effective, this would benefit students' ultimate progress. Also, elective courses from other disciplines, as well as interactions with established local communities with intrinsic issues, ensure a multi-disciplinary approach and the continuance of experiential learning.

Built environment higher education programmes at *all* NQF levels have traditionally encouraged experiential learning with a hands-on approach through visiting building sites and interacting with professionals in this field. This approach has blended with the studio-based pedagogy and the encouragement of reflective practice. As observed by professors of architecture education, Kolhe and Tarar (2017), experiential learning has a key role to play in the education of the builders of the future and these include planners, architects and engineers. They commented on how this theory of learning moves away from the traditional 'chalkboard' approach leading to change and the enhancement of communication and teamwork skills, ultimately encouraging lifelong learning.

In architecture tertiary studies, studio work also exemplifies this theory of experiential learning as students learn by experiencing and experimenting with different materials and theories. Kolb's (1984) experiential theory, and constructivism, where students construct their understanding of the world with real-world problem-solving, applies in the studio as well. This theory of learning by doing has its historical roots in the work of Dewey (1929) and Bruner (1961) as well as Vygotsky (1978) and is still relevant in many paradigms of education. However, a reassessment of how these theories work in the 4IR should be considered.

Entrepreneurship and innovative thinking

The 'SAQA Unit Standard Identity (ID) 114600' at NQF Level 4 applies to the development of innovative thinking in small businesses. Accredited providers who offer this unit standard include training companies, filmmaking organisations, consulting engineers and transport firms. Figure 2 illustrates the importance of creative skills as part of the soft skills to be developed for business management and is pertinent, as many architecture graduates will establish their own businesses. Figure 2 also illustrates how creativity in business management links with other soft skills such as problem-solving and its importance in innovative practices.

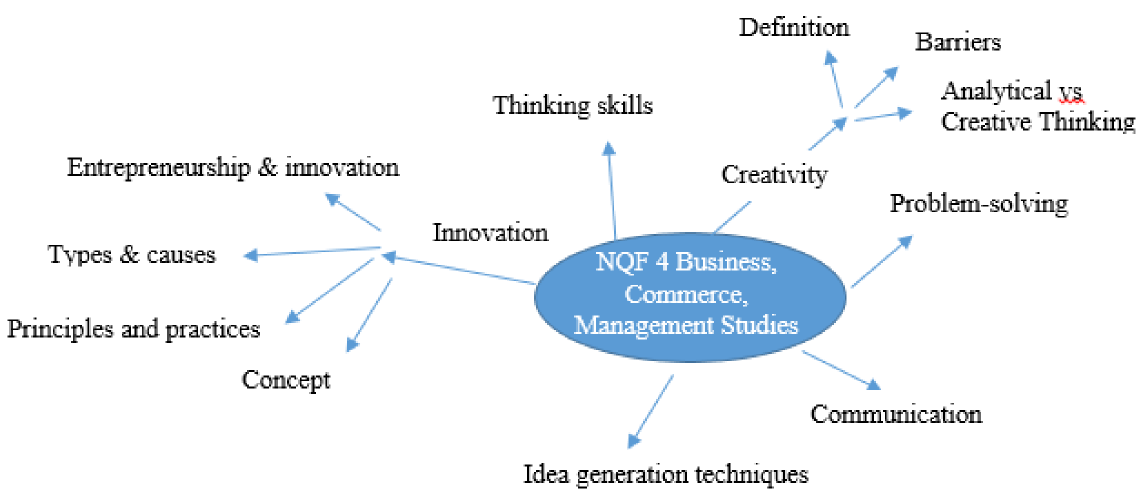

Figure 2: Creativity in business management (Source: Adapted from SAQA Unit Standard Identity [ID] 114600)

Creative problem-solving is key for the development of skills, and rote learning is a thing of the past. Robots are ideal for handling repetitive tasks. Gleason (2018) reports that experiential and problem-based learning are essential components of higher education pedagogy in the 4IR. Singapore's institutions of higher education, for example, aim to upskill and educate their citizens by shifting the population's skill sets.

An example worth emulating

Singapore is well-known as a country that embraces technology. Gleason (2018), in referencing Singapore, believes that humans will always drive innovation and creativity and should learn to work alongside robots, which have been referred to as ‘cobots’. Collaboration with government and business is recommended and, according to Gleason (2018), both should provide finance, with the former being committed to up-skilling its citizens. Adaptable and flexible mindsets mean cognitive agility that enables people to keep current in fast-changing environments.

Singapore has two large-scale initiatives, *SkillsFuture* and *Smart Nation*, which work alongside their institutions of higher education to prepare the population to live and work in the 4IR. The beneficiaries of these ventures include citizens of all age groups and the nation’s economy.

The Smart Cities in Singapore, with the IoT and Wi-Fi-enabled devices, will see communication enhancing lifestyles for city residents. However, these citizens need to become digitally literate to take full advantage of these technologies. Gleason (2018:165) states “*In preparation of 4IR, Singapore is deploying a multi-faceted strategy that merits rigorous appraisal by other countries and institutions of higher education*”. Perhaps, this example from Singapore is worth emulating by countries such as South Africa.

South Africa in the 4IR

During the 2020 budget speech, Mr Tito Mboweni, South African Minister of Finance and former Governor of the South African Reserve Bank, spoke of South Africa’s commitment to ‘not being left behind’ as far as 4IR is concerned (SA Parliament, 2020). He advised that schoolchildren, particularly those from disadvantaged communities, should learn robotics and coding skills. Smart cities, he said, are developing, and two examples are Oliver Tambo Airport and King Shaka International Airport – the international airports in two of South Africa’s nine provinces. Education was given high focus in the budget, and there are plans to build a new university of science and innovation in the Ekurhuleni region of Gauteng, South Africa’s most populous province.

Lifelong learning

Architectural studies do not stop at tertiary level, as CPD ensures that architectural professionals are kept at the cutting-edge of technology and has become essential for each professional's career requirements. Vestburg (2018) commented that 4IR needs to embrace the concept of lifelong learning:

> There's something else we need from a Fourth-Industrial-Revolution education system: the full embrace of the concept of lifelong learning. I realise I'm hardly the first to espouse the lifelong-learning ideal, but we need to be more emphatic about making it a reality. Rather than a nice add-on to our current formal education system, it should be the concept around which the entire system is understood and organised.

Teamwork or group work is mentioned repeatedly by academics and practitioners as being advantageous in the workplace. Teamwork provides informal, formal and non-formal learning opportunities. The latter also includes social media. However, students are frequently resistant to teamwork where, for example, uneven workloads are experienced, as commented in the study on which this paper draws. As architectural professionals practise in multi-disciplinary environments, the groundwork for these aspects should take place at tertiary level although such skills are honed throughout the course of life. Peerutin (2019) comments that it is puzzling that more practices have not taken advantage of outsourcing highly skilled experts to form teams. Collaboration and communication are key CCFOs, and conflict management and cross-cultural awareness are important considerations in the built environment.

METHODOLOGY

The quest was to examine how, by the introduction of CCFOs, architects can become multi-skilled, multi-disciplined and possibly even polymaths (whose knowledge spans a variety of topics).

An empirical, longitudinal combined research methodology was used for the study on which this paper draws to derive benefit from both the rich, interpretative, in-depth qualitative approach and the more scientific, generalisable quantitative approach. The rigorous and persuasive mixed methods project enabled insights from graduates from four tertiary institutions in South Africa in the discipline of architecture. Responses were evaluated from an architectural and an educational perspective.

Two instruments were formulated. The core considerations for assessing the CCFOs were addressed by a quantitative approach using a questionnaire submitted via email with Likert scale responses of ‘Yes’, ‘No’, and ‘Sometimes’, analysed in Microsoft Excel. Ethical considerations were adhered to as respondents were advised that all data would be kept confidential.

A sample of M.Arch. graduates from UKZN, University of Cape Town (UCT), University of the Free State (UFS), and Nelson Mandela University (NMU) participated in the study. The years in which the sample had graduated ranged from 2014 to 2018. The data were acquired from 17 graduates with M.Arch. Degrees. The qualitative questions were devised using the broad, universal issues deemed important for the future of architectural practice, namely climate change, water security, an ageing population, social identity, an ethical and empathetic understanding of diverse perspectives, social justice, smart cities, building technologies, reuse of materials and virtual worlds, mentioned in Finch and Melvin’s (2017) article concerning their vision for the architecture profession for the next 10 years.

STUDENT FEEDBACK ON THE MARCH 2020 CURRICULUM

There were 17 responses to 45 requests made to the four educational institutions. The respondents highlighted the lack of guidance in their curriculum on the topics of new building technologies such as nanotechnology, smart cities and virtual worlds, all issues raised as important for future architects by Finch and Melvin (2017). The data revealed that M.Arch. graduates would thus be under-prepared, in terms of 4IR readiness, for practising as architectural professionals.

All responding students commented that their CAD skills were mostly acquired during their working experience and that their exploration of virtual space was self-taught. One student regretted the emphasis placed on hand-drawn work, as expert CAD skills were expected in the marketplace. She commented, “*Viscom*[9] *ended in undergrad and while I was studying the course never went into computer graphics, rendering/3D software and only focused on hand-sketching - a major stumbling block I now find in the workplace*”.

[9] Viscom stands for Visual communication, which is a module in architecture studies that uses a variety of computer software and hand skills.

Presentation skills were emphasised in the summative assessment stages of the architecture learning programmes, as this is where the students graphically display their design creations. Students print out large-scale drawings, sketches and 3D-rendered imagery. One student commented, "*Well presented schemes often masked their underlying architectural flaws*." Another said, "*Sometimes people passed because their presentations were* flashy. But virtual worlds are important in the workplace where the cost savings using this technology are considered essential. One student commented on how presentation skills were expected from students to communicate their design work, but no formal instruction on this aspect was received.

Another area needing development emerged, of curriculum coverage regarding running an architectural practice. Some Respondents pointed to a lack of understanding of the current metrics in finance, marketing, professional services and operations. One student said, "*Only the bare minimum was covered within certain courses*." Another commented, "*This would be highly beneficial if added to the curriculum*." However, in one institution, a module entitled *Simulated Office Practice* does aim to introduce some of these skills. A graduate from another institution said, "*It was covered to a minor degree in a specific module*." Considering the importance of entrepreneurship, it is something that should be addressed in greater detail in the curriculum.

Teamwork

Teamwork in the 4IR is essential, particularly as some projects are complex in concept, requiring multidisciplinary skills. Responses regarding the inclusion of teamwork in the curriculum were varied but it appeared that the students did not like it. One respondent said, "*Not everyone contributed equally to the team*." Another said, "*Mine was one of the very few teams that got along and worked together effectively, personalities were complementary, and this allowed me to enjoy it more than some of my classmates."*

Conflict resolution is something that frequently arises in the built environment profession, and teamwork, even if disliked, gives students insight into what could happen when they start working. For instance, one graduate said, *"A team's success or failure depends entirely on the individuals that make up the group. So, when one or two let you down, it constantly creates tension."*

CONCLUDING OBSERVATIONS

Graduates in architecture can evolve into polymaths if exposed to wide-ranging learning opportunities and collaboration with stakeholders in business and government. The development of the architecture curriculum should be an ongoing exercise to ensure that students' skills are current and relevant in the context of the 4IR. Opportunities for multi-disciplinary relationships between Architecture, Information Technology (IT), Environmental Science, and Engineering would assist universities with the costs involved in obtaining suitable resources such as those required for 3D printing, smart cities, robotics, material fabrication and others.

A key question is, '*Can universities endure the fluidity of these changes?*' In this study, although the sample was very small, a key finding was that the responding graduates reported being ill-equipped to run architectural practices. A greater emphasis on the administration and solving of entrepreneurial challenges in architectural practices will address this issue. Furthermore, creativity and communication skills are emphasised in the literature, and such skills should not be neglected in the formulation and modification of curricula to prepare architecture students to work cooperatively in the context of the 4IR. Further research on other issues also described in the Finch and Melvin (2017) list need to be explored if future architects are to be viewed as polymaths in the true sense of the word, and again take their rightful places as project leaders.

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PAPER 2

The Hybrid Flipped Classroom: An Intersection between the Fourth Industrial Revolution (4IR) and Health Professions Education

Dr Rivak Punchoo, Mr Sachin Bhoora and Dr Liz Wolvaardt

ABSTRACT

The Fourth Industrial Revolution (4IR) defines the use of varied technologies, which fuse and interact across the physical, digital and biological spheres and therefore are relevant to health professions education (HPE). The hybrid classroom utilises face-to-face teaching with computer-mediated instruction to promote effective teaching and learning. The 'flipped classroom', on the other hand, is a teaching model, which inverts the traditional approach to teaching by presenting learners with their course content material in advance of their contact teaching sessions and thereby focuses the learners on conceptual problems during the contact sessions. Chemical pathology is a laboratory-based discipline, which teaches the biochemical understanding of disease. In this study, we combined the hybrid and flipped classroom teaching approaches and 4IR technologies to curriculate a pilot study unit in the chemical pathology training of postgraduate students at the University of Pretoria (UP). Here, we describe the pedagogic principles of the teaching model in our study unit; the design elements of the model; and discuss our experiences and challenges in developing our teaching unit. Our experience identifies the flipped hybrid model as feasible and an effective method to apply evidence-based education principles to curriculate a case-based approach to chemical pathology studies at the post-graduate level. An important caveat in using 4IR technology is the prudent use of aligning relevant technologies to learning objectives to avoid content overload and distraction by unnecessary online e-tivities. In conclusion, it is evident that the ongoing use of 4IR principles and technology in HPE is unavoidable if we are to meet the needs of a changing health education system and the healthcare workforce.

INTRODUCTION AND BACKGROUND

The Fourth Industrial Revolution and Health Professions Education

The 4IR defines the use of varied technologies, which fuse and interact across the physical, digital and biological spheres (Schwab, 2016) and therefore have a considerable impact on disciplines, economies and industries. The incorporation of technologies to enhance educational outcomes and skills were emphasised by the key stakeholders at the 2019 South African Digital Economy Summit (South African Government, 2019). According to the World Economic Forum (WEF, 2018:para. 1), “the skill sets required in both old and new occupations will change in most industries and transform how and where people work” in the 4IR. A Foundation for Young Australians’ (FYA, 2017) report estimates that in 2030, workers will spend almost 100% more time problem-solving at work, 41% more time applying critical thinking and 77% more time using mathematics and science skills than they did at the time of writing the report.

The 4IR workspace therefore will require learning, unlearning and re-learning to function effectively in changing work contexts (Toffler, 1970). Skills highlighted as important for the 4IR workspace include complex problem-solving; critical thinking; creativity and an agile mindset; and judgement and decision-making (WEF, 2020). Therefore, higher education, including the health professions education (HPE) sector, needs to adapt itself for the 4IR. Educators need to prepare new graduates with appropriate skills to tackle a demanding and changed workspace.

Penprase (2018:219) identifies four critical requirements for the design of education programmes. Firstly, educational plans incorporating 4IR can include “hybrid online and in-person instruction and efficient and seamless integration of global videoconferencing and a wide array of asynchronous educational resources” (Ibid.). Secondly, an emphasis on hybrid instruction and the optimisation of flipped and online courses (concepts explored later in this paper) can develop efficient environments of learning which can adapt to the diversity of students and student needs. Thirdly, a deep intercultural understanding and respect of human freedom and the rights of trainees require recognition. These aspects can be supported by interdisciplinary and global curriculum design, which can improve the development of intercultural and interpersonal skills and therefore empower novice graduates in the workplace. Fourthly, an overlay of ethical and critical thinking will enable the development of thoughtful and evaluative approaches to the exponential utility of varied technologies. These four requirements can guide approaches to HPE and curriculum reform across the HPE spectrum.

Telang (2019) also highlights the role of curriculum transformation to meet the future needs of learners and emphasises student-directed learning, peer learning, 'cybergogy' and integrated assessments as essential components of 4IR in HPE. Cornu (2011) notes that educators need to recognise that digital natives (the generation Z born after 2012) learn in different ways and therefore must be taught in different ways, and this can include the use of Artificial Intelligence and simulation-based learning. Furthermore, interprofessional education needs to be expanded to provide opportunities to learn, research, and work (Telang, 2019). These strategies allow graduates to work with new technology and each other in the context of how the world is working (Butler-Adam, 2018).

The 4IR can transform HPE by the production and sharing of content freely on a global stage with an emphasis on educators functioning as resource guides (Hamisah and Puteh, 2018). Couros (2015; cited in Fomunyam, 2019:273) further acknowledges that "Technology will never replace great teachers, but technology in the hands of great teachers is transformational". The adoption of the 4IR in science education is growing (Sahin, 2018) and advances in technology will continue to encourage collaboration and global exposure in education (Dabbagh, 2018). Fomunyam (2019) also recognises that the 4IR is more than technology-driven change and instead possesses a disruptive innovative potential, which can positively impact health and education sectors.

The National Qualifications Framework (NQF) and Level Descriptors

The National Qualifications Framework (NQF) Act No. 67 of 2008 (Republic of South Africa [RSA], 2008: Clause 4) defines the NQF as "a comprehensive system approved by the Minister for the classification, registration, publication and articulation of qualifications in South Africa". The South African NQF comprises ten levels, each defined by an NQF Level Descriptor that describes the learning achievements or learning outcomes appropriate for qualifications at the particular level (SAQA, 2012).

The NQF level descriptors form an essential backbone for the construction of curricular approaches and outcomes specified for each level in the multi-level NQF system. Each of the level descriptors identifies ten common competences at levels applicable for each NQF level and provides an essential map to assist students and educators along an integrated ladder of competences.

The NQF and its level descriptors thus provide an essential framework to define course objectives and provide learning opportunities in HPE. In the context of 4IR, teaching and technology similarly need to scaffold the progression of knowledge, skills and attitude domains as students progress to advanced studies by aligning and using context-specific technologies relevant to the future 4IR professional workplace.

Chemical Pathology and the Bachelor of Science Honours (BSc (Hons) programme at the University of Pretoria (UP)

Chemical pathology, also termed clinical biochemistry, belongs to the family of pathology disciplines taught at Universities and Universities of Technology (UoTs) in South Africa and involves the biochemical investigation of bodily fluids. The changes in body fluid chemistry inform the diagnosis and monitoring of disease states (Royal College of Pathologists, 2020).

The discipline draws knowledge from the basic sciences: biochemistry, molecular biology and physiology, which are applied to laboratory testing in disease states. Some of the primary learning outcomes in chemical pathology include the measurement and interpretation of tests (analytes) in bodily fluids, research on the biochemistry of disease and scientific development to find new ways to measure analytes. Clinical scientists, medical consultants and biomedical scientists are all involved in providing a clinical biochemistry service to enhance evidence-based and contextually relevant biochemical testing.

At UP, the Department of Chemical Pathology provides postgraduate study opportunities for students who have completed undergraduate studies in the biological sciences. The postgraduate study programmes offered are BSc (Hons), Master of Science (MSc) and Doctoral (PhD) degrees, and these programmes provide trainees with discipline-specific knowledge and research learning opportunities.

Students exiting the BSc from various streams of the biological sciences pursue the BSc (Hons) programme in the Department. The class enrolment for the BSc (Hons) is, on average, five students each year with an average of two students continuing to further higher education degrees in the Department. Students have no formal undergraduate training in chemical pathology but study basic science major subjects. It is expected that prior learning of biological sciences provides sufficient baseline knowledge to complete the Honours programme. A small group of scientist interns enrolled in the National Health Laboratory Services (NHLS) scientist internship programme also attend the BSc (Hons) programme.

These BSc (Hons) students and scientist interns are taught theoretical modules and pursue a research elective. The theory modules are a challenge for students, as they are required to develop knowledge across diverse topics in chemical pathology. These topics cover expansive content and are applied to clinical cases.

The teaching landscape at UP

At the Faculty of Health Sciences at UP, in which the Department of Chemical Pathology is located, the Blackboard™ learning management system (LMS), Blackboard™ Mobile, and Blackboard™ Collaborate technologies, are used in a blended teaching and learning environment, which applies electronic technology in combination with traditional learning opportunities.

The teaching and learning model is partitioned into sequentially linked pre-class, in-class and post-class stages. The pre-class stage provides students' preparative work, for example, videos, electronic lectures (e-lectures) and electronic activities (e-tivities); which prepare students for the contact in-class session. The pre-class stage activates prior knowledge, decreases cognitive overload, encourages active learning and broadly prepares students for lifelong learning. Formative assessments, which encourage problem-solving and self-regulated learning, form an essential component of this stage.

The in-class stage focuses on engagement consisting of exploring problems and scaffolding concepts explored in the pre-class stage. This inquiry-based learning approach stimulates critical thinking and creates opportunities to forge deep understandings of concepts as students retrieve information and make sense of discontinuities in the content material (National Academies of Sciences and Medicine, 2018). These outcomes are also aligned with preparing students for the 4IR as they develop problem-solving skills, creativity, teamwork, intercultural communication and collaboration (Department of Education Innovation [UP] 2020).

The post-class stage consolidates learning through the use of activities, for example, assignments, which allow students to organise their knowledge into meaningful hierarchical patterns. Anti-plagiarism software on the LMS is also available to students to encourage original thought and sound academic writing.

The three-stage model (Figure 1) was applied in teaching chemical pathology in the BSc (Hons) programme in the Department of Chemical Pathology at UP.

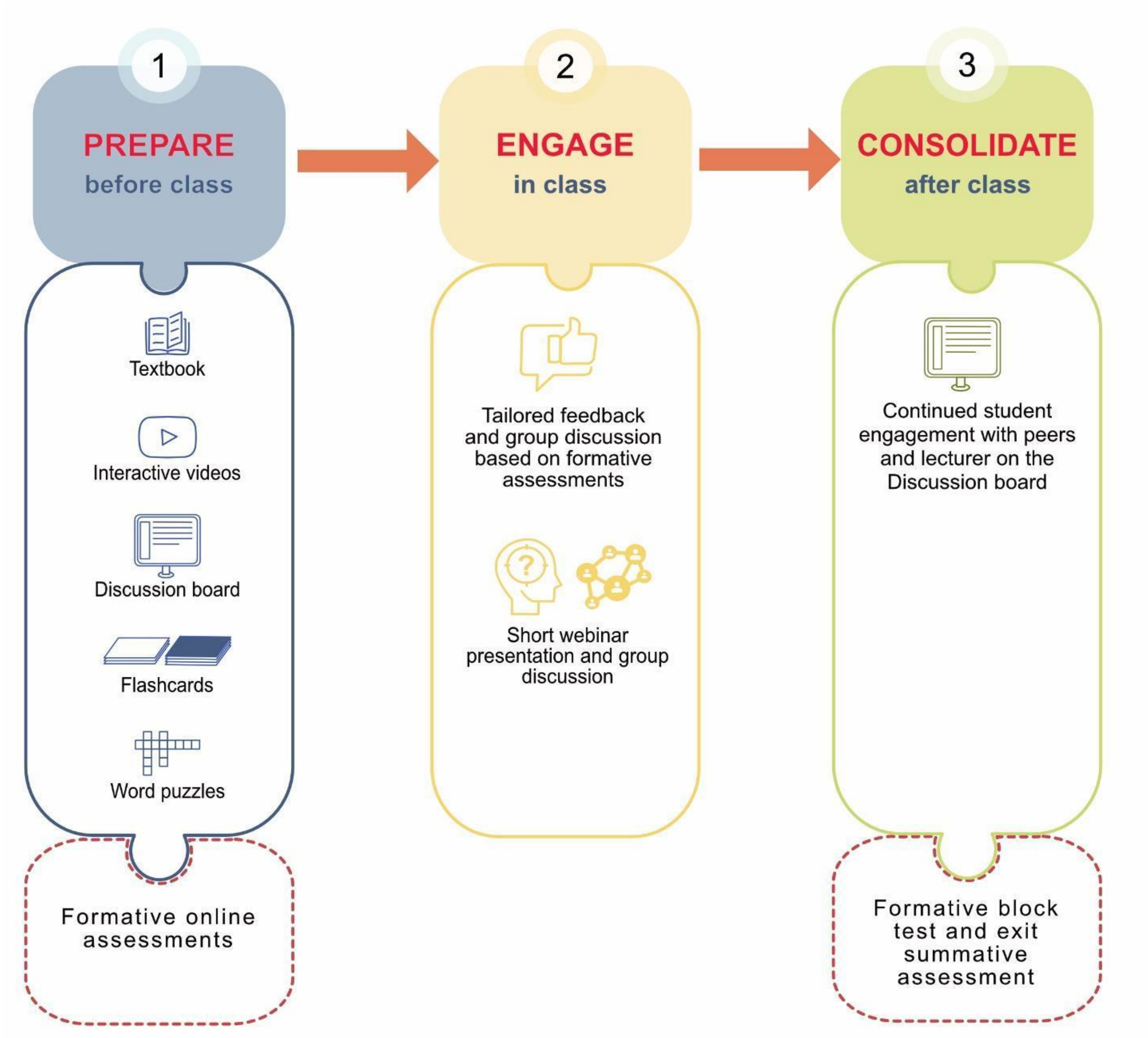

Figure 1: The three-stage teaching and assessment model in the BSc (Hons) in chemical pathology at UP (Source: Authors' personal collection)

PURPOSE OF THIS PAPER

The purpose of this paper is to:

- provide an overview of the pedagogic principles framing the teaching and assessment model used in the pilot study unit;
- describe the design elements of the model; and
- discuss the experiences and challenges of academic staff in developing a teaching unit that uses a hybrid flipped teaching model.

PEDAGOGIC PRINCIPLES APPLIED IN THE FORMULATION OF THE TEACHING INTERVENTION IN THE DEPARTMENT OF CHEMICAL PATHOLOGY

The academics in the Department of Chemical Pathology at UP employed pedagogic principles from an established evidence-base. These pedagogic principles included the hybrid-learning model, the flipped classroom instructional model, and the case method and e-learning approaches. The teaching and assessment components were designed using e-lectures and e-tivities on the LMS and shareware applications. This teaching approach targeted criteria in the NQF Level 8 descriptors and utilised the hybrid flipped design.

Hybrid learning

Hybrid learning is a pedagogical approach that combines face-to-face instruction with computer-mediated instruction (Ferdig et al. 2012; Qi, 2008). This approach scaffolds learning units, building successively on previous learning objectives (Garrison and Kanuka, 2004). It employs asynchronous and synchronous learning modes and therefore affords a flexible learning approach in time and space to improve deep understanding and enable the "highest levels of educational mastery" (Powell et al. 2014:6). Multiple modes of hybrid delivery exist with various mixtures and approaches to optimise the achievement of learning goals (Garrison and Kanuka, 2004).

The flipped classroom

The flipped classroom is an educational approach that reverses the traditional lecture and homework elements of a course (Moffett, 2015). Students are first presented with course material in advance of the contact session. Students can, therefore, engage with content and related material outside the class, for example, reading a book chapter before the in-class contact session. Contact time shifts from delivering content information to focussing on activities and discussions related to the content and related conceptual problems (Bishop and Verleger, 2013). The flipped classroom instructional model allows content material to be delivered outside the classroom while the formal lecture is used to "work through problems, advance concepts and engage in collaborative learning" (Tucker, 2012:770). Bishop and Verleger (2013:5) support the role of technology in the flipped classroom and broadly view this model as "an educational technique that consists of two parts: interactive group learning activities inside the classroom and direct computer-based individual instruction outside the classroom".

The advantages of the flipped classroom are the provision of increased learning opportunities for all learners, which is supported by a teaching evidence-base (Kachka, 2012a, Johnson, 2013). Other advantages include improved student-lecturer engagement fostered by corrective feedback during the contact session and the economical use of time exploring learning objectives (Bergmann et al. 2013; Johnson, 2013). This approach directs active student learning to solve conceptual problems (Bergmann et al. 2012). The student is also advantaged as the instructional format provides flexibility, which supports student self-paced learning (Johnson, 2013, Butt, 2012), for example, students can repeatedly watch video study material outside the classroom until basic concepts are mastered. Lectures and study material can be composed and delivered using the learning technology available in an LMS or other educational software. Contact time is used to clarify problematic concepts and improve evaluation of cases, thus holistically contributing to the development of higher cognition domains (Anderson et al. 2001).

The e-learning approach

According to Ruiz et al. (2006:207), e-learning uses "internet technologies to deliver a broad array of solutions that enhance knowledge and performance". For example, lectures are delivered in bite-sized virtual presentations with interaction using self-assessment questions and multimedia such as videos. E-learning is active, and interactivity maintains learners' interest. It also provides a means for practice and reinforcement that improves learning. Additionally, there is increased accessibility to course materials, the opportunity for personalising instruction and self-pacing. Educators become "facilitators of learning and assessors of competency" rather than distributors of content (Ruiz et al. 2006:207).

Case-based method

The case-based method of learning is a form of inquiry-based learning and fits on the continuum between structured and guided learning (Banchi and Bell, 2008; Thistlethwaite, 2012). The case method utilises two components: cases and case discussion. Case-based learning promotes active learning. Active learning methods appeal to students in the affective domain, motivating them to engage with the material even when it is challenging. The students improve their cognitive skills by using real case evidence and select relevant theoretical concepts from course content material. Student engagement is increased, and students learn the material more profoundly employing higher-order cognitive thinking skills, for example, analysis, interpretation and evaluation (Entwistle 2009). Thus, there is a shift away from the passive acquisition of knowledge to improved understanding and retention of knowledge (Thistlethwaite, 2012).

Case-based discussions in small groups promote an opportunity for students to learn from each other (co-operative learning), which allows them to take ownership of their learning. Co-operative learning identifies gaps in student knowledge and promotes mastery of knowledge. In addition, co-operative learning increases retention improves critical thinking and course satisfaction in comparison to traditional lecture instruction (Velenchik, 2018).

FLIPPED HYBRID TEACHING IN UP'S DEPARTMENT OF CHEMICAL PATHOLOGY

An overview of the flipped hybrid study unit in the Department of Chemical Pathology

The BSc (Hons) students in the Department of Chemical Pathology were taught a theory study unit on endocrinology[10] from their syllabus, which was conducted for one week. This study unit used a hybrid flipped classroom model that consisted of online pre-class teaching using an e-lecture and other e-tivities: puzzles, flashcards, case videos and an interactive discussion board for case study discussion. The material was delivered on the institutional LMS and other application platforms for Blackboard™ non-integrated software. Further, a one-hour in-class session provided tailored feedback on cases, reinforced essential facts using a webinar segment and addressed new conceptual problems in a peer-learning environment. The post-class session encouraged engagement through the continued use of the discussion forum. Formative assessment in this study unit utilised 'e-tivity' challenge

[10] Endocrinology is the branch of biology and medicine that studies the normal production and functions of chemical messengers (hormones) produced by glands in the human body. The hormones are released into the blood and transported to target organs to exert biological actions. Endocrinology is studied in health and disease states (Huhtaniemi and Martini, 2015).

questions and a discussion board. The post-class assessment consisted of a formative test and a summative assessment exit examination.

Online teaching

The lesson plan was designed using the backward design (Wiggins and McTighe, 2011) where key learning objectives aligned to assessments were first defined. The online teaching activities and in-class session teaching were blueprinted to objectives (learning outcomes) and assessments. A PowerPoint™ virtual lecture that covered foundational knowledge and a clinical case vignette was delivered on the LMS. Students were required to use the virtual lecture and parts of a prescribed textbook chapter to guide their analysis and evaluation of the case vignette. Students were required to evaluate laboratory data in conjunction with a patient's history and clinical findings, which reflected an authentic application of the subject. Students answered the clinical case questions on the online discussion forum tool. A conversation amongst students and the lecturer was encouraged, and the lecturer addressed conceptual problems. The online forum also provided a collaborative learning environment and followed Mazur's (2013) peer instruction model where a problem posed by the instructor was answered by reflection, peer interaction, and corrective feedback.

A second clinical case was provided online to students using a clinical case video sourced from an open-education resource on YouTube™. The video was aligned to a learning outcome in the unit and delivered using the open-access EdPuzzle™ platform[11]. Questions were embedded at various stages in the video and emphasised high cognitive skills. The student responses were recorded on the platform. This platform functioned independently of the LMS, and student responses were not integrated into the Blackboard™ Grade Centre. However, the responses provided useful feedback to the lecturer on student performance and provided topics for further exploration during the contact session.

In addition, a core conceptual area was explained to students using a short five-minute 'Conceptual Nugget' video. The Conceptual Nugget was based on real-life blackboard-styled writing using a screencast video composed on Apple iPad®. The instructional content was captured in real-time using the iPad®'s Notes application tool. To improve engagement

[11] For more information, visit: https://edpuzzle.com/

with students, a voice-over recording was superimposed on the video using the iMovie® application on the iPad®. The video delivered tailored content aligned to a course objective/ learning outcome and was uploaded to the LMS.

Flashcards and crossword puzzles were used to improve engagement with the virtual lecture and the prescribed chapter. The flashcards provided summaries of key content areas and were composed and distributed online using Cram™. Each flashcard asked a single question and focussed on a single concept and thus provided students with easy-access summary points on critical concepts, enabling student revision. Crossword puzzles were formulated on the Discovery Education™ Puzzle Maker online tool[12]. The puzzles required students to answer low cognitive domain questions on the module's content, aimed to improve engagement with the virtual lecture and prescribed chapters. Both the flashcards and the puzzles were not integrated on Blackboard™ but delivered on their respective open-access software platforms.

In-class contact session teaching

The contact session was facilitated by the lecturer, who reviewed unresolved case-based questions and theoretical problems, which arose in the Blackboard™ Discussion forum and EdPuzzle™. The contact session also employed Mazurs's (2013) peer instruction model, which encouraged peer-learning in small groups and further provided a useful discussion and link to a webinar segment on endocrinology for post-lecture engagement.

Post-class engagement

The discussion board was regularly reviewed by the lecturer in the week of the study unit, and post-class student queries were redressed. This approach finalised corrective feedback on all questions and conceptual problems.

Formative assessment

All online scored activities did not contribute to the final class mark for the unit as the activities were designed to develop learning and provide feedback opportunities. Students were encouraged to complete all online activities and attend the contact session. Reminders to complete all formative work were also sent out via announcements on the LMS.

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[12] The tool can be accessed at http://puzzlemaker.discoveryeducation.com/

A formative written test was administered at the end of the unit, which blueprinted online content and consisted of short-answer questions and a clinical-case study. Students could peruse their answers in conjunction with a memorandum. Some students also requested a discussion of their test scripts with the lecturer.

Summative assessment

The unit was assessed at the end of the year (together with fifteen other units) using a high-stakes end-of-year exam, which blueprinted content and was similar in format to the formative end-of-unit test. Students did not receive feedback on the final summative assessment as this provided an exit point to the completion of the degree.

EDUCATORS' EXPERIENCES

Educators with time constraints and low confidence in using technology find the design of teaching material requiring technology expertise unappealing (Shimamoto, 2012; Snowden, 2012; Johnson, 2013). Multi-disciplinary team inputs into the design and delivery of online course material were an essential enabling factor in the pilot study of the Department of Chemical Pathology at UP. The teaching staff involved in this unit attended a formal short course on developing online teaching skills, but also developed information technology expertise on the job. A qualified instructional designer and educational consultant assisted with the pedagogic and technical review of the study unit.

One of the main pitfalls discussed in the literature in the development of a flipped classroom is the increased time and work involved in designing course material (Wagner et al. 2013). This project was approached as a pilot intervention, and only a single unit in the degree was changed, thus providing educators with the opportunity to learn about hybrid course design without the pressure of multiple timelines. The use of a Gantt chart enabled the planning and timely execution of tasks in the design of the study unit.

Student engagement involves activities both inside and outside of the classroom and operates at many levels (Alexander, 2009; Hardy and Bryson, 2011) and is shown to predict academic success (Rodgers, 2008, Strydom and Mentz, 2010, Roberts and McNeese, 2010). The engagement by students in pre-class and in-class activities is critical to optimise student learning (Kachka, 2012b). Student participation was encouraged by stipulating that all activities needed completion for entrance into the final assessment.

Technological availability, including the provision of online learning, has been shown to enhance student engagement (Robinson and Hullinger, 2008; Rodgers, 2008). The pilot study unit employed various online teaching tools and formative online assessments, which provided diverse ports for student engagement. Pre-class and in-class student engagement was supported by Mazur's (2013) approach to instructive learning, which encouraged student group learning. Jones (2008) advocates that opportunities for rigorous and relevant learning are impactful to secure a high level of student engagement and thus facilitate academic success.

There is a common misconception that the strength of the flipped classroom centres on the use of technology (Bergmann et al. 2012). Designers of the pilot, when designing the teaching materials foregrounded only the use of relevant technology, which supported learning objectives. The flashcards provided quick summary revisions which students accessed on-the-go on their mobile phones; the clinical case videos encouraged interpretative skills, which were blueprinted to assessments. The Conceptual Nugget video complemented the virtual content material and allowed repeated review of an essential problem concept. Also, the use of the discussion forum allowed the lecturer to be accessible off-site and provide asynchronous feedback. The judicious choice of relevant technologies, therefore, was positive in supporting the hybrid teaching in this study unit.

Rowe et al. (2013:7) acknowledge that technology in the HPE classroom has the benefits of enhancing content with rich media and developing relevant attributes; however, the authors also note that "a sound pedagogical teaching strategy must drive and support the implementation of technology in teaching practice". Lockyer et al. (2005) further identify that when approaching the flipped model, educators should perform a needs assessment, determine content and learning outcomes, and select appropriate educational and assessment methods. Therefore, the use of technology needs careful consideration to ensure the fitness for purpose of the relevant learning outcomes and planned assessments based on pedagogic evidence. The consistent use of the backward lesson plan (Wiggins and McTighe, 2011) was vital for selecting relevant and aligned online teaching and assessment technologies, and further integrating the online activities with the in-class and post-class stages of our teaching model. Thus, the overall pedagogic design of the study unit was critical to correct selection of the online teaching and assessment.

The pre-class and in-class partitioning of content material was guided by the revised Bloom's taxonomy (Anderson et al. 2001). For example, low cognitive thinking, comprehension of essential knowledge, and early attempts at analysing clinical cases were delivered in the pre-class e-tivities and formative assessments. The corrective feedback, which focussed on higher cognitive thinking, was based on the case vignette and was conducted online and further explored during the in-class session. The discussion board functioned as a mediating tool between the pre-class session and in-class session to advance and consolidate mastery of concepts progressively. This controlled partitioning of content delivered across the stages of the teaching model used, improved integration of learning objectives and avoided the common pitfall of content overload in flipped classroom instruction (Johnson, 2013).

Also, in order to optimise the effective engagement with the diverse learning opportunities and prevent content overload, each activity was carefully allocated a time limit based on the ten notional hours assigned to the study unit. The allocated time budget ensured feasible alignment and integration of teaching and assessments across all stages of the teaching model.

There was clear communication on the structure and intent of the unit, and sufficient timing was allowed for on-boarding and engaging in pre-class activities. Ellaway and Masters (2008) identify that it is essential to ensure that all students are willing to participate in the online pre-class activity and that they can access the material. The purpose of the flipped classroom was explained to students to prevent them from getting 'lost' in the pre-class activities (Strayer, 2007). Students understood the challenges of approaching clinical cases in the examination and could appreciate the flipped design, which provided focussed teaching on higher cognition skills.

Rowe et al. (2013:1) support technology that increases "teaching activities that are learner-centred, interactive, integrated, reflective and that promote engagement" in HPE. The pilot teaching intervention used an inquiry-based approach that incorporated the case method, face-to-face sessions and small group co-operative learning. The pilot study unit connected activities in the three stages of the teaching unit to encourage mastery of concepts. The use of the Blackboard™ LMS provided tools that permitted students to interact with online course material and authentic clinical cases; thus promoting active learning. The role of the conversations and their outcomes need explicit definition and communication to students (Berge, 2002). Students were attentive to the discussion threads, which formed an examinable component, and were keen to clarify problem concepts on the discussion board.

Furthermore, the problems raised online formed the muddiest points, which were explored in-depth during the contact session. Also, peer learning was fostered during the online and in-class discussion, as students reflected and commented on each other’s answers, in line with Faust and Paulson’s (1998) note that online conversations facilitate peer learning and the identification of student comprehension gaps.

Improved lecturer-student interaction in flipped classrooms supports the clarification of problems and allows the lecturers to obtain real-time feedback on pre-class activities (Snowden, 2012; Johnson, 2013; Cooper, 2000). The online discussion forum was particularly useful to allow the lecturers to gather information about student engagement and understandings of clinical case material. In the pilot unit, the lecturer adapted teaching during the in-class session to target real-time student problems ahead of the summative assessment.

The LMS-derived metrics, for example, number of attempts to access study material, number of attempts at formative assessments and identification of individual contributions to discussion threads, served as critical early warnings of student access and engagement with online material. The in-built LMS metrics, therefore, provide a useful additional real-time alert to educators of student engagement. In addition, the LMS Grade Centre on Blackboard™ provides a record of students’ scores for all online assessments. It can, therefore, inform lecturers of at-risk students early in the study unit to facilitate timeous academic support. The latter feature was not exploited in the pilot intervention as the lecturers had not graded student responses in the discussion threads but used the discussion platform to provide peer-learning and lecturer corrective feedback.

CONCLUSIONS

The hybrid flipped classroom in a postgraduate study unit in chemical pathology emphasises the relevance of the 4IR in HPE. This teaching and learning approach develops students' knowledge, skills and attitudes in and for a workspace, which is impacted by ever-advancing technology.

The hybrid flipped classroom requires consideration of essential pedagogic principles, access to an LMS and electronic tools, and educational expertise to design online teaching and assessment activities that meet the educational intent. The approach is advantageous as it blueprints high cognitive thinking, facilitates learner-centred education and enhances educator–student interaction.

The planning and adaptation of any module using technology and the flipped classroom can benefit from careful planning, an administrative information technology support system and a phased introduction. These factors encourage stakeholders to on-board the changed design and the delivery of the teaching model. An important caveat in using technology is the prudent use of aligning relevant technologies to learning objectives/ learning outcomes to avoid content overload and the distraction of unneeded online e-tivities.

The ongoing use of 4IR principles and technology in HPE is unavoidable if we are to meet the needs of a changing health education system and the healthcare workforce.

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PAPER 3

Artificial Intelligence (AI) in Student Recruitment and Selection: AI and the Need for Authenticity and Integrity

Dr Divya Singh and Ms Avani Singh

ABSTRACT

The importance and transformative potential of technology – including Artificial Intelligence (AI) and machine learning – for Higher Education Institutions (HEIs) cannot be gainsaid. As South Africa embraces the Fourth Industrial Revolution (4IR), the inherent potential that technology offers for innovation and development coheres with the objectives of the National Qualifications Framework (NQF). Through automation, HEIs can streamline complicated, cumbersome, time-consuming and resource-intensive processes.

However, while alluring, this also brings with it incumbent challenges. When considering the application of AI for university selection and recruitment practices, the most crucial consideration is whether the AI system will be a responsible solution. Here, the test stands on three pillars: is the machine thinking rationally; (ii) is the machine making the right decision; and (iii) will the machine behave ethically? An interrogation of the use of algorithms for selection and recruitment highlights apprehensions about producing student archetypes and gives rise to profound concerns regarding the realisation of diversity and democratisation of access to higher education and learning.

As HEIs prepare for the deluge of technology in the 4IR, the duality of the relationship between the legal and ethical considerations, on the one hand, and the opportunities presented by the technology, on the other, must be an integral aspect of adoption. This challenge is compounded by the critical and thorny legal and ethical questions that arise, such as how to overcome bias in AI and ensure transparency and accountability. Moreover, regard needs to be had to safeguarding the right to equality, the right to privacy and the restrictions on automated decision-making. In the final analysis, it is therefore vital to ensure that the ethics, values, rights and standards espoused by the university and the higher education sector, as well as the principles required by law, are protected and promoted.

This paper focuses on the critical issue of access to higher education through recruitment and selection processes. The discussions consider the efficacy of technology-enabled selection and recruitment practices in HEIs and the likelihood of technology optimising the

NQF agenda. In seeking to understand these competing rights and interests, this paper proposes measures that HEIs can take to strike an appropriate balance between harnessing the power of AI in a manner that gives effect to authenticity and integrity as well.

INTRODUCTION

There is no gainsaying the changes wrought by technology to regular human engagement. Technology enables connection across geographic borders, as well as social and economic boundaries, creating new and still uncharted opportunities for learning and self-development. These changes, with their inherent potential for innovation and development, are recognised in the objectives of the NQF. Sub-sections 5(1)(b) and (d) of the NQF Act No. 67 of 2008 are of specific relevance, providing, amongst others, that the objectives of the NQF are to –

(b) facilitate access to, and mobility and progression within, education, training and career paths;

…

(d) accelerate the redress of past unfair discrimination in education, training and employment opportunities.

However, there are also several incumbent challenges. In the context of education, this was most recently evidenced by the outcry in August 2020 in the United Kingdom (UK) following the decision by the Office of Qualifications and Examinations Regulation (Ofqual) to use an algorithm to moderate unstandardised A-level and other teacher assessments. To some, it may have appeared that a standardisation algorithm could be an effective way to solve a difficult problem at a massive scale; however, as explained by Jones and Safak (2020:para. 5), "the choices that were made delivered results that were seen as unfair, unjust and untrustworthy, and have resulted in protests by hundreds of students, lobbying by parents, backlash across the media, the threat of legal action and ultimately a monumental backpedal by Ofqual".

This paper focuses on the critical issue of the use of AI to foster access to higher education through recruitment and selection processes. The discussions consider the efficacy of technology-enabled selection and recruitment practices in HEIs and the likelihood of technology optimising the NQF agenda. Taking into account the potential risks that may arise, this paper also proposes measures that HEIs can take to strike an appropriate balance between harnessing the power of AI in a manner that gives effect to authenticity and integrity as well. Indeed, as HEIs become increasingly responsive to the possibilities proffered by 4IR, AI - with its yet unharnessed capabilities - will become more salient over the next decades. Emphasising this reality, the World Economic Forum (WEF) (2016:para. 3) points to the impressive progress made in AI in recent years, driven by exponential increases in computing power and the availability of vast amounts of data. Further explaining why today's technological transformations represent the arrival of a new and distinct industrial revolution, the WEF (2016:para. 3) highlights the critical factors of velocity, scope and systems impact.

Businesses and organisations are increasingly confronted with AI that promises opportunities to streamline complicated, cumbersome, time-consuming and resource-intensive processes through automation, and universities have not been exempt. While alluring and significant in any decision-making process, AI is never the full consideration. As a rule of general application, decisions to adopt AI should integrate two further key vectors, namely the legal and ethical deliberations of the decisions taken. In this context, the reminder from Hanson (2009:1) is apposite: "In higher education … we face a decade in which institutional integrity and legitimacy is under fire." As HEIs prepare for the deluge of technology in the 4IR, the duality of the relationship between the legal and ethical considerations, on the one hand, and the transformative potential of the technology, on the other, must be an integral aspect of adoption. In this regard, the promise of technology must consciously align with the broader higher education commitment to academic authenticity and integrity.

AI FOR RECRUITMENT AND SELECTION

It is undeniable that in South Africa, the state's financial contribution to higher education has not kept up with the number of learners with access to university study. According to the Institute for Security Studies (ISS), government funding *per capita* has been consistently declining since 1994. In 2016, spending on higher education was 0.72% of gross domestic product (GDP) – lower than both the African (0.78%) and international (0.84%) averages (Reva, undated: para. 6). With the limited budgets and institutional rivalries built on reputation, and institutional rankings and competition linked to success and throughput, universities are eager to ensure that students enrolled are both most likely to be retained and to succeed to graduation. While not restricted by enrolment caps and state subsidies, private HEIs are equally committed to demonstrating graduate success and throughput. As emphasised by Chen and Do (2014:18), the accurate prediction of students' academic performance is one of the critical factors considered by institutions these days when making admission decisions.

Supporting this imperative, AI and machine learning - specifically predictive analytics for recruitment and selection - are already an intrinsic aspect of the institutional admissions management plans of many universities in the United States of America (USA).[13] These universities have been increasingly applying machine learning for purposes of new student profiling and prediction of success, as well as to promote institutional efficiency during the enrolment processes.

With the focus on widening access and the massification of higher education, universities in South Africa receive thousands more applications for places than they can accommodate. While many universities depend solely on quantitative data, other universities globally are also recognising that the "inclusion of qualitative components in applications can provide a more comprehensive representation of each applicant's potential than quantitative measures could do on their own" (Alvero et al, 2020: section 2.1). However, qualitative applications are significantly more resource-intensive processes as each one requires individual consideration. Furthermore, the method introduces different apprehensions, such as the potential for human bias and subjectivity.

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[13] The literature provides various definitions and descriptions of AI. One of the less complex definitions is provided by Kukulska-Hulme et al (2020:3), who explain it as "computer systems that interact with people and with the world in ways that imitate human capabilities and behaviours." A more comprehensive definition is provided by the Independent High-Level Expert Group on Artificial Intelligence (2019:6), set up by the European Commission, who define it as follows:

> Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions. As a scientific discipline, AI includes several approaches and techniques, such as machine learning … machine reasoning … and robotics.

As noted above, machine learning – underpinned by algorithms – is a sub-field of AI, which involves "software able to recognise patterns, make predictions, and apply newly discovered patterns to situations that were not included or covered by their initial design." (Popenici and Kerr, 2017:2).

That said, with the advances in machine learning and the AI capabilities to ‘read’ text statistically (Alvero et al, 2020: section 2.3), this could be an attractive solution to the resource burden and subjectivity constraints confronting institutions. It also has the potential to provide better customer service and quick turnaround times to ensure that students can receive feedback much sooner. Reflecting on the promise of machine learning, Klutka, Ackerly and Magda (undated:9) refer to forms of AI currently available in marketing automation, and predictive analytics “that plug into customer databases and ‘learn’ what the ideal customer is that has purchased a product.” Describing the success of Harley Davidson sales in the New York City market, they note that how a person behaves in the buying process, and what the person responds to, are all possibilities for diagnosis by the system. “This AI can then find individuals that match these traits and show them ads for the product” (Klutka, Ackerly and Magda, undated:10). In higher education admission processes, such technology will enable much more focused student recruitment, thereby allowing universities to “narrowly define the ‘ideal’ student and use AI to select the best candidates” (Klutka, Ackerly and Magda, undated: 20). The university can thus single out the best students for individualised engagement about the university, and why it is best suited for them.

Against this backdrop, the remaining issue then appears to be that of cost – yet this is not so. The most crucial consideration is whether the AI system will be a responsible solution. Considering the possibilities of AI for university selection and recruitment practices, the test stands on three pillars: (i) is the machine thinking rationally; (ii) is the machine making the right decision; and (iii) will the machine behave ethically? Triangulating university responses to these questions aid in assuring a functionality that subscribes to the values of higher education and the priorities of the NQF.

Bearing in mind the objectives of the NQF, examples of how universities have applied AI in recruitment and selection are analysed in this paper to identify the related risks and opportunities. Some cases specific to the university sector include the work of Andris, Cowen and Wittenbach (2013), who used machine learning to find spatial patterns that might favour prospective college students from specific geographic areas in the USA. The university could then establish ‘loyalty ZIP codes’ and hone into particular areas and target those students most likely to apply, enrol and succeed (Ibid:58). This approach was undoubtedly more efficient when compared with the traditional, often superficial, broad-brush method commonly employed by universities due to limited funding.

Other universities use a combination of historical and current enrolment data, learning analytics, and the academic performance data of past and current students, to develop predictive models for ‘recommender systems’. The system then guides the students’ enrolment to specific programmes and majors in which they are most likely to succeed (Ekowo and Palmer, 2016:7 and 9). While optimised student success is an unambiguous objective of all HEIs, this limited and shoehorned strategy to access must beg the following questions: what about students’ acquisition of new knowledge in an area outside of their comfort zone? What about extending the neural pathways of students to explore something different? While prioritising student success, what happens to students’ overall development and focus on issues such as social consciousness and civic engagement? And what about learning for enjoyment?

It would be naïve to suggest that university education is not about discipline-specific learning. However, there is a concurrent groundswell of research emphasising the need for higher education to focus on holistic student development. Another important consideration for universities using predictive analytics to guide students towards specific learning paths is the acknowledgement that the best grade is not necessarily what will gear a student to be successful in the current world-of-work and life (Stelnicki and Nordstokke, 2015). There is also no consensus on the existence of a linear correlation between academic grade excellence in high school, university success and achievement in the world of work (Muller, 2013; Wolmarans, Smit, Collier-Reed and Leather, 2010).

Further interrogations on the use of algorithms for selection and recruitment highlight apprehensions about producing student archetypes. If properly founded, this fear raises a more profound concern about whether such an outcome is not inherently counterintuitive to the fundamental principles of diversity and democratisation of access to higher education and learning. A further challenge with shoehorning students based on algorithmic factors of success arises when the information is used by enrolment officers to exclude students because they are considered a success risk.[14] There is no refuting the material costs linked

[14] At Mount St Mary’s University, the institution used a survey to identify students likely to dropout. The idea was that the students would be “encouraged to leave before they were included in the retention data” collated for purposes of government reporting and national rankings. A fundamental ethical concern with this approach is that students were neither informed of the purpose of the survey, nor were they aware that some students may, as a result of the findings, be “pressured to leave” (Ekowo and Palmer, 2016:2). In defence of the

to marketing and student recruitment, and universities – with all their current cost containment imperatives – need to be as strategic as possible with their limited resources. However, while the positive potential of machine learning for recruitment and selection processes engenders excitement, there is a definite alternate reality signalling potential unintended consequences.

ETHICAL AND LEGAL DECISION-MAKING

The advent of AI and other similar technologies gives rise to critical and thorny legal and ethical questions, including questions about safety, security, the prevention of harm and the mitigation of risks; about human moral responsibility; about governance, regulation, design, development, inspection, monitoring, testing and certification; about democratic decision-making; and the explicability and transparency of AI and 'autonomous' systems (European Group on Ethics in Science and New Technologies, 2018:8). To protect society against the abuse of AI and new technologies, the European Group on Ethics in Science and New Technologies proposes nine ethical principles and democratic prerequisites when contemplating a new system: human dignity; autonomy; responsibility; justice, equality and solidarity; democracy; the rule of law and accountability; security, safety and bodily and mental integrity; data protection and privacy; and sustainability. These ethical considerations may be considered as yardsticks for the design and implementation of any AI system, including in HEIs.

AI bias in selection and recruitment

As stressed by Remian:

> Authenticating the knowledge and predictions of AI becomes more important when AI is used for education since the further spread of inaccurate or outdated content could defy educational goals and further reinforce false information (2019:20).

One of the gravest concerns with AI, and especially machine learning, is that bias in the system may be unconscious or - more critically - not programmed but learned by the machines. In addition to bias, two other elements, namely transparency and accountability, must be considered when adopting machine learning. Only when all three aspects are

university, the president explained that unsuccessful students would be refunded their study fees and advised to enrol elsewhere where they had a better opportunity for success. According to the university, it was in fact "helping [students] avoid accumulating debt for a degree they might not have any chance of earning" (Ibid.).

successfully addressed will an institution be able to claim the authenticity and integrity of the system. While machine learning in higher education, and specifically in the domain of selection and admission, has tremendous potential, it also presents challenges. Today, there is neither the will nor the proven reason to stop the ‘tsunami’ of technology. However, one of the most significant risks of the 4IR is for persons to become drawn into the hype and excitement and, fearful of being left behind, inadvertently further propagating and entrenching stereotypes and current inequalities. Confirming this challenge, Alvero et al (2020: section 2.3) reiterate that:

> AI is often described as having the ability to rapidly scale discrimination and exacerbate social inequality.

The South African entrant to higher education over the last 25 years (and perhaps in the next 25 years) presents with a significantly different profile to those who fed the university pipeline in the pre-1994 era and the few years post-democracy. As the numbers of historically disadvantaged students entering university grew, different race and gender demographic representations began to emerge, and the student profile changed to many (if not most) coming from homes where parents were not university graduates. With the introduction of fee-free higher education, the opportunity for students from lower-income families to enter university also increased exponentially.

However, the stark reality is that the admission and successful track records of the post-apartheid university student continue to be chequered by the apartheid legacy and are still developing. Against this backdrop, the even-handed outcomes of predictive analytics are doubtful, especially taking cognisance of the factors (such as race, ethnicity, high school, anticipated study areas, and family history) included by the data to ‘train’ the machines for recruitment and selection. For example, at Wichita State University, the student recruitment programme uses the specific factors of gender, race, ethnicity, standardisation test scores and parents’ university background. Based on comparative ratings, which interpret and indicate the individual’s likelihood to attend the institution, the university targets prospective students for recruitment (Ekowo and Palmer, 2016:11).

Also using machine learning for recruitment, the University of Ithaca extended the list of factors for selection to include the number of friends and photographs on social media. The university collected information about its students from their posts on the internal university social media platform, intended for communication between peers *inter se*, and between students and their lecturers. The university then linked the information with the academic performance of the identified students and using machine learning and analytics, compared the student data with that from applicants to determine prospective students based on their potential for success (Felton, 2015). The example from the University of Ithaca highlights a material ethical - and legal - concern, namely whether students received advanced knowledge about how the institution intended on using their social media information beyond the academic imperative, and whether they had the opportunity to consent. In a similar vein, Ekowo and Palmer (2016:11) explain, that “[c]olleges have long streamlined their recruitment efforts by purchasing student names and their scores for relatively little from third-party organisations.” As will be seen later, such practices raise real questions about the integrity of the collection process.

Colleges have also used predictive analytics to assist in identifying the financial need and ability of students (Ekowo and Palmer, 2016:6). The ethical challenge with this is whether the outcome is to enable the university to better budget to support such students, or whether the universities are using the data to eliminate students who may not be able to pay the fees of the institution.

In looking at algorithms and machines to determine recruitment, one may be lulled into a false sense of acceptance that at least the process will be objective. However, the sub-optimal outcome of Amazon’s experimental recruitment engine – intended to mechanise the search for ‘top talent’ – dashes the thought. Early in the process, the developers realised that the system displayed a distinct gender bias toward male applicants when it came to recruiting for specific technical positions. Upon further examination, it transpired that the computer models had been trained on resumés submitted to companies in the preceding ten years – a time when the industry was overwhelmingly male-dominated. Consequently, the machine learned to penalise resumés, which included the word “woman”. Amazon eventually disbanded the project, acknowledging that while in this instance the bias was identified and remedied, there was no guarantee that the machines would not themselves devise other secondary or ‘proxy’ attributes that could also prove discriminatory (Dastin, 2018; Kim, Soyatu and Behnagh, 2018).

The Amazon experience was not an isolated instance of machine learning going rogue (Popenici and Kerr, 2017:2-3). In a different experiment, researchers at Carnegie Mellon University also noticed that men were more likely to be targeted for high paying executive jobs: in one instance, the researchers were not able to identify the cause; in another, the system was explicitly trained to reject candidates with poor English language skills and, over time, the algorithm taught itself to equate English sounding names generally with acceptable qualification for the job (Verlinden, 2018). Such examples demonstrate the need for absolute assurance that where the human factor is crucial, data that informs the algorithm must be both reliable and valid.

Given the socio-economic factors used to ‘train’ the machines, none of the AI systems indicated above resonate with the NQF objective of widening higher education access to previously disadvantaged individuals. Ekowo and Palmer (2016:14) also stress the potential for predictive models to perpetuate injustice for historically underserved groups because “they include demographic data that can mirror past discrimination included in the historical data.” Many South African applicants - for any number of reasons, including the reality of being first-generation university entrants - would either have their applications declined or be steered away from the more intense (and often economically lucrative) programmes on the basis that the system indicates a lack of potential to succeed. Such an approach must be antithetical to the national goals for more black graduates and more women graduates, especially in the discipline fields of science, technology, engineering and mathematics at a national level. It further points out why, in South Africa, machines alone will not be effective in university recruitment and selection practices.

The research further illuminates the need for universities considering AI systems for admission to understand how, why and by whom the machine was trained. HEIs must understand the AI system and be able to clearly define the value and its synergy with the institutional mission and purpose. In a country of acknowledged social, structural, and economic inequality, the factors applied must not - intentionally or otherwise - reinforce discrimination. Summarising the three fundamental problems that arise with the use of AI, Yu (2019:19) refers to algorithmic deprivation; algorithmic discrimination; and algorithmic distortion. With specific regard to algorithmic discrimination, he notes that the concerns “range from errors to biases and from discrimination to dehumanisation” (Yu, 2019:19) which tend to be particularly problematic for those on the unfortunate side of the algorithmic divide. In most instances, the worst affected are the poor, the disadvantaged, and the vulnerable.

Confirming the findings in the case studies above, Yu (2019:17) states:

> While the existence of algorithmic bias alone is bad enough, the problem can be exacerbated by the fact that machines learn themselves by feeding the newly generated data back into the algorithms. Because these data will become the new training and feedback data for machine-learning purposes, algorithms that are improperly designed or that utilise problematic data could amplify real-world biases by creating self-reinforced feedback loops. As time passes, the biases generated through these loops will become much worse than the biases found in the original algorithmic designs or the initial training data.

Further to the above considerations, Alvero et al (2020: section 6) stress the distinctly different approaches by AI researchers and university selection and enrolment officers to the values of fairness and bias. They note:

> AI researchers tend to be concerned with fairness and bias at the population level and worry when patterned evaluative outcomes do not approximate population demographics. By contrast, admission officers tend to emphasise fairness of evaluation for individual applicants.

These divergent ethical priorities must be much more closely aligned before universities begin to consider AI and machine learning for recruitment and selection, and the caution by Popenici and Kerr (2017:4) bears notice:

> With the rise of AI solutions, it is increasingly important for educational institutions to stay alert and see if the power of control over hidden algorithms that run them is not monopolised by the tech-lords… Those who control algorithms that run AI solutions have now unprecedented influence over people and every sector of contemporary society.

In private higher education, in the absence of state funding, it is plausible that algorithms used in recruitment management will favour selecting wealthier students over their less affluent peers simply because these are the students always enrolled. Some institutions will accept this, satisfied that the commercial enterprise will be protected; however, other institutions may find that this unacceptable and contradictory to their central vision to widen access for *all* South Africans.

The legal parameters and standards

As is often the case, the law tends to lag in technological developments. However, in South Africa, the Constitution of the Republic of South Africa, 1996 – and specifically Section 9 (which provides for the right to equality) and Section 14 (which guarantees the right to privacy of every person) – may provide the necessary guidance that will be especially applicable to AI. As seen from the discussion above, the implementation of AI-based technologies in student recruitment and selection has the potential to violate these rights, and it is therefore imperative that institutions contemplating the use of AI take appropriate measures to safeguard against any rights violations. In what follows, we look specifically at the right to equality, the right to privacy and restrictions on automated decision-making.

The right to equality

The right to equality is given content through the Promotion of Equality and Prevention of Unfair Discrimination Act 4 of 2000 (PEPUDA), a comprehensive South African anti-discrimination law. Section 1 defines equality as including "the full and equal enjoyment of rights and freedoms as contemplated in the Constitution and includes *de jure* and *de facto* equality and also equality in terms of outcomes." Section 6 expressly prohibits unfair discrimination based on:

(a) race, gender, sex, pregnancy, marital status, ethnic or social origin, colour, sexual orientation, age, disability, religion, conscience, belief, culture, language and birth; or

(b) any other ground where discrimination based on that other ground –

- (i) causes or perpetuates systemic disadvantage;
- (ii) undermines human dignity; or
- (iii) adversely affects the equal enjoyment of a person's rights and freedoms in a serious manner that is comparable to discrimination on the ground in paragraph (a).

In relying on AI for decision-making, universities must be cognisant not to violate the right to equality or perpetrate an act of discrimination based on any of the prohibited grounds (as in the case of Wichita State University, noted above). Relying on Section 13(1) of PEPUDA, a prospective student alleging that they have been the subject of a discriminatory decision by the university need only make out a *prima facie* case of discrimination. After that, the burden shifts to the university to prove either that the discrimination did not take place, or that its conduct was not based on any of the prohibited grounds. To satisfy its onus, the university will first have to justify the basis of its decision; and further show that its decision followed the law.

The right to privacy

In addition to the constitutional and common law right to privacy, HEIs must comply with the Protection of Personal Information Act No. 4 of 2013 (POPIA), which provides a comprehensive legal framework for data protection in South Africa. POPIA requires HEIs using AI or machine learning to make decisions about students to ensure that: (i) the affected students are adequately informed of the intention; and (ii) the personal information processed for decision-making purposes complies with the conditions stated in the law. POPIA further expressly requires that personal data may only be processed if, given its purpose, it is relevant, not excessive, and there is a valid justification for the processing. Additionally, the collection of personal information must be for a specific, explicitly defined and lawful purpose related to a function or activity and should not be retained for any longer than is necessary to achieve the goal unless one of the legislated exceptions applies. Notably, while HEIs may seek consent from data subjects for the processing of their personal information, this is not a silver bullet. The burden will remain on the institution to prove that the consent was given in a voluntary, specific and informed manner (that is, that it was validly obtained). As such, HEIs must be open and transparent with students about the purposes for which personal information is being collected and used (see the University of Ithaca case), as well as the consequences of their compliance or refusal to provide the information as requested.

Restrictions on automated decision-making

Section 71 of POPIA deals specifically with the question of automated decision-making. Sub-section (1) provides that a data subject may not be subject to a decision that results in legal consequences for them, or which affects them to a substantial degree, which is based solely on the automated processing of personal information intended to provide a profile of that person. Sub-section (2) sets out certain exceptions to the general prohibition, such as whether the decision is in connection with the conclusion or execution of a contract, and appropriate measures are in place to protect the data subject's legitimate interests. 'Appropriate measures' in this regard require that the data subject has an opportunity to make representations about the decision and is provided with sufficient information about the underlying logic of the automated processing of the information to make such representations. The insertion of this provision evinces a clear understanding from the legislators of the potential for risk attendant upon automated decision-making, and the broader implications that this may have on affected persons. HEIs would be advised, as a rule of general application, to avoid decisions taken by solely automated means unless there is absolute certainty and clarity that the rights and interests of students can be appropriately protected.

The European Parliament report by the Panel for the Future of Science and Technology (2020:1) describes data protection as being at the forefront of the relationship between AI and the law. AI systems need to collect and process data to make intelligent decisions, therefore making access to data fundamentally important. (WEF, 2019:6). However, appropriate means and mechanisms must be in place to ensure that the personal data in the possession or under the control of the university, for example, is not subject to unlawful access or abuse. As noted by the Panel for the Future of Science and Technology (2020:i):

> AI enables automated decision-making even in domains that require complex choices, based on multiple factors and non-predefined criteria. In many cases, automated predictions and decisions are not only cheaper but also more precise and impartial than human ones, as AI systems can avoid the typical fallacies of human psychology and can be subject to rigorous controls. However, algorithmic decisions may also be mistaken or discriminatory, reproducing human biases and introducing new ones. Even when automated assessments of individuals are fair and accurate, they are not unproblematic: they may negatively affect the individuals concerned, who are subject to pervasive surveillance, persistent evaluation, insistent influence, and possible manipulation.

To withstand the legal - and ethical - challenges, HEIs will, therefore, need to be transparent in setting out their recruitment strategies and the principles that inform their selection processes. Students must know if they are being subject to automated decision-making, as well as be provided with the underlying logic of the automated processing, with a reasonable opportunity to make representations on the decision. To the extent that an automated outcome determines a result, universities should consider coupling such automation with human interventions to oversee the process and apply an independent mind to the determinations to preserve the values of a human-centric society.

CONCLUSIONS: RE-IMAGINING AI AND STUDENT RECRUITMENT/ SELECTION – THE NEED FOR AUTHENTICITY AND INTEGRITY

When implementing AI, it is vital to ensure that, in the final analysis, the ethics, values, rights and standards espoused by the university and the higher education sector, as well as the principles required by law, are protected and promoted. Where machine learning is used, this will inevitably include how the predictive models are created and by whom. Given the complexity of the processes and the decision-making involved, universities must develop institutional frameworks (including risk and impact assessments) to guide their approaches, implementation, and application of AI within the institution concerned, based on multi-stakeholder collaboration. This is an optimal strategy to promote accountability, transparency, privacy and impartiality, and create trust in what could quickly become a contested activity (WEF, 2019:9 and 11). As explained by the United Kingdom Information Commissioner's Office (ICO), an approach that favours explaining AI-assisted decisions to affected individuals makes good business sense. It fosters trust, enables one to obtain more credible and reliable information, and gives one an edge over other organisations that are not as progressive and respectful in their interactions (2020:16). The ICO further points to the risks incumbent in not explaining AI decisions, including the potential for regulatory action, reputational damage, and disengaged public.[15] Crucially, and as a further demonstration of considered and informed decision-making, it is imperative that institutional spokespersons explaining AI-assisted decisions to affected individuals, fully understand the models, choices and processes associated with the AI decision-making (ICO, 2020:16).

While the increasing use of AI can have revolutionary benefits for HEIs, it is only by fostering a culture of authenticity and integrity, that it will be possible to realise truly and meaningfully the opportunities that AI can offer. This means adopting an approach that is clear, coherent, transparent, and responsible, and which abides by relevant principles of law and ethics. As students increasingly demand agency over their information and the decisions taken about them, HEIs should not risk being on the unfortunate side of the benefits that the technology can create.

[15] Expanding on its recommendation for explanation and engagement, the ICO has identified six main types of explanation: rational explanation; responsibility explanation; data explanation; fairness explanation; safety and performance explanation; and impact explanation (2020:20).

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PAPER 4

Institutional Audits for South African Higher Education Institutions in the Era of the Fourth Industrial Revolution (4IR)

Dr Britta Zawada

ABSTRACT

Institutional audits have been acknowledged as an effective mechanism to improve quality in higher education. The Higher Education Quality Committee (HEQC) of the South African Council on Higher Education (CHE) approved a new framework and manual for institutional audits to be initiated by the CHE in 2021[16]. In this paper, the methodology, standards and guidelines of the 2021 institutional audits will be outlined. The way in which the methodology, standards and guidelines already incorporate notions of the Fourth Industrial Revolution (4IR) will be discussed and benchmarked with the African and European Standards and Guidelines (ASG, 2019; ESG,2015). The notion that 4IR technology should be a means to an end (the end being quality education), and not an end itself, informs this paper.

INTRODUCTION

External quality assurance was recognised as a key strategic driver in South African Higher Education (HE) in the Higher Education Act, 101 of 1997, as amended (henceforth referred to as the HE Act). The HE Act also provided for the establishment of the CHE and its permanent committee, the Higher Education Quality Committee (HEQC). Auditing Higher Education Institutions (HEIs) is given as a specific function of the CHE and the HEQC in the HE Act. The National Qualifications Framework (NQF) Act 67 of 2008 confirms the CHE as the Quality Council for higher education and assigns the following quality assurance-specific functions to the HEQC:

(i) develop and implement policy for quality assurance
(ii) ensure the integrity and credibility of quality assurance; and
(iii) ensure that such quality assurance as is necessary for the Higher Education Qualifications Sub-Framework (HEQSF) of the NQF is undertaken[17].

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[16] At the time of writing in 2020 this paper was based on a 2020 draft version of the institutional audit documents (CHE, 2020a and b), but it has subsequently been updated to reflect the final approved and published documents (CHE, 2021a and b).

[17] The South African NQF comprises three articulated NQF Sub-Frameworks, the Higher Education Qualifications Sub-Framework (HEQSF), Occupational Qualifications Sub-Framework (OQSF) and General and Further Education and Training Qualifications Sub-Framework (GFETQSF).

The higher education sector in South Africa has registered some successes since the onset of democracy in the country in 1994, but challenges remain (CHE, 2016). At the national level more generally, the external situational analysis of the *CHE's Strategic Plan 2020-2025* (CHE, 2019:15) states that "Unemployment, poverty and inequality remain pressing developmental challenges and threaten political stability." These challenges are further explicated in the policy vision of the *White Paper for Post School Education and Training* (WPPSET) (DHET, 2013) and the draft *National Plan for the Post-School Education Sector* (NPPSET) (DHET, 2019a), which directly inform both planning and funding as strategic drivers in the PSET sector in the time frame of the NPPSET from 2019 to 2030. Quality assurance, and specifically the external quality assurance function of the CHE in the higher education sector, forms the third strategic driver for the sector, which has a system-wide goal for "improved quality of post-school education and training provision" with explicit outcomes (DHET, 2019a:79) in terms of improving quality, through:

a) improved quality of teaching and learning;
b) improved quality of research;
c) well-managed and governed institutions;
d) well-qualified staff;
e) improved quality-assurance capability;
f) improved quality of infrastructure; and
g) safe and healthy environments for students and staff.

The NPPSET (DHET, 2019a:86) then specifically refers to a new round of institutional audits as a mechanism for triangulating information about the performance of the sector, as well as strengthening the advisory function of the CHE, and improving the efficiency and effectiveness of accreditation processes.

Institutional audits are "an external quality review process of an institution's quality management system and its constituent elements, based on that institution's identity, nature, context and strategic goals. Such a review systematically and objectively evaluates the system's appropriateness, coherence and effectiveness in assuring the quality of institutional delivery of higher education's core functions" (CHE, 2021a:8). Institutional audits are:

> Aimed at assessing the integrated quality management systems at institutions with a specific focus on the management of the core academic functions of higher education, that is, teaching and learning, research, and community engagement, as framed by

> their respective vision, mission and strategic goals. The ways in which governance, financial management and sustainability impact on the delivery of the academic project and the quality management system at an institution, may, however, form part of an institutional audit from a quality perspective (Ibid:14).

The CHE and HEQC instituted the first cycle of institutional audits between 2004 and 2011, followed by the Quality Enhancement Project. A summary and assessment of these initiatives are available in the *Framework for Institutional Audits 2021* (CHE, 2021a). An external panel evaluation with the task of reviewing the effectiveness of the first round of institutional audits confirmed the usefulness of institutional audits as an instrument to develop, establish and evaluate quality at the institutional level in higher education, with recommendations for the differentiation and simplification of what was also perceived as an onerous administrative process. Between 2017 and early 2018 the CHE developed a new draft framework for institutional audits and piloted both the draft framework and manual in 2019 with two volunteer institutions, one public and one private. The pilot audits were evaluated and provided important feedback for the CHE to improve these documents. The *Framework for Institutional Audits 2021* (CHE, 2021a) and the *Manual for Institutional Audits 2021* (CHE, 2021b) were then published after final approval by the HEQC and CHE (CHE, 2021a and CHE, 2021b). The CHE commenced with a new cycle of institutional audits in March 2021 using the new *Framework for Institutional Audits 2021* and *Manual for Institutional Audits 2021* (CHE, 2021a and CHE, 2021b).

METHODOLOGY, STANDARDS AND GUIDELINES IN INSTITUTIONAL AUDITS

The first element of the audit mandate is that the CHE and HEQC, in consultation with the sector, developed a common quality assurance framework for all HEIs. In the case of institutional audits, a peer reference group assisted the CHE to develop the *Draft Framework for Institutional Audits 2020* (CHE, 2020a) and the *Draft Manual for Institutional Audits 2020* (CHE, 2020b). The documents were then made available on the CHE website requesting feedback and were sent to all public and private HEIs for feedback. Over 330 pages of feedback were received from the higher education sector and incorporated into the final version of the *Framework for Institutional Audits 2021* and the final version of the *Manual for Institutional Audits 2021* (CHE, 2021a and CHE, 2021b). Using peer experts and communities of practice to develop quality assurance frameworks, standards and guidelines, has two advantages: firstly, knowledge, experience and wisdom from within the sector are harnessed to benefit the entire sector, and secondly, an inclusive consultative process creates buy-in for and ownership of the process, standards and guidelines in the sector.

The second element of the CHE institutional audit framework is that the foundational approach of the CHE and HEQC has not changed, and still focuses on the definition of quality in higher education as: fitness of purpose, fitness for purpose, value for money and transformation (CHE, 2001). A variety of critiques and other definitions of *quality* and *quality culture* in higher education can be found in Zawada (2019).

The third element of the institutional audits framework and manual is that it is based on the principle that HEIs are ultimately responsible for their own quality. An important part of institutional audits is, therefore, the self-evaluation and self-reflection that institutions have to do, which result in a Self-Evaluation Report (SER) that forms the basis of an institutional audit. An institutional SER is supported by a portfolio of evidence (PoE) that informs the self-evaluation and validates the claims that an institution makes in the SER.

The fourth element of an institutional audit is that the SER and the PoE are evaluated and validated by peers. Peer evaluation is an ancient and enduring custom in higher education and allows the CHE and HEQC to manage the process of institutional audits objectively. The peers involved in institutional audits will be experienced higher education colleagues nominated by the sector and will conduct institutional audits after having received training and induction from the CHE. The requirements for audit panel members, for the peer evaluation process and the ethics around institutional audits, for both institutions and audit panel members, are dealt with extensively in the *Manual for Institutional Audits 2020* (CHE, 2021b).

The fifth of the five elements of an institutional audit is that, after the HEQC has evaluated the final audit report of an institution and decided on an audit outcome with commendations and recommendations, the particular institution embarks on an improvement phase. The developmental aspect of institutional audits is as important as the accountability aspect, and the assessment of the 2004-2011 institutional audits indicated that more attention should be given to the post-audit improvement phase of institutional audits to take quality improvements in institutions to higher levels and to ensure the longer-term impact of the audit processes.

The 2021 institutional audit framework is based on four focus areas, each with four standards (as outlined in the *Framework for Institutional Audits 2021* [CHE, 2021a:20 -21]), as follows:

1. the institution's governance, strategic planning (such as vision, mission and goals), management and academic leadership;
2. the design and implementation of an integrated quality management system in the institution;
3. the coherence and integration of the components of an integrated quality management system in the institution; and a focus on
4. learning and teaching, for example, curriculum review and development, student engagement and student success.

Each of these focus areas has four standards associated with it, as outlined in the *Framework for Institutional Audits 2021* (CHE, 2021a:23-26). These standards are described below.

Focus Area 1: Governance, strategic planning, management and leadership support the core academic functions

The four standards in Focus Area 1 concentrate on the role that an institution's governance, strategic planning (as contained in its vision, mission and strategic goals), management and academic leadership functions play in its quality management, in order to enhance the likelihood of student success and improve the quality of learning, teaching and research engagement, as well as accommodate the results of constructive, integrated community engagement. These standards are as follows.

Standard 1:	The institution has a clearly stated vision and mission, and strategic goals that have been approved by appropriate governance structures, subject to comprehensive stakeholder engagement.
Standard 2:	The stated vision, mission and strategic goals align with national priorities and context (e.g. transformation, creating a skilled labour force, developing scarce skills areas and a critical citizenry and contributing to the fulfilment of national goals as informed by the NDP and related national planning), as well as sectoral, regional, continental and global imperatives (e.g. Africa Vision 2063 or the Sustainable Development Goals).
Standard 3:	There is demonstrable strategic alignment between the institution's quality management system for core academic activities across all sites

and modes of provision, and its vision, mission and strategic goals, as well as its governance and management processes.

Standard 4: There is a clear understanding of and demonstrable adherence to the different roles and responsibilities of the governance structures, management and academic leadership.

Focus Area 2: The design and implementation of the institutional quality management system supports the core academic functions

The four standards in Focus Area 2 concentrate on how the design and implementation of an integrated quality management system in the institution enhances the likelihood of student success and improves the quality of learning, teaching and research, as well as accommodates the results of constructive, integrated community engagement within the context of the institution's mission. These standards are as follows.

Standard 5: A quality assurance system is in place, comprising at a minimum of:

(i) governance arrangements
(ii) policies
(iii) processes, procedures and plans
(iv) instructional products
(v) measurement of impact, and
(vi) data management and utilisation

as these give effect to the delivery of the HEI's core functions.

Standard 6: Human, infrastructural, knowledge management and financial resources support the delivery of the institution's core academic functions across all sites of provision along with the concomitant quality management system, in accordance with the institution's mission.

Standard 7: Credible and reliable data (for example, on throughput and completion rates) are systematically captured, employed and analysed as an integral part of the institutional quality management system so as to inform consistent and sustainable decision-making.

Standard 8: Systems and processes monitor the institution's capacity for quality management, based on the evidence gathered.

Focus Area 3: The coherence and integration of the institutional quality management system supports the core academic functions

The four standards in Focus Area 3 concentrate on the coherence and integration of the various components of the institutional quality management system and how these work in concert to support the likelihood of student success and improve the quality of learning, teaching and research, as well as accommodate the results of constructive integrated community engagement in accordance with the institution's mission. These standards are as follows.

Standard 9:	An evidence-based coherent, reasonable, functional and meaningfully structured relationship exists between all components of the institutional quality management system.
Standard 10:	Evidence-based regular and dedicated governance and management oversight of the quality assurance system exists.
Standard 11:	Planning and processes exist for the reasonable and functional allocation of resources to all components of the institutional quality management system.
Standard 12:	The quality assurance system achieves its purpose efficiently and effectively.

Focus Area 4: Curriculum development, learning and teaching support the likelihood of student success

The four standards in Focus Area 4 concentrate on how effectively the institutional quality management system enhances the likelihood of student success, improves learning and teaching and supports the scholarship of learning and teaching. These standards are as follows.

Standard 13: An effective institutional system for programme design, approval, delivery, management and review is in place.

Standard 14: There is evidence-based engagement at various institutional levels, among staff, and among staff and students, with:

a. curriculum transformation, curriculum reform and renewal
b. learning and teaching innovation; and
c. the role of technology (1) in the curriculum, (2) in the world of work, and (3) in society in general.

Standard 15: The students' exposure to learning and teaching at the institution across all sites and modes of provision is experienced by them as positive and enabling of their success.

Standard 16: Institutions engage with and reflect on the employability of their graduates in a changing world.

The 16 standards described above should apply to all public and private HEIs in South Africa. The standards are elaborated and explained in the *Manual for Institutional Audits 2021* (CHE, 2021b) by a variety of guidelines. The differentiation of HEIs based on the context, history and identity of an institution would find expression in the differentiated use, application and evaluation of the guidelines.

THE CHE (2021) INSTITUTIONAL AUDITS AND 4IR

The Fourth Industrial Revolution (4IR) can simply be defined as the "fusion of technologies that is blurring the lines between the physical, digital and biological domains" (Butler-Adam, 2018:1). Butler-Adam (2018) then goes on to refer to two implications of Artificial Intelligence (AI) in higher education, namely for the world of work generally and for teaching and learning. Castrillon and Menon (2019) focus on the implications of 4IR for the curriculum and learning and teaching technologies. De Villiers (2020:5) phrases one of the imperatives for South African universities as having to respond “to the challenges and opportunities presented by the rapid technological developments associated with the fourth industrial revolution (4IR)”, and Zelesa (2020:18-19), at the same conference, warned that:

> Technology is always historically and socially embedded … [and] technological changes … produce and reproduce both old and new opportunity structures and trajectories that are simultaneously uneven and unequal because they are conditioned by enduring social inscriptions of class, gender, race, nationality, ethnicity and other markers, as well as the stubborn geographies and hierarchies of the international division of labour.

Zelesa (Ibid.) concluded that technologies “are all means, not ends, and we need to ask ourselves what is the end”, and whether we are “simply consumers or are we also creators?” One of the outcomes of the DHET (2019b:81) colloquium on 4IR in the PSET sector was that South Africa should “leverage 4IR technologies to improve access, equity, quality, success, efficiency and responsiveness of education and training”, and this has direct relevance for quality assurance and institutional audits.

The next section of the paper will not focus more on the implications or advantages and disadvantages of 4IR for higher education in general; nor will it engage in any critique, either positive or negative, of the notion or implementation of 4IR, but will merely describe how 4IR already plays a role in the 2021 institutional audits.

The role of 4IR in institutional audits can be divided into two parts:

- the substantive incorporation of 4IR into the standards and guidelines, including the role of data as part of the evidence on which institutions base their self-evaluation; and
- the operational incorporation of 4IR in the methodology and logistics of conducting institutional audits, i.e., into the world of work for both internal and external quality assurance.

It is important to note that in both cases, it is clear that 4IR is regarded, not as an end, but as a 'means to an end', the end being quality educational provision.

Substantive incorporation of 4IR into CHE quality standards and guidelines

The 4IR is incorporated into the standards and guidelines in the *Framework for Institutional Audits 2021* and the *Manual for Institutional Audits 2021* in three different ways, as outlined (CHE, 2021a and 2021b).

The first way in which 4IR is incorporated into the institutional audit standards and guidelines is that *HEIs will be expected to develop, maintain and use adequate and relevant Information and Communication Technology (ICT) infrastructure and to support both staff and students with both access and training*. Standards 6 and 7 (described earlier in the paper along with all the other standards) refer to the notion that data management and utilisation should give effect to the core functions of HEIs, with specific reference to learning and teaching, research, community engagement and quality assurance. Guidelines for Standards 6 and 7 require, amongst others, that:

- information and communication technology infrastructure, appropriate to the nature and size of the institution, exists to facilitate quality management in the institution;
- adequate and appropriate ICT facilities are provided for staff and students; and
- staff should be trained and supported to teach online.

The second way in which 4IR is incorporated into the institutional audit standards and guidelines is that *HEIs will be expected to develop, maintain and use adequate and relevant data and data management* to support their core functions and their internal quality assurance. Both Standards 7 and 8 (described earlier in the paper) refer to data and data management, and Guidelines as outlined in the *Manual for Institutional Audits 2021* (CHE, 2021b:19-20), are provided below. Guidelines 7.1 to 7.4 and guideline 8.1 are described.

7.1 An electronic, protected and legally compliant data-management and retrieval system in the institution has the capacity to provide accurate, complete and on-time information to support the quality management of the core functions.

7.2 A variety of different types and sources of data are used by the institution, e.g. quantitative and qualitative data, input and output data, data required by legislative agencies (such as data on the Higher Education Management Information System [HEMIS] and the Higher Education Quality Committee Information System

[HEQCIS]) and specifically-sourced data (such as through student and staff surveys).

7.3 The institution develops the capacity to interpret the data and to act on the results.

7.4 An evidence- and data-led approach is used to improve teaching, student success, the student experience, differential success rates, etc.

8.1 Decision-makers at all institutional levels have ready, but appropriate and protected, access to sufficient, reliable and current electronic evidence (data, information and institutional knowledge) that allows them to make informed decisions on the quality management of the core academic functions of the institution.

Not only will institutions be required to create, maintain and interpret quality data, but they will also be required to create levels of data literacy and awareness amongst staff at all levels. Ethical and compliant use and storage of staff and student data will become part of the institution's Portfolio of Evidence (PoE), but changing raw data into business intelligence to assist in decision making for quality purposes, will be important.

The third way in which 4IR is incorporated into the institutional audit standards and guidelines is that *HEIs will be expected to show evidence of serious engagements with the notions of 4IR in the curriculum, in pedagogy and in the world of work, and in society in general*. This is made explicit in Standard 14 (described earlier), and the Guidelines as outlined in the *Manual for Institutional Audits 2021* (CHE, 2021b:23), are provided below.

14.1 Formal consultative and decision-making structures in the institution, at institutional, faculty/school and departmental levels, allow for engagement by staff and students on the transformation and/or reform and renewal of curricula, on innovation in learning and teaching approaches, including the role, function and administration of assessment, and the role of ICTs in the attainment of graduate attributes.

14.2 Formal structures include curriculum transformation, reform and renewal, as well as methodological innovation and the use of ICTs in teaching and learning as standard items on meeting agendas.

14.3 The institutional culture is such that discussions on curriculum transformation/reform/renewal, teaching/learning innovation and ICTs in learning and teaching occur regularly between staff, and between staff and students, and other stakeholders, such as professional bodies and the community.

4IR world of work and internal and external quality assurance

In terms of external quality assurance, the CHE has for some time already used online submission systems for the purposes of accreditation and national reviews; this will continue to be the case with institutional audits as described in the *Manual for Institutional Audits 2021* (CHE, 2021b) and summarised in the bullets below. The Coronavirus (Covid-

19) pandemic and national regulations in terms of travel and large meetings have fast-tracked a process that was already underway.

- The initiation phase and pre-audit visits will be done digitally via e-mail and online meetings.
- The capacity development of staff in institutions to prepare for the institutional audits will be done via an e-Learning platform.
- The recruitment, contracting and training of audit panel members will also be done using a variety of digital communication and e-Learning platforms.
- The submission of institutional SERs and PoEs will be done electronically.
- HEIs will have to build or acquire relevant and secure platforms and access to data (both qualitative and quantitative) for audit panels to access externally as part of the institutional PoE.
- Institutions are encouraged to include audio-visual material (of facilities, for example) in their PoE, which would minimise the need for and duration of physical site visits.
- Audit panel meetings (for pre-audit preparation and post-audit report writing) will be done using digital online platforms and collaborative writing tools.
- All CHE governance structures, including the Institutional Audits Committee as a sub-committee of the HEQC, and the HEQC itself, have been using online meeting platforms since the Covid-19-induced national lockdown was announced in March 2020 that continued at various levels into 2021.

Re-imagining the traditional site visits and face-to-face interviews used to validate claims by institutions in their SERs and PoEs, will be an immediate requirement for the near future, but it is believed that institutional audits can, to a large extent, continue under the Covid-19 lockdown restrictions, using various digital platforms, thereby irrevocably changing the world of work of quality assurance practitioners, as well as staff in HEIs.

CONTINENTAL BENCHMARKING

In the development of the *Framework for Institutional Audits 2021* and the *Manual for Institutional Audits 2021*, two sets of benchmarking standards and guidelines were considered as representative examples of global benchmarking, namely the African Standards and Guidelines (ASG, 2019) at continental level, and the European Standards and Guidelines (ESG, 2015). It is important to note that the benchmarking practice undertaken was to consider good practice in other spaces, but not the wholesale importation of the other's practice, especially considering one's own country context, history, identity and ultimate goals. In this paper, only the continental benchmarking with the ASG (2019) is addressed, and specifically as it relates to 4IR.

As far as 4IR is concerned, the ASGs contain Standard 11, which states that "The institution shall ensure that it collects, analyses, and makes use of relevant information for the effective management of its programmes of study and other activities" (ASG, 2019:24). This is largely aligned with the first and second ways in which 4IR is incorporated into the CHE (2021b) standards and guidelines as described above. The ESG (2015:14) Standard 1.7 for Information Management refers to 'data' but not specifically to electronic data or data management.

As far as curriculum is concerned, the ASGs contain Standard 7, which refers to the design, approval, monitoring and evaluation of study programmes, which is similar to the CHE (2021b) standards and guidelines on curriculum reform and renewal, but the ASGs do not explicitly refer to an engagement with 4IR or technology in curriculum and programme development. The generic "aligned with the needs of stakeholders" (ASG, 2019:19) only indirectly covers this issue. The CHE (2021b) standards and guidelines can be said to exceed the benchmark in this case. The ESG (2015:12) Standard 1.2 for the design and approval of programmes also refers to 'stakeholders' and 'institutional strategy' but does not refer to anything related to 4IR directly.

The ASG (2019:17-18) Standard 5 for infrastructure contains very explicit guidelines for e-Learning, with a range of extensive and explicit requirements for ICTs, hardware, software, training and support, which far exceeds what the CHE (2021b) standards and guidelines require. This difference was, however, based on two assumptions:

- firstly, most HEIs in South Africa are subject to and adhere to ICT governance, risk and compliance protocols, and it was therefore thought that it would not be necessary for a quality assurance agency to validate these, or be possible for a panel of academic peers to adequately evaluate such technical detail; and

- secondly, it was thought that to ensure quality provision, the notion of technology in teaching and learning, and in assessment, should be approached from the perspective of pedagogy rather than from the perspective of technology.

It would be important to validate these two assumptions empirically, in other words for the CHE, firstly, to confirm that all HEIs, particularly private HEIs, do have such ICT governance, risk and compliance protocols in place, and that evidence of such protocols exist. The second assumption is more of a philosophical stance, but future research will be able to bear out whether this approach is valid and impactful.

The ASGs for external quality assurance provide useful and valid generic standards and guidelines on how to perform external quality assurance activities, such as institutional audits, but none of them refers to issues of 4IR in the world of work as far as quality assurance practice is concerned, as yet. All indications are, however, that the Covid-19 pandemic will catapult everyone into the digital space.

CONCLUSIONS

Within the legislative and policy context of the CHE and HEQC, institutional audits of HEIs will resume in 2021, based on a new framework and manual that were approved by the HEQC (CHE, 2021a and 2021b). In this paper, the consultative process of developing this framework and manual was described, with an outline of the standards and guidelines. The way in which the CHE (2021a and 2021b) standards and guidelines take account of the imperatives of the 4IR were described and were benchmarked against the ASGs (ASG, 2019). It was shown that the ASGs and CHE standards and guidelines (2021a and 2021b) are largely aligned in terms of data and information management requirements for supporting quality provision in HEIs. The ASGs, however, focus more on the technical requirements for the ICTs supporting e-Learning, whereas the CHE (2021b) standards and guidelines focus explicitly on curriculum renewal and pedagogical innovation as entry points for 4IR to enter into the quality conversation. Whether the CHE (2021a and 2021b) assumptions on these issues are valid will require empirical research. Possibly due to the Covid-19 pandemic and national restrictions during the development of the CHE documents, the CHE (2021a and 2021b) documents are more explicit than the ASGs in terms of 4IR operations and practices in external quality assurance activities. Whilst the CHE (2020c) guidelines to institutions on maintaining quality provision during the Covid-19 pandemic focus on remote teaching, learning and assessment, they do not focus on technical requirements that form the basis of such activities. It is acknowledged that the technical ICT infrastructure at an institution may impact directly on quality, although the question remains whether it would be appropriate for a quality council working with peer academics who may not be experts in ICT requirements, to focus on such technical requirements. The benchmarking with the ASG (2019) seems to indicate that it should.

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PAPER 5

Improving Quality Programme Review for the Department of Informatics at the University of Pretoria (UP): A Case Study Characterised by International Collaboration and Good Practices

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ABSTRACT

Annual learning programme reviews have previously been a tedious manual process. It has been almost impossible to map programme outcomes to accreditation bodies' requirements as well as institutional graduate attributes, but more so, the assessment of these outcomes across modules and on a programme level. The cultures at higher education institutions tend to follow silo approaches between modules within departments, across departments as well as within specific Schools and Faculties. The evolution of e-Learning platforms and assessment technologies that could potentially assist in assessment practices in higher education, presents its challenges if the implementation of the technology is not embedded in an overarching design and delivery assessment process within a programme and institution. To implement technology to assist in the reporting on the quality assurance of learning requires an interactive and engaged partnership between institutional management, academic staff, technical support staff, and educational professionals. This paper focuses on one department's approach of elevating a programme review cycle to the implementation of a culture of a full programme assessment cycle, incorporating a Learning Management System's functionality.

INTRODUCTION

Annual programme reviews have previously been a tedious manual process. In many instances, the absence of an institution-wide approach and process to these programme reviews makes the alignment and reporting of programme outcomes to accreditation body requirements, institutional graduate attributes, as well as National Qualification Framework (NQF) Level Descriptors almost impossible. Despite initiatives and strategies by the Department of Informatics at the University of Pretoria (UP) to overcome challenges during a programme review cycle, the assessment and reporting on students' performance against these learning outcomes remain a South African, as well as global, concern.

In the United States (US), this concern is evident in the articles, guidelines, and resources appearing on regional and discipline accreditor sites, higher education assessment associations' sites, and higher education news organisations, to guide institutional and programme assessment staff and instructors. Because of these concerns, the importance of understanding student performance on key touchpoints in the curriculum becomes even more critical (Smalley, 2020).

The Fourth Industrial Revolution (4IR) unlocked opportunities for Higher Education Institutions (HEIs) to investigate technologies, such as a Learning Management System (LMS) (e.g. Blackboard) and Assessment Management Systems (AMS) (e.g. Weave and Watermark), to be integrated as part of a total programme review and assessment process. Even with the evolution of LMS platforms and assessment technologies to enhance efficiencies for institutions with their assessment practices, significant challenges for the successful implementation of the technology remain if an overarching design and delivery assessment process within a programme and institution does not exist. Implementing technology to assist with the reporting on the quality assurance of learning requires an interactive and engaged partnership between academic staff, technical support staff, and educational professionals. Institutions and programmes should be careful about thinking that technology is the magic tool to fix and replace academic processes, of which the objectives are to maintain and report on academic quality (Academies Australasia Colleges [AAC], 2020). Technology is only the vehicle used to execute the institution's assessment processes, standards and criteria. Humans are still at the centre of 4IR (Huba and Kozák, 2016), and thus the focal point of this paper.

The case study initiative presented in this paper is a study that focused over an extended period on the Department of Informatics' (UP) approach of elevating an annual programme review cycle to develop a culture of programme assessment processes for lecturers through the use of *Blackboard Learn Goals Tool* (BbGT) – a functionality in the UP's official LMS – to facilitate Informatics' data-gathering processes on programme outcome achievements for its Accreditation Board for Engineering and Technology (ABET) accreditation[18].

[18] The Accreditation Board for Engineering and Technology (ABET) is a non-governmental organisation that accredits post-secondary education programmes in applied and natural science, computing, engineering and engineering technology. It is based in the United States and has global reach.

This paper aims to provide a brief background and introduction to the higher education landscape in South Africa, as well as a global perspective on Quality Councils and other quality assurance bodies, and the relevance of 4IR within the HEI landscape to contextualise a case study at UP that will be introduced in a subsequent section. The case study is an ongoing initiative, and the Department of Informatics at UP perceives its successes as milestones successfully reached. The authors believe that this initiative can be replicated nationally and internationally, and therefore will highlight the challenges experienced, and how these were overcome through international collaboration and the sharing of good practices.

BACKGROUND

The higher education landscape

Globally, quality assurance and accreditation systems and processes are developed and monitored either by countries or education sectors (Botha and de Villiers, 2017). The South African Qualifications Authority (SAQA) is a statutory body that oversees the successful implementation and further development of the NQF, of which the objectives are to enhance inclusivity, mobility in, and the quality of education and training, amongst others (SAQA, 2020)[19].

Guided by the implementation of educational policies, guidelines and Quality Councils' requirements, it is therefore expected of HEIs to align teaching, student learning activities, and assessment constructively with programme outcomes. For professional learning programmes, this would also mean that programme outcomes should be aligned with the applicable professional body accreditation requirements. Institutions should have academic processes in place to support academic staff to ensure student learning and programme effectiveness. There are three focus areas of academic processes, which this case study considered (Thiagaraja College of Engineering, 2020):

[19] The NQF in South Africa comprises three articulated NQF Sub-Frameworks, for higher education, occupational qualifications, and general and further education and training respectively. Each NQF Sub-Framework is overseen by one of three Quality Councils and the three NQF Sub-Frameworks are coordinated by SAQA.

- *teaching and learning processes* - new initiatives are planned and organised through processes such as curriculum development, content delivery, and learning processes;
- *assessment* - technology (e.g., assessment tools) and assessment methodologies are considered holistically to address programme assessment and reporting requirements; and
- *lecturer development* - focusing on facilitating and building lecturers' competency through fit for purpose workshops and training opportunities.

This commitment to HEIs delivering programmes of quality, and meeting educational (curricular and instructional) quality standards, is seen in the historical development of discipline-specific accrediting bodies, such as the Accreditation Board for Engineering and Technology (ABET, 2020), and the Association to Advance Collegiate Schools of Business (AACSB, 2020). These bodies ensure consistent understandings of what is to be learned as well as the reciprocity of credits and degrees among institutions. On a regional scale, is the 2015 Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG, 2015) for example, in which European Union Ministries of Education put forth a series of guidelines to promote the development of practices within institutions and programmes to address educational quality assurance indicators. The slightly later African Standards and Guidelines (ASG, 2019) similarly promote quality practices in Africa. These guidelines and indicators exist to help African and European HEIs respectively to strengthen higher education's knowledge-based foundation to include social and economic skills, competencies for lifelong learning, and adaptability to the needs of 4IR.

4IR and technology in higher education

Technology has disrupted and attracted significant attention across the globe (Zhong, Xu, Klotz and Newman, 2017; Kruger and Steyn, 2019). The focus of 4IR is on the end-to-end digitisation of various industries and processes and integrating digital ecosystems into these industries (Lidong and Guanghui, 2016; Kruger and Steyn 2020). These technologies – such as Augmented Reality (AR), additive manufacturing (AM), Big Data analytics, to name but a few – have the possibility of changing and impacting various industries (Wang, Wan and Zhang, 2016; Kruger and Steyn, 2020; Huba and Kozák, 2016). The education industry is not excluded (Lafuente and Berbegal-Mirabent, 2017). HEIs need to be able to manage the shift to teaching in the context of the 4IR to ensure that graduates can adapt to these 4IR technologies that their work environments will require from them (Martin, Bohuslava and Igor, 2018).

Educational technologies have been helping HEIs' move into the 4IR, in their re-working or re-imagining of how instruction and curriculum could be delivered to learners, and their ability to expand the access to education beyond their brick-and-mortar locations. Clayton Christensen, as cited in Maloney and Kim (2020), pegged LMS's as a disruptive innovation in education as early as 2011. Today, the LMS – in its facilitation of remote but collaborative communication, its delivery of micro-learning units, its promotion of self-directed and self-remediated learning pathways, and its connecting of the learner to materials, to evaluations of learning, to peers, to instructors, and advisors – is a microcosm for many of the skills needed in the 4IR and social, cultural, and employability landscapes. Additionally, the ability to align and capture data points on learners, and their performance on learning outcomes within and across courses from the programme and institutional perspectives, for analysis, is key to the kind of data analytics HEIs need today. Thus, using a feature like Blackboard's Goals Tool (which contains an institution's and a programme's learning outcomes and is native to the Blackboard Learn environment) to align these outcomes to signature assignments or evaluation rubrics and exam questions, will provide a programme with evidence of the effectiveness of its assessment plan. These data points, along with many others, within the LMS will be critical to HEIs taking proactive steps to ensure student retention and persistence, design appropriate student services and academic support, develop students and lecturers' 4IR skills, and make instructional and curricular improvements to prepare learners for the 4IR world of today and tomorrow. The next section discusses the Case Study, which is the focus of this paper.

CASE STUDY: DEPARTMENT OF INFORMATICS (UP)

Context

The Informatics modules, as part of the curriculum for the Bachelor of Commerce (BCom) Informatics: Information Systems programme, are offered by the Informatics Department at UP. This programme is the only programme in Africa that is internationally accredited by ABET. Over the years, the Department established a process for programme review in alignment with ABET requirements. In November 2016, the department decided to act on the ABET accreditation report recommendation which had the objectives to elevate the current process to programme assessment level, and leverage technology into the annual cycle. The ability to report on student learning and programme effectiveness for accreditation did not happen overnight – it involved continuous improvement and the enhancement of teaching and learning processes, curriculum development and delivery.

For many professional learning programmes, an annual programme review is a painful process as lecturers have to work together to align their module outcomes to that of the accreditor's required outcomes, as well as to the institution's graduate attributes. This difficulty could be due to the lack of understanding by lecturers of the value and importance of the role of programme review as an activity within the bigger picture of programme assessment practice. Lecturers have been used to thinking in terms of 'his' or 'her' courses and the tasks related to the courses, rather than how 'his' or 'her' courses fit into the larger programmes, and this is because of HEIs' silo culture. Additionally, a lack of resources to engage in programme-level assessment practices, such as the resources and staff needed to develop and deliver Continuous Professional Development (CPD) on programme assessment approaches, and fear of change, have created a culture of resistance within HEIs. For many lecturers, programme review becomes a 'tick-box' exercise for accreditation approval, leaving little room for dialogue on how a programme could improve its curriculum and the actions needed to assure quality and effective student learning.

Furthermore, the opinion of lecturers that programme assessment is an additional burden to an already loaded teaching portfolio, is a global phenomenon (Newberry, Robinson and Botha, 2021; Wang and Hurley, 2011; Scott and Danley-Scott, 2015; Kadakia and Bradshaw, 2020). The Department's Head of Informatics, and its education consultant, were not unmindful of, or without empathy for, the challenge facing lecturers, given the insights from past ABET assessment activities and the amount of manual data collection the lecturers had to provide. The Head and consultant aimed to develop a practical solution called *Programme Alignment, Implementation and Reporting* (PAIR) for implementation through consultation with the Department's established international partner, Blackboard Consulting. PAIR is illustrated in Figure 1 and will be discussed in more detail in the sections that follow.

When examining the adoption of technology to support institutional and programme assessment practices, a critical success factor is the social interaction amongst the key stakeholders. Furthermore, the problem with the acceptance of new technology is often seen in the reaction of the people who need to interact with the technology, as they are often sceptical and, to some extent, unwilling to embrace technology. Implementing technology to assist with reporting on the quality assurance of learning, quality assessment, and the continuous improvement of student learning, requires an interactive and engaged partnership with all those who support the teaching, learning, and assessment processes in an HEI.

Phase 1: PAIR Framework and introduction of the Blackboard Goals Tool

The first phase of the case study focused on the Department's approach to changing its attitudes over a period of time, from thinking about student learning in silo modules, to looking at where learning occurs regarding standards across the programme. With this programme perspective, the Goals Tool (BbGT) in UP's Blackboard LMS could be used to map and align learning outcomes to every department's module assessment opportunities and student activities, as well as to institutional graduate attributes, and accreditation criteria. For the Department, the mapping was based on the summative assessments of all the modules, which were captured using the LMS grade centre. The use of Blackboard's Goals technology-enabled further use of Blackboard's add-on analytics software for the creation of two module-level reports that were made available to lecturers for their online modules: a goals performance report and an outcomes coverage report. The Department Head had access to an additional analytics report: an overarching programme level report.

These two module reports helped the programme and its lecturers to develop a culture of moving from having only a programme review approach, to a quality programme assessment process, through discussions within the Department on how students were performing regarding the programme, ABET criteria, and institutional outcomes. Blackboard's Consulting provided a workshop on the programme to help to convert current module-level assessment processes to programme level by drawing on international programme and discipline assessment practices. A Comprehensive Programme Assessment Praxis (CPAP) (to be discussed later in this paper) guided the Department to move from a single grade for assessment and programme review Framework (PAIR) to a model (i.e. CPAP) that blended US assessment approaches and strategies (Botha, Newberry and de Villiers, 2019).

It is important to note that the Department arrived at the model described by inviting relevant support departments and key stakeholders to assist in the development and execution of the framework. One such department that played a critical role is the Department for Education Innovation (DEI) that manages, amongst other things, UP's official LMS. Not all the instructional designers and education consultants in the DEI were initially involved, although the heads of these units were consulted throughout the study. There was close collaboration with the Deputy Director of E-learning and Media development who provided support for piloting the BbGT and assisted with creating high-level reports for the Informatics Department. During the final evaluation phase of the study, two demonstrations and proof of concept workshops were held with: (1) the education consultants, instructional designers and management of Education Innovation, and (2) all academic staff of the Informatics Department – in total 27 participants.

Following is a snapshot of the collective feedback received from the survey that was administered after the workshops. Figure 1 illustrates participants' current job titles of which the lecturers were most presented (56%).

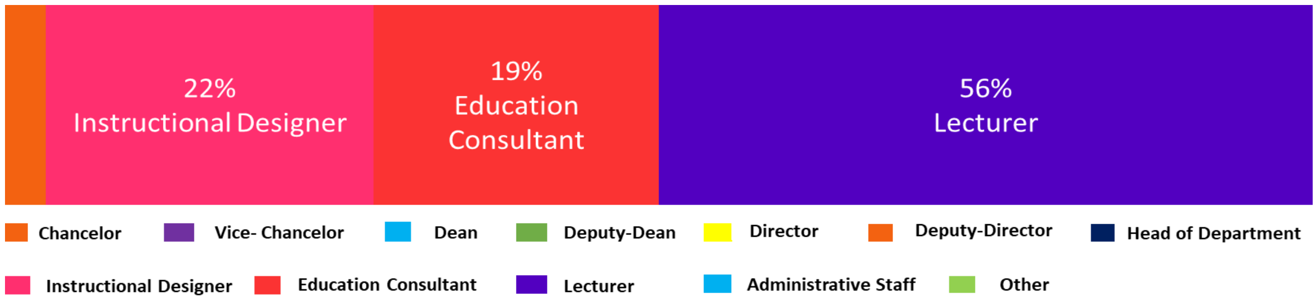

Figure 1: Workshop participants' current job title (Source: Authors' own illustration).

The participants were also asked to indicate their views on the feasibility of the PAIR framework and the BbGT with reference to the following attributes of the diffusion of an innovation: relative advantage, compatibility, complexity/simplicity, trial-ability, and observability (Rogers, 2003). The results in Tables 1 and 2 show on a continuum that PAIR and BbGT are respectively extremely, very, quite, somewhat or not feasible, based on a set of open-ended questions.

Table 1: Statistical breakdown of the results obtained for the proof of concept for the feasibility of the PAIR Framework for Programme Review

#	Question	Extremely feasible (%)	*	Very feasible (%)	*	Quite feasible (%)	*	Somewhat feasible (%)	*	Not feasible at all (%)	*	Total **
1	Relative advantage	16.00	4	44.00	11	24.00	6	16.00	4	0.00	0	25
2	Compatibility	4.00	1	36.00	9	28.00	7	32.00	8	0.00	0	25
3	Complexity/ Simplicity	0	0	25.00	6	33.33	8	37.50	9	4.17	1	24
4	Trial-ability	4.00	1	48.00	12	24.00	6	20.00	5	4.00	1	25
5	Observability	20.00	5	40.00	10	20.00	5	12.00	3	8.00	2	25
*** Number of participants that completed the survey ** Total number of participants that completed the survey**												

Table 2: Statistical breakdown of the results obtained for the proof of concept for the feasibility of the Blackboard Goals Tool

#	Question	Extremely feasible	*	Very feasible	*	Quite feasible	*	Somewhat feasible	*	Not feasible at all	*	Total **
1	Relative advantage	11.11%	3	44.44%	12	29.63%	8	11.11%	3	3.70%	1	27
2	Compatibility	3.70%	1	37.04%	10	33.33%	9	22.22%	6	3.70%	1	27
3	Complexity/ Simplicity	3.70%	1	14.81%	4	37.04%	10	37.04%	10	7.41%	2	27
4	Trialability	7.41%	2	48.15%	13	22.22%	6	11.11%	3	11.11%	3	27
5	Observability	14.81%	4	48.15%	13	18.52%	5	11.11%	3	7.41%	2	27
*** Number of participants that completed the survey ** Total number of participants that completed the survey**												

The feedback from the open-ended questions was constructive of which the following points are of critical importance – and in this regard, PAIR was designed and developed with these basic assumptions and challenges in mind.

- Lecturers will be more encouraged to adopt PAIR for quality programme review and use BbGT if they do not feel that their current teaching, learning and assessment practices are disrupted and that the support structures for implementation are readily available.
- The following main themes were identified from the participants' feedback of the open-ended question related to BbGT: the need for (1) guidance; (2) an implementation plan; (3) teamwork and a centralised approach; (4) an institutional

strategy; (5) buy-in in the use of the BbGT; (6) revisiting the curriculum and learning outcomes alignment of programmes;

- The proposed PAIR and continuous research on the adoption and implementation thereof can add value to the lecturer's work outputs, the impact and quality of course design, as well as to student success levels and therefore the success of the institution at large.
- Leadership, the involvement of the Quality Assurance unit and collaboration of instructional designers and education consultants, are viewed as critical aspects for the successful implementation of the framework and BbGT as this process might also be experienced as being over-complex and not familiar.

Therefore, in addition to the academic and educational technology support offered by educational consultants and instructional designers at UP, the immediate key stakeholders who should provide direction to lecturers, management and support staff on the potential implementation of the PAIR and BbGT, would be the management of the Department for Education Innovation, and offices of the Vice-Principal: Academic, Institutional Planning, Quality Assurance, and Academic Planning.

Feedback from participants during the ‘proof of concept workshop’ of PAIR and BbGT voiced the imperative that senior management buys into this concept and is on-board for successful implementation. They further communicated their concern that for programmes without accreditation bodies, it would be difficult to achieve engagement with this process. They raised concerns about limited institution-wide uptake due to the teaching and learning mandate within each faculty at UP. Although this might be a challenge in the interim, the authors are convinced that this might change in the near future.

Many investigative conversations were initially held with the Director and Deputy- Director of the Quality Assurance and Academic Planning unit at UP about the potential for implementing a tool such as BbGT, but more so, how this technology could and should be incorporated as part of UP’s academic processes. Through the engagement of these stakeholders, a platform was established in which continuous dialogue could take place around critical topics, such as:

- the various ways in which the assessment of student performance in relation to learning outcomes can be conducted;
- the influence of institutional academic processes and context;
- models for teaching and learning; and
- the influence of existing organisational-, higher education sector- and accreditation pressures.

Towards conclusion, then, the impact of technology, or the use of the BbGT in the assessment of student learning outcomes, remains a critical aspect to consider in terms of how it provides direct evidence of learning and efficiently provides the data on programme (and institutional) assessment processes. These efficiencies were critical for lecturers' participation in the programme assessment process. Too often, these technologies, often unknown to lecturers (Botha, Smuts and de Villiers, 2018), are not implemented as part of a more significant assessment solution, which frustrates lecturers. For these reasons, the proposed CPAP process (Figure 3), which came after the PAIR Framework (Figure 2) of Phase 1, was introduced to ensure the adoption (Botha, Jordaan and Scheepers, 2018), effective implementation and use of the BbGT in support of the programme assessment process in the Department. The initial South African contribution, PAIR (Figure 2), which serves as the delivery component of CPAP, was introduced first, followed by the US contribution of the development component which manifested in the creation of CPAP (Figure 3) (Botha et al. 2019).

PAIR Framework

In response to ABET recommendations, the PAIR Framework (Figure 2) was initially designed for quality programme review during Phase 1, where the use of technology was considered as part of the review process. In 2019, PAIR then led to a more mature model, CPAP (Figure 3) that now incorporates PAIR.

The design and development of PAIR were grounded in the theories of Diffusion of Innovations (Rogers, 2003) and Constructive Alignment (Biggs, 2014). PAIR consists of four main components and four quality-assured deliverables. The Framework is characterised by discussions and dialogue on curriculum and technology matters. It holds lecturers, and programme and module coordinators accountable for the quality assurance of learning, and the reporting thereof. The central component is connected to each of the four components of the Framework, indicating the movement between the components towards the centre, which exemplifies ‘student success’.

Figure 2: PAIR Framework for Quality Programme Review (Botha et al. 2019)[20]

Preferably, the programme review process would start with the first component – the ’**Programme Review Partnership Meeting’.** This meeting should be chaired by the Head of Department and bring together the programme coordinator, module coordinators, an education consultant, and an instructional designer. The nature of the meeting is to discuss collectively and decide on an action plan for quality programme review, which in CPAP, will now be ‘programme assessment’ as the focus.

The second component, **‘Programme Outcomes Alignment’**, focuses on activities and support to the department by their education consultant on all curriculum matters. The outcomes to be achieved by incorporating this component in the Framework, are the delivery

[20] The following acronyms can be explained as follows: QA=Quality Assurance, LMS=Learning Management System, and BbGT=Blackboard Learn Goals Tool.

of quality-assured module study guides, planning and development of programme outcomes and alignment maps, as well as assessment plans built from a programme, not a module perspective.

The instructional designers provide the necessary support and training to academic staff on e-Learning and the use of the LMS in the **'LMS Implementation'** component of the Framework. It is understood in this phase that, for the use of BbGT, the programme will revisit the e-learning strategy and approach. The quality assurance deliverable for this phase is the comprehensive programme outcomes alignment and assessment map.

The **'Reporting for Programme Improvement and Accreditation'** component focuses on the creation of the programme's outcomes alignment map that will be used with BbGT. This phase requires a close working relationship between the assessment professional (and or person managing the BbGT), the curriculum committees, and the established academic partnerships. During this phase, lecturers will also be trained in the use of the BbGT. The quality deliverables created for this phase are the course coverage report and course performance report generated by BbGT.

Closing the loop for the programme review cycle (in CPAP referred to as the programme assessment cycle) within PAIR is the second **'Programme Review Partnership Meeting'** that will typically be at the end of an academic year. The agenda will be different from the first meeting – it will involve the review of the whole programme and modules linked to the programme. It will also include the analysis of the BbGT reports of the modules and programme as a whole. The discussions will be around identifying gaps in the curriculum and assessment; duplications and challenges in the curriculum that affect the quality assurance of learning; and student success findings, and finally, a decision is made on an action plan for the next programme review cycle.

The dynamic nature of PAIR allows, at any stage in the delivery of the Framework, for the education consultants and instructional designers to work collaboratively to establish a 'partnership' amongst lecturers and their support structures. The next section provides a high-level and holistic overview of CPAP and its implementation in the department during Phase 2.

Phase 2: Comprehensive Programme Assessment Praxis (CPAP)

To improve PAIR's processes for a programme and elevate PAIR to institutional-level use, a design phase was included (Figure 3) to ensure that appropriate and meaningful data could be collected. The CPAP Framework outlines the necessary steps in the design of a programme that proceeds with the development of individual modules in a programme delivery phase.

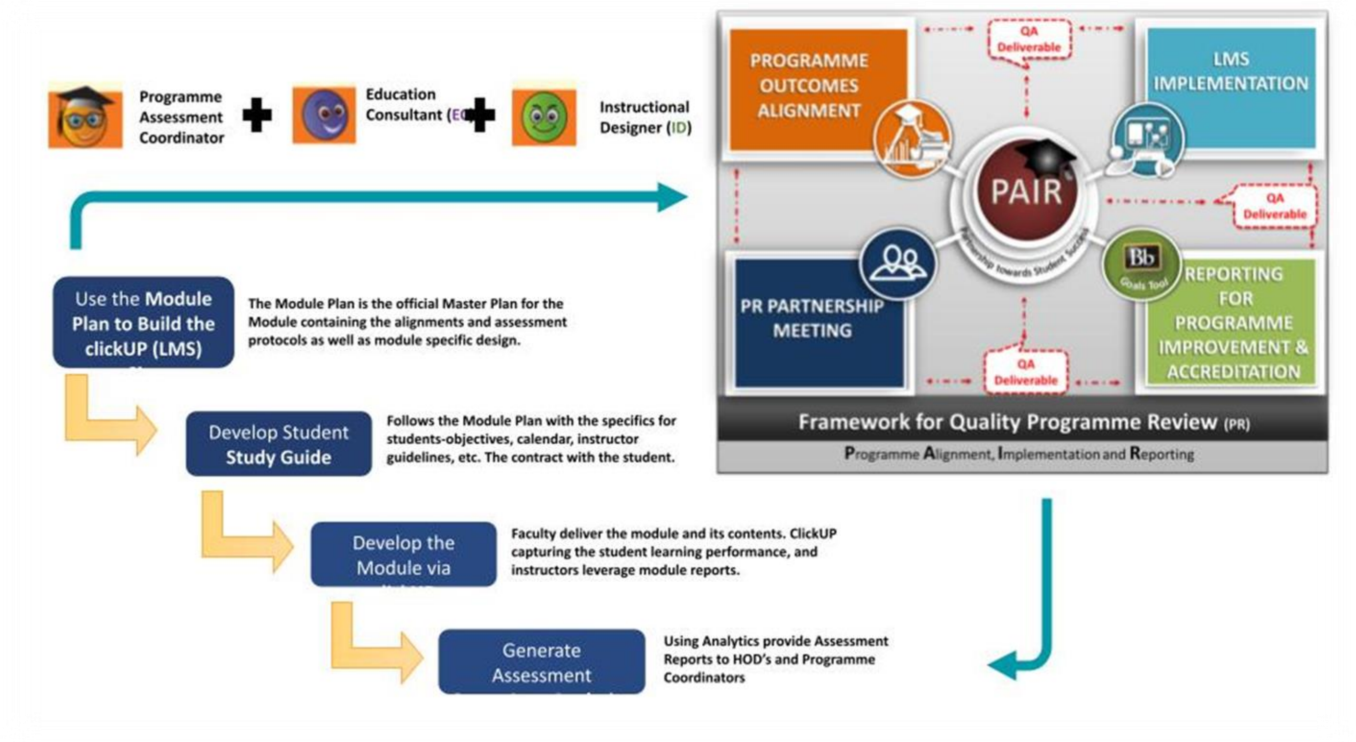

Figure 3: Comprehensive Programme Assessment Praxis (CPAP) (Botha et al. 2019).

The five steps of CPAP present an improvement cycle process representing good assessment practices at programme level:

1. the design of the programme's learning outcomes to establish learning expectations, a curriculum map, an assessment plan, and a module plan;
2. the delivery of the programme, which includes modalities, methods and practices;
3. the plan for evaluating key places in the programme where programme, accreditor, and institutional learning expectations are met;
4. the analysis of results on student performance evaluations across the programme; and
5. the development of an action plan for curricular, instructional, and student support improvements (Botha et al. 2019).

CPAP will, therefore, allow education consultants, instructional designers, programme coordinators, and lecturers to move through the design and delivery phases of their programmes in clearly defined practices.

For the Department, the implementation of CPAP was a significant milestone. Through collaboration and an evolving partnership over the years, CPAP now provides the Department with a systematic process for assessing programme and institutional student learning outcomes through a consistent and programmatic collection of data on student performance utilising UP's LMS technologies. These technologies include *clickUP* (the in-house name for the UP's LMS), the Goals Tool, and Analytics for Learn. CPAP, therefore, helped the Department to establish a process for developing the necessary mechanisms to standardise and systematise assessment data capture and reporting for the BCom Informatics: Information Systems programme to ABET (Botha et al. 2019).

If CPAP is fully adopted and implemented successfully in the next few years, then for the next ABET accreditation cycle period (briefly described in the upcoming Phase 3), the assessment process for ABET will be built on a solid base of information on student learning to support the Department and UP as a whole (Botha et al. 2019).

Phase 3: What is next for UP programme assessment?

The third phase in this case study is to instantiate the CPAP process with the full implementation of the BbGT. This use of CPAP will allow the Department to focus on the assessment of student learning outcomes. The first assessment cycle in 2021 will relate to the ABET criteria focusing on teamwork: *Function effectively as a member or leader of a team engaged in activities appropriate to the programme's discipline.* Following 2021, the focus will be on the other ABET criteria, one for each year.

The Coronavirus (Covid-19) pandemic, sad as it is, is forcing HEIs worldwide to undertake a rapid transformation to online learning. For UP and its Department of Informatics, the pandemic has provided a unique opportunity to implement CPAP and *clickUP* (LMS) more quickly than anticipated. With every teaching and learning and assessment activity in the programme, now online, the Department has been able to align and report on the performance of students against ABET criteria and programme outcomes across the entire Informatics programme.

As stated earlier, this journey in the Department was not without its challenges. One example of the difficulties faced is that although a tool is available, the lack of a formal implementation process for the entire institution complicates the request for comprehensive support to use this tool as part of the academic process to its fullest extent. Nevertheless, by strengthening its partnership with institutional support units and a willingness to learn from international colleagues and specialists in the field of programme review and assessment, this ongoing journey has been a rewarding and positive experience. In the section that follows, the authors reflect on a few milestones that were achieved successfully. This section will lead the reader to the final recommendation by three of the authors, two of whom are from the US, and the concluding thoughts.

REFLECTIONS

Looking back to the positive outcomes for this case study and the Department of Informatics, it is clear that there were some key highlights, as follows.

- The Department managed to incorporate curriculum mapping and alignment workshops; BbGT training; LMS grade centre training; and quality review and improvement of all module study guides.
- The Department successfully implemented the BbGT for reporting on the summative assessment of ABET criteria, programme outcomes and institutional graduate attributes during the first phase of the Department's initiative implementation stage. The 2019 BbGT reports provided each lecturer in the Department with a roadmap on actions to be taken for informing continuous improvement of all the Informatics modules. Some of the action plans were already being implemented in 2020, despite the current pandemic with its associated challenges.
- It is too early for this case study to report on any student success that might be due to CPAP implementation. However, there is an overall awareness of designing quality study guides for students. There is also visible improvement in the writing of learning outcomes and assessment criteria, as well as the constructive alignment of content, assessment opportunities and student activities, and learning outcomes – across the learning programme.
- The feedback from the ABET accreditation visit in 2019 commended the Department on the processes that it established.

- Phases 1 and 2 provided the foundation for continuous improvement into Phase 3 and beyond.

PROPOSED RECOMMENDATION – ASSESSMENT TECHNOLOGY ADOPTION FRAMEWORK (ATAF)

When an HEI wants to implement technology to enhance reporting on students' performance on learning outcomes, the 80/20 principle dictates: 80% of the drivers for success are academic processes/ 20% comprises the configuration of technology – academic processes need to be in place for the successful implementation and sustainable adoption of the technology. For the Informatics Department to move its initiative within UP from a pilot to institution-wide adoption, the Head of Department and the Department's education consultant realised that full support from all key stakeholders and support units in the institution would be needed to elevate the CPAP to institution-wide use.

To support the Department and UP in this endeavour, three of the authors of this paper published a chapter, titled: *Adoption and integration of learning technologies across the institution – enabling a solution for assessment and technology* (Newberry, Robinson and Botha, forthcoming 2021). In this chapter, the authors focus on the assessment of learner performance at the programme and institutional levels and the intersection with Assessment Technology (AT), and propose an Assessment Technology Adoption Framework (ATAF) (Figure 4). This Framework consists of four quadrants, as follows.

- **Assessment** – assessment administrators and professionals who need AT to guide and support the assessment practices within programmes to ensure the institution is meeting its various reporting responsibilities and improvement actions.
- **Academics** – institutional assessment directors and programme assessment coordinators who work closely with academic units to support their discipline-specific assessments. For successful adoption and use of an AT, academics must be fully vested in the process of assessment of learning outcomes if any technology is to be successful.
- **Educational Technology** – staff and units involved in assisting the academic units with their technology needs for teaching and learning – their participation throughout the ATAF process is vitally important for successful implementation, adoption, and sustainability.

- **Assessment Solution** – represents the technology application and the activities of the consultant who guides the other three units through configuration and establishing good practices for sustained management and adoption.

A working partnership connects these quadrants to support and facilitate the assessment processes of academic units across an institution so the data can lead to actionable results for improvements in teaching and learning.

Figure 4: Assessment Technology Adoption Framework (ATAF) (Newberry, Robinson and Botha, Forthcoming 2021).

Each of the quadrants in Figure 4 contributes to the five-stage process of technology adoption. These stages are described as: Gathering requirements; building the vision; enabling the solution; empowering the team; and growing and sustaining the vision. According to the authors of the chapter (Newberry, Robinson and Botha, forthcoming in 2021, no pagination yet):

> This process of adoption begins with defining a mutually understood and defined vision for a scalable, sustainable, and systemic use of an AT system to support the evaluation of student performance on institutional and programme level learning outcomes so that Academic and Assessment quadrants have actionable information to develop plans for improvements.

The authors share ATAF as a guide and as a consideration for institutions. The ATAF Model, "combines people, roles, and practices with a process of adoption in order to execute a shared vision for effectively implementing a technology to assist with evaluating learning outcomes at the institutional and program level to improve learning and learner success" (Ibid.).

As noted, the successful implementation of Assessment Technology requires an interactive and engaged partnership between academic staff, technical support staff, and educational professionals. At Framingham State University, in Framingham, Massachusetts (FSU), the Education Technology Office created an intake form to aid in the adoption and use of the Blackboard Outcomes Tool. The form facilitates conversations to ensure that the stakeholders and project leaders are fully vested in the specified process of assessment. During these discussions, the seeds are sown for collaboration, trust and respect. The form serves as a conversation starter after a department expresses interest in the assessment. Talking through each section, the team can identify signs of success, opportunities for improvements, and reveal challenges and risks. This shared vision not only establishes a project roadmap but also reveals the work that needs to be completed to move forward with the project.

Through their experience with the form, FSU learned that when they begin with a conversation to understand goals, identify mutual understandings of roles, and take advantage of good consulting practices, they are in a better position to leverage the technology platform to enable a solution. The form is freely available online.[21]

CONCLUSIONS

A merger of two perspectives – a South African/ UP high-capacity classroom and, to some extent, decentralised organisation with US good practices for assessment – helped to elevate an initial assessment Framework for adoption by UP. Because of the involvement and continuous commitment of the Department of Informatics, their previous model of module programme review has evolved into a programmatic perspective on student learning outcomes. The Department of Informatics has a better understanding of student and programme performance that is backed by data across the programme, which has led to

[21] To view the form, please click the following link: http://bit.ly/enablingsolutions (Accessed: 06 August 2020).

data-driven improvements to enhance student learning. The Department of Informatics aims now to foster an emerging community of practice within South Africa.

The case study presented shows that HEIs must consider carefully, what is required of their staff and students to address 4IR demands. The ATAF can assist and add value to this process. Irrespective of the technology used, institutions must include all stakeholders in the identification of needs, the planning, the selection of the assessment technology, and its implementation. Further useful website references in this regard include the Association for the Assessment of Learning in Higher Education (AALHE) (2020), *Inside Higher Ed* (2020), and McKinsey Group Institute (2020).

The Department of Informatics presents a roadmap (CPAP) that UP and any institution globally could adopt for further development to ensure quality programme assessment across an institution. Together with the use of the proposed ATAF, the work done at the programme level can move to an institutional level. Finally, the authors believe that this Framework could be replicated at other HEIs in South Africa for the benefit of the institutions and their students.

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SKILLS DEVELOPMENT, EMPLOYMENT AND ENTREPRENEURSHIP IN THE AGE OF THE FOURTH INDUSTRIAL REVOLUTION (4IR) IN SOUTH AFRICA

PAPER 6

Aligning Post-School Education and Training (PSET) and the National Qualifications Framework (NQF): Potential and Challenges in the Age of the Fourth Industrial Revolution (4IR)

Dr Sonja Loots and Mr Neil Butcher

ABSTRACT

The Fourth Industrial Revolution (4IR) brings with it changes in knowledge, skill, and competency demands. This will require a stronger connection between education, training and labour market sectors. It will also require a more fluid system that recognises qualifications, knowledge, skills, or competencies obtained through various experiences, as well as through formal, informal and non-formal learning. In this paper, we review international examples of how countries or regions are aligning sectors to optimise their readiness for the technological revolution in which we find ourselves. We then bring these examples home to discuss what might need to happen in the South African context to take advantage of the opportunities that the 4IR brings.

INTRODUCTION

The 4IR embodies change, which in turn demands mirrored responsiveness from systems and sectors. It is defined as the confluence of multiple digital, physical, and biological technologies that are changing the way in which we live, work, and interact. The 4IR is rapidly changing the way humans create, exchange, and distribute value, resulting in systemic change across many sectors and aspects of human life, with cross-cutting social, political, cultural, and economic implications (Schwab, 2018). In the South African context, it is the intersections between the technology revolution, a transforming society, and potentially radical new ways of doing business and governing that make the 4IR so disruptive and transformative.

While there is general agreement that fundamental changes are underway, commentaries and predictions about what these changes mean and their implications for society reveal wide-ranging perspectives and disagreements (e.g. Bessant, 2018). Some implications of the 4IR, such as deepening inequalities, digital divides, and increased automation of jobs are, however, evident. Unemployment as a result of technology could deepen existing inequalities and widen the gap between returns to labour and returns to capital (Peters, 2017). The World Economic Forum (WEF, 2018) estimates that, by 2022, 75 million current job roles will be displaced by the shift in the division of labour between humans, machines, and algorithms.

In South Africa, for example, several companies, particularly in the financial sector, have already implemented retrenchments due to task automation or displacement, and the WEF expects around half of all jobs to be affected by automation. However, while advances in technology require less human capital in some jobs, there are growing demands for other types of jobs, including data analysts and scientists, software developers, and e-commerce and social media specialists, amongst others. The WEF further estimates that 133 million new job roles may emerge simultaneously to those displaced. In many cases, it is the composition of skills required to perform a job that will change, and not necessarily deeming skills redundant. Other paid work opportunities that are also expected to grow include those that leverage uniquely human skills, such as customer service workers, training and development specialists, and innovation managers. These will be further supplemented by an entirely new set of specialist roles related to understanding and leveraging the latest emerging technologies such as Artificial Intelligence (AI) and machine learning specialists, process automation experts, information security analysts, and blockchain specialists. Beyond technical skills, soft skills, such as creativity, originality and initiative, critical thinking, persuasion and negotiation will retain or increase their value, as will attention to detail, resilience, flexibility, and complex problem-solving (WEF, 2018).

Taking these expected implications of the 4IR as a departure point, we reflect on some international trends in strengthening the relationship between the supply and demand of skills, knowledge and competencies, particularly in relation to how innovative initiatives are formally recognised in National Qualifications Frameworks (NQFs). We conclude by discussing the potential and challenges these changing times could hold for the South African context.

THE SOUTH AFRICAN CONTEXT

South Africa’s struggling economy and state of social welfare are in desperate need of intervention – even more so in a post-Coronavirus (Covid-19) world. The basic education system is plagued by challenges such as poor regional policy implementation, inefficient teaching and learning, and staggering resource inequalities (Allais, Cooper and Shalem, 2019; Van der Berg, Spaull, Wills, Gustafsson and Kotze, 2016). In addition, issues of quality haunt the sector. For example, the quality of mathematics education is ranked 128th out of 137 countries in the Global Competitiveness Ranking (WEF, 2017). Furthermore, of all learners who wrote the National Senior Certificate (NSC) examination in 2018, only 21% obtained a Bachelor's pass (entry requirement for Bachelor's degree at a university), and only 58% passed mathematics with a score higher than 30% (Department of Basic Education [DBE], 2019). In essence, success in mathematics is often a requirement for entry to digital education and work. However, South Africa does not produce school leavers with the quality of mathematics abilities required, nor in the quantities needed. The country also has a very high 'Not in Education, Employment, or Training' (NEET) rate of 34%, a labour market participation of 60%, and an overall unemployment rate of 30% (Statistics South Africa [StatsSA], 2020).

Moving to the workplace, only 20% of those in employment have a tertiary qualification, while 32% have completed secondary education and almost half of the workforce does not have a Grade 12 certificate (Labour Market Intelligence Partnership, 2016). In addition, only 28% of organisations surveyed by Deloitte (2017) are helping employees to build their skills. This bombardment of statistics paints a picture of a country with a large pool of human capital from which to draw in order to engage in education and training; however, that pool significantly reduces when needing to tap into the foundational skills necessary to build and advance technology and innovation. There is also a lack of a culture of learning – which is a foundational requirement for nurturing a lifelong learning system that would allow citizens to transition in and out of education and training regardless of their age, position, or employability status.

This demands a renewed look at the efficiency of the interplay between the skills, knowledge and competencies developed through education and training, and the rapidly changing demands for relevant skills, knowledge and competencies in the world of work. Addressing these challenges will require working partnerships between education and training sectors, government departments, and employers, to repurpose and reconfigure curricula considering lifelong learning and the need for a broader and more agile Post-School Education and Training (PSET) system to respond to skills needs as they arise. It also implies a shift from the current predominant orientation towards content-focused programmes that prepare people at the beginning of their working lives for permanent employment, towards becoming more holistic, focused on developing a broader range of capabilities that are required for success at work, and enabling people to access ongoing, and increasingly flexible, learning opportunities throughout their lives. At the core of the recommendations to align the PSET sector with the 4IR is a focus on relevant curricula, flexible teaching and learning practices, a wider variety of short course offerings, developing digital skills, a stronger focus on Work-Integrated Learning (WIL), making conscious efforts to embed graduate attributes into qualifications, and stimulating innovation and entrepreneurship.

INTERNATIONAL TRENDS

For many countries, the anticipation of the impact of the 4IR breathed new life into concepts such as lifelong learning, upskilling, reskilling, and skills alignment. The after-effects of the Covid-19 pandemic are almost certain to further fuel the urgency to invest in these constructs. Through recent involvement in a range of research and consultative projects on the topic, we summarise some of the main efforts that countries are pursuing to align education and training with changing workforce needs and ensure quality. These include a stronger focus on workforce skills development, investing more in the quality and relevance of Technical and Vocational Education and Training (TVET), adapting processes to recognise non-formal education in NQFs, regional quality benchmarking, and developing frameworks for digital skills development. Underpinning all these initiatives are strong relationships within and across sectors, simplified processes, and clear links between policy goals, implementation strategies and monitoring and evaluation efforts.

Workforce Skills Development

As the need for more regular skills alignment intensifies, countries are considering more structured approaches to invest in continued training options for those already participating in the labour market. Developed by the World Bank (2019) to support frontier economies high in productivity, innovation and income to further advance competitive skills development, the Precision Training Framework brings together three key avenues of skills development among employees – individualised learning, workplace training, and Public-Private Partnerships (PPPs, as illustrated in Figure 1).

Individualised learning is technology-driven and allows employees to upskill at their own pace and through a variety of teaching and learning platforms. Workplace training is employer-driven, involves some form of skills assessment and development plan, and takes place through a range of teaching and learning platforms, including online, blended or traditional face-to-face mechanisms. Lastly, PPPs in the Precision Training Framework context are contractual agreements between educational institutions and the private sector, where employees could benefit from formal courses, students could gain experience in workplaces, and curricula could be influenced by the realities of workplace skills demands.

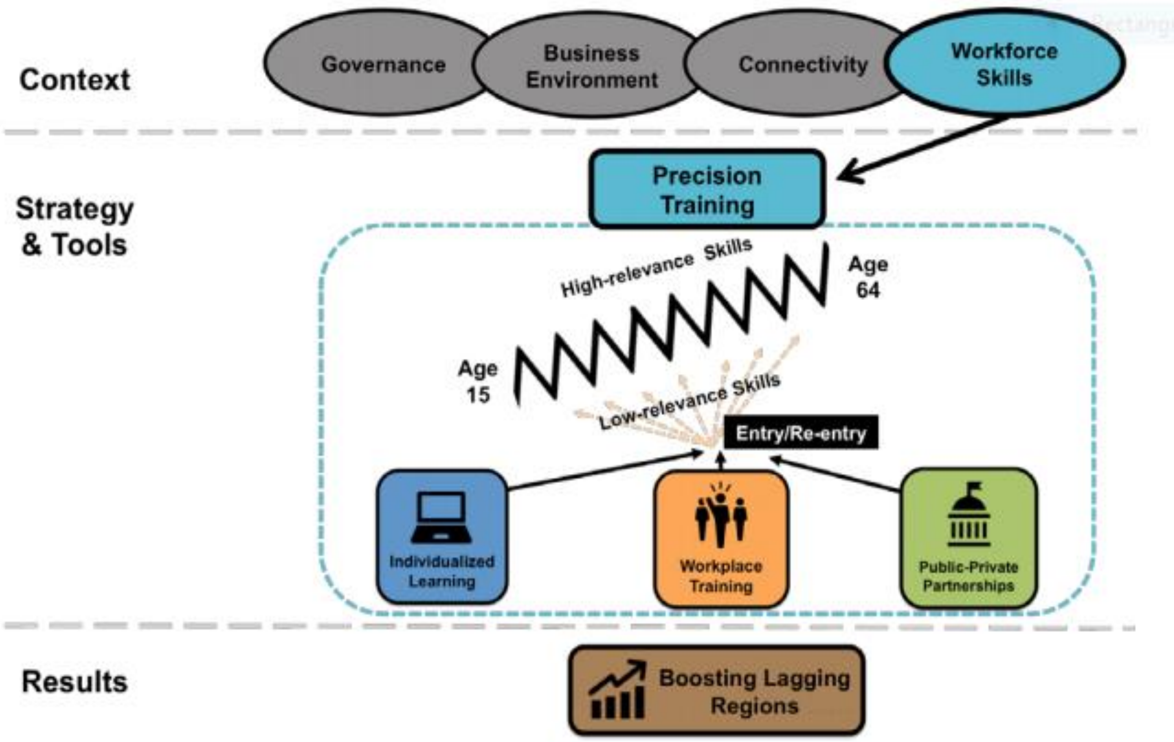

Figure 1: Precision Training Framework (World Bank, 2019).

PPPs represent a spectrum of programmes characterised by cooperation between government and the private sector, where both share in risks and rewards. It is possible to categorise PPPs into three types: the state-regulated bureaucratic model, the dual system model, and the volunteerism model.

In the *state-regulated bureaucratic model*, national education systems define, provide, and finance training, with the private sector primarily playing a consultative role (examples include programmes in France, Italy, Sweden, and Finland). Within this model, training is usually an extension of the national education system, where the national curriculum determines the content of the courses, but often fails to reflect the realities of local labour demands. In the *dual system model* (seen, for example, in Germany, Austria, Switzerland, Denmark, and Norway), the design, development, and implementation of training all involve many public and private stakeholders. PPPs form ‘intermediary’ institutions. They are independent of both the state and private companies but regulate vocational education qualifications. These PPPs ensure the stability of training during economic change and serve to limit the control that the state and the market might have on the training system. A national pilot study to implement a dual system model for training apprentices in Engineering studies in South Africa showed great promise, with lecturers, employers, and students finding the method beneficial on a variety of levels. However, challenges such as a lack of trust in governmental programmes, the inefficiency of Sector Education and Training Authorities (SETAs) and bureaucracy of processes, and a lack of capacity in TVET Colleges had a significant impact on the success of the model (Duncan, 2015).

Finally, the *volunteerism model* focuses on workplace training and apprenticeships, often paid for by the private employer or firm. Although this model is greatly dependent on companies’ willingness to participate in and bear the expenses of training programmes, it could be mediated by effective Active Labour Market Policies (ALMPs) or other government incentives to upskill or reskill the labour force. An example of an industry-led initiative is the Bosch Technical Industrial Apprenticeship programme in Vietnam, established in 2013 to guide industrial mechanics training. In 2016, the programme started offering mechatronics as a second discipline to its vocational training curricula. Apprentices undergo three and a half years of theoretical studies at a TVET college and practical training with modern machinery and equipment at Bosch. A total of 24 apprentices are recruited annually. By 2017, female apprentices accounted for 23% of the 93 apprentices. There is no tuition fee, and apprentices receive a monthly allowance. The programme is designed not only to equip apprentices with technical skills but also to prepare them for long-term career development by building their social skills (United States Agency for International Development [USAID], 2014; Vietnam Investment Review, 2017; World Bank, 2019).

The successful implementation of all three components (individualised training, workplace training and PPPs) is subject to a context of good governance, connectivity, and an enabling business environment. It is also key to include all three components for the success of a precision training system. The result would be an agile, demand-driven skills environment in which individuals can receive skills training and re-training through various means throughout their lives.

Investing in the quality of TVET systems

As part of a global movement towards a lifelong learning approach to education and training and recognition of the vital role the TVET sector could play in such a system, efforts to increase the quality and relevance of the TVET sector are also increasing. Beyond work-based learning and other PPPs to enhance the relevance of curricula and aligning skills demand and supply chains, quality in the TVET sector can be enhanced by making sure that TVET educators are adequately skilled to provide leadership skills development.

A core component of re-training and upskilling TVET educators is Continuing Professional Development (CPD). While educators may have formal teaching qualifications, their skills are often outdated (Rawkins, 2018). Several countries, however, have made inroads into providing effective re-training and upskilling to TVET educators. For example, Kazakhstan uses a cascading training model to overcome issues with the vast size of the country and large distances between cities. In this model, both TVET educators and external trainers are trained at a Vocational Education Centre. The Centre established a commission that determines the criteria with which the external trainers must comply. Once qualified, external trainers can conduct professional development courses in other regions to share advanced teaching experiences within the TVET system. The system, therefore, increases the reach of the training (British Council, 2017). CPD in Finland takes a different form. The legislation provides a broad framework within which reskilling and upskilling operate by setting qualification requirements. While CPD for teaching staff is defined by legislation, TVET educators are given relative autonomy in deciding on their CPD pathways, with inputs from trade unions and employers. Most continuing training is free, and educators' employers – mainly local authorities under which the TVET institutions fall – are responsible for funding (European Centre for the Development of Vocational Training [CEDEFOP], 2019).

Singapore's Institute of Technical Education's Total Organisation Capability initiative allows TVET lecturers to re-train or upskill themselves through industrial and workplace attachments or postgraduate courses. In-service courses are usually provided by professional learning designers from the teaching and learning centres, which ensures that lecturers are up to date with the most current pedagogical practices, including the use of educational technologies for teaching and learning (United Nations Educational, Scientific and Cultural Organisation [UNESCO] –UNEVOC, 2020).

Several countries are also moving towards developing Technical and Vocational Qualifications Frameworks (TVQFs) that flow from NQFs and represent the levels associated with TVET qualifications. Such frameworks are being developed or have been implemented, for example, in Thailand, Iraq, Jordan, and Bangladesh. The European Qualifications Framework (EQF) also has a similar publication on levels three and four of the Framework to provide depth on Initial Vocational Education and Training qualifications (CEDEFOP, 2020).

Including recognition for non-formal education

A flexible education and training system implies a wider variety of places, and a wider variety of means through which knowledge, skills and competencies could be acquired and recognised. To formally acknowledge new ways of education and training, accreditation systems need to adapt accordingly. Examples of how the thinking around more flexible accreditation systems is developing, include recognition of micro-credentials, availing opportunities for unemployed people to develop in-demand skills, recognising supplementary skills development, and recognition for collections of acquired skills.

Micro-credentials are short, low-cost online courses that individuals complete to improve selected skills. These courses provide learners with digital certification or a ‘digital badge’ on completion. Additionally, micro-credentialing offers flexibility through shorter learning pathways, the possibility to overcome time and resource constraints, the potential to enable the Recognition of Prior Learning (RPL), and the more transparent recognition of skills and qualifications required by employers. For example, employers are able to determine whether candidates have demonstrated specific knowledge, skills, and competencies of interest without having to rely on traditional formal qualifications as a proxy for employability skills (Keevy, Rein, Chakroun and Foster, 2019).

The success of micro-credentials, however, depends on a few key factors:

- access to connectivity, equipment, and digital skills. Heavy reliance on technology for micro-credentialing creates a risk of perpetuating digital insiders and outsiders, while further excluding those already excluded from the labour market;
- pathway visibility or the ability to 'connect the atoms' so that work-seekers can understand and are able to develop marketable portfolios of credentials that combine effectively into more meaningful qualifications over time. Similarly, from an employer-perspective, credential portfolios need to represent a meaningful whole that is recognisable to employers as a desirable skill set, rather than fragmented or seemingly unrelated skills; and
- quality assurance so that skills are portable and there is trust in the signal provided by the micro-credential. Systems are needed to help learners and employers identify which learning opportunities and micro-credentials are valid and of quality (Keevy et al. 2019).

In the United States, the Lumina Foundation (2015) has developed an eight-level Framework that promotes the concept of a common credentialing language for credential evaluation. Similar to NQFs, the Framework is organised around competencies that are broken into two learning domains: knowledge and skills, the latter of which is further divided into specialised skills, personal skills and social skills. In addition to the Framework, the Credential Engine provides a suite of web-based services that creates a centralised Credential Registry to house up-to-date information about all credentials (e.g. degrees, licenses, badges and apprenticeships), their comparability, and a platform to support customised applications to search and retrieve information about credentials.

The Educational Research Institute (2018) in Poland recently published a seven-country report on approaches to include non-formal education qualifications in NQFs. Some of the innovative ways to recognise alternative qualifications include availing opportunities for the unemployed to develop in-demand skills, recognising supplementary skills development, and recognition for collections of acquired skills, among others.

In France, qualifications, competencies, and skills that correspond to the cross-cutting demands of selected jobs are identified and listed in an Inventory. Unemployed people are provided with an annual 25 hours 'training allowance' aimed at guiding training towards courses that lead, among other things, to the qualifications listed in the Inventory. Different types of incentives urge training providers to include their qualifications in the Inventory. The qualifications in the Inventory are classified into three categories: i) qualifications that are legally linked to a particular profession in France, e.g. electrician accreditations; ii) qualifications that relate to a specific field and are highly valued in a particular occupational environment, e.g. Microsoft Certification or a qualification in copper welding; and iii) qualifications that apply to a homogeneous set of competencies that may be required in one or more occupations, e.g. an office skills certificate, managing a work team as part of a business skills certificate, etcetera.

In Hungary, citizens can opt to ‘top-up’ a vocational qualification by completing a course that will enable them to enter an additional scope of work. For example, the qualification of a geriatric or paediatric nurse can be added to the general qualification of a nurse. The vocational examination will then include the content of the additional modules.

The Scottish Credit and Qualifications Framework (SCQF) is an extensive example of an inclusive lifelong learning framework. It includes over 11,500 programmes, of which over 800 are considered to be non-formal. The qualifications range from SCQF Level 1 to SCQF Level 11 and from one SCQF credit point to over 100 SCQF credit points. The only requirements for inclusion are proof that the relevant level outcomes for the qualification are met, as well as that these four criteria are adhered to: i) it is based on learning outcomes; ii) it consists of at least ten notional hours of learning; iii) it is subject to internal and external quality assurance; and iv) it is formally assessed. Owners of the programmes range from formal education institutions to government agencies, professional organisations, individual employers and training companies, trade unions, youth organisations, community organisations, adult education organisations and charities. Table 1 below illustrates some of the non-formal programmes, their SCQF levels, credit value, and the owners of the programmes.

Table 1: Example of non-formal education and training in the SCQF

SCQF Level	Qualification Owner	Qualification Name	Credits
6	Award Scheme Development and Accreditation Network (ASDAN)	Certificate in Personal Effectiveness	15
4	Sports Leaders UK	Sports Leadership	7
8	Institute of Counselling	Certificate in Youth Counselling	20
10	Chartered Institute of Bankers in Scotland	Chartered Banker Diploma	125

The SCQF also coordinates National Progression Awards (NPAs), which aim to assess the collective value of programmes or courses to contribute towards broader qualifications. NPAs are available at SCQF Levels 2-6 and are mainly used by colleges for short study programmes, such as return-to-work courses or part-time learning for those already in work. They are designed to assess defined sets of skills and knowledge in specialist vocational areas and how they link to National Occupational Standards and are frequently being implemented in newer areas such as Digital Literacy and Social Software.

REGIONAL BENCHMARKING

NQFs should be living documents that evolve with technological, social, and economic changes. Consequently, the need to benchmark internationally has increased, particularly in relation to the emergence of digital credentials and the need to develop methods and tools to recognise the skills of migrants and refugees (European Training Foundation [ETF], 2019). Forming regional alliances in quality benchmarking and increased mobility has worked for the European Union (EU) and South-East Asian countries in the Association of Southeast Asian Nations (ASEAN) network. Both regions have established regional qualification frameworks that guide NQF alignment.

The EU has also started benchmarking beyond European borders to align international thinking about quality frameworks and ultimately to ease mobility. To see whether countries outside of the EU are thinking along the same lines when conceptualising NQFs, the EQF was compared with the Hong Kong Qualifications Framework (HKQF; European Commission, 2017a), the New Zealand Qualifications Framework (NZQF; European Commission, 2016a), and the Australian Qualifications Framework (AQF; European Commission, 2016b). These comparisons showed a common understanding that qualifications are linked to learning outcomes, that these outcomes are in a hierarchical structure, and that learning takes place through different experiences and in a variety of environments. Because the EQF is a meta-framework, it does not specifically list qualifications, which limits comparisons to broad conceptualisations of learning outcomes. Furthermore, the individual countries' descriptions of learning outcomes are more detailed and context-specific, as would be expected.

Reflecting on the comparisons, however, leads to identifying gaps. For example, while the HKQF aligns with a robust quality assurance system, the rapid development of TVET systems requires the framework to be more specific about the levels related to TVET qualifications. For New Zealand, involvement with the EQF benchmarking allowed renewed engagement with the private sector to fine-tune one of the level descriptors, while, in Australia, the engagement between the project teams led to a more functional understanding of governance, regulation, and quality from contextual and international perspectives.

FRAMEWORKS FOR DIGITAL SKILLS DEVELOPMENT

The following are key ideas:

> Students will be able to truly develop their digital skills and to effectively use technologies only if the digital skills of the teachers/trainers themselves have been developed and only if [the] development of digital skills is seamlessly integrated into educational/training projects (PricewaterhouseCoopers [PWC], 2020:25).

Digital skills refer to the ability to use information technologies to find, evaluate, use, share, and create content. Without investing in different levels of digital skills development, a country's prospects of taking full advantage of the 4IR seem dim. An example of a comprehensive, outcomes-based framework is the EU's Digital Competence (DigComp) framework (European Commission, 2017b).

The DigComp 2.1 framework consists of five broad competence areas, collectively representing 21 competencies. Parallel to the competence areas are eight proficiency levels, grouped further into four additional proficiency levels - foundation, intermediate, advanced, and highly specialised. The framework is especially useful for defining basic and intermediate skills that need to be acquired by the youth population. The competence areas identify individual abilities that need to be covered under broader digital skills, while proficiency levels correspond broadly to the types of tasks involved in different types of occupations. Hence, the *foundation* level of proficiency in digital skills covers abilities required to carry out simple tasks using simple digital technologies, such as the capacity to use basic digital devices or applications. Foundational digital skills are typically used in vocational or informal sector occupations and occupations involving routine tasks. *Intermediate* level proficiency would typically be required in middle-level occupations such as skilled technicians and the general workforce in the formal small and medium enterprises. *Advanced* level proficiency, which requires greater analytical skills as well as theoretical knowledge, is typically required of occupations with a high level of information and communications technology intensity, involving applications of digital technologies, including information technology engineers and increasingly, finance professionals. Lastly, *the highly specialised* level of proficiency in digital skills is required in scientific and advanced professional occupations and underpins the ability to develop new digital technologies, products, and services. South Africa has done some work on digital skills development, particularly through the Department of Communications and Digital Technologies (DCDT); however, it still lacks a comprehensive strategy to embed digital skills in all spectrums of education and training.

Table 2: DigComp 2.1 Framework

Competence areas	Competencies	Proficiency levels
Competence area 1: Information and data literacy	1.1 Browsing, searching, filtering data, information, and digital content	Foundation (Levels 1-2)
	1.2 Evaluating data, information, and digital content	
	1.3 Managing data, information, and digital content	
Competence area 2: Communication and collaboration	2.1 Interacting through digital technologies	Intermediate (Levels 3-4) Advanced (Levels 5-6) Highly specialised (Levels 7-8)
	2.2 Sharing through digital technologies	
	2.3 Engaging in citizenship through digital technologies	
	2.4 Collaborating through digital technologies	
	2.5 Netiquette	
	2.6 Managing digital identity	
Competence area 3: Digital content creation	3.1 Developing digital content	Foundation (Levels 1-2) Intermediate (Levels 3-4)
	3.2 Integrating and re-elaborating digital content	
	3.3 Copyright and licenses	
	3.4 Programming	
Competence area 4: Safety	4.1 Protecting devices	Advanced (Levels 5-6) Highly specialised (Levels 7-8)
	4.2 Protecting personal data and privacy	
	4.3 Protecting health and well-being	
	4.4 Protecting the environment	
Competence area 5: Problem-solving	5.1 Solving technical problems	Foundation (Levels 1-2) Intermediate (Levels 3-4)
	5.2 Identifying needs and technological responses	
	5.3 Creatively using digital technologies	
	5.4 Identifying digital competence gaps	

IMPLICATIONS FOR THE SOUTH AFRICAN CONTEXT

The examples shared in this paper indicate that there is international recognition of the growing need to be more inclusive in recognising a wider variety of education and training accomplishments in pursuit of building lifelong learning systems and heeding the call to adapt to a changing education and training landscape brought on by the 4IR. Countries are engaging in efforts to increase public-private collaborations, there are movements to benchmark quality internationally to increase movements of students and workers, and there are several efforts to widen the scope of NQFs to acknowledge non-formal education and training. For the 4IR specifically, efforts to ensure a digitally competent population through mapping digital skills and competencies could provide a vital foundation for citizens to participate in a digital economy and allow them the choice of pursuing further digital skills development.

Turning back to the South African context, as a prelude to the conversations in this edition, Chetty (2019) lists some of the initiatives in which the South African Qualifications Authority (SAQA) has been involved to prepare for the 4IR, some of which include providing digital seals and electronic SAQA Certificates of Evaluation in verifying and evaluating foreign qualifications, and engaging in international forums on digitising RPL and articulating learning outcomes in relation to the 4IR. While these efforts are a step in the right direction, it might be necessary to reflect on what would be necessary to accelerate South Africa's initiatives towards more flexible and inclusive education and training.

Moving towards more relevant curricula and more flexible teaching and learning practices will require collaboration between governmental departments, the South African Qualifications Authority (SAQA), the Quality Councils, Sector Education and Training Authorities (SETAs), professional bodies and others to assist institutions to introduce more flexible learning opportunities and much greater agility and responsiveness in curriculum development processes. This work includes the adaptation of quality assurance mechanisms for open learning approaches. These measures should complement (or, where necessary, replace) the normal monitoring and assessment roles and activities of the Quality Councils, including institutional audits and programme accreditation. The lessons learnt from piloting a dual model in South Africa noted earlier, point to the importance of improving relationships between public and private entities and the SETAs as an intermediary. In addition, innovative interventions cannot be possible if smothered by bureaucratic processes. The existing articulation and flexible learning pathways initiatives (e.g. SAQA-Durban University of Technology [DUT] research on articulation [2018]; SAQA-UNESCO Flexible Learning Pathways study [Bolton, Matsau, and Blom, 2020]) provide strong foundations on which to build.

The pace of demand for different skills is accelerating in parallel with the development of new technologies. In response, the variety of non-formal education and training offerings is rapidly widening. Keeping pace with determining the quality of these offerings, accrediting non-traditional qualifications and introducing new technologies to the world of quality enhancement, are not small tasks – particularly when rigid policy frameworks and a lack of financial and human capacity hinder such progress.

However, to advance the country's economic participation and development to meet the needs of the 4IR, there is a need to review the current credential landscape through a collaborative and coherent approach between SAQA, the Council on Higher Education (CHE), the Quality Council for Trades and Occupations (QCTO), Umalusi, the Department of Higher Education and Training (DHET), the Department of Basic Education (DBE), professional bodies and key non-profit and private sector actors. This exercise should aim to review the current NQF-related legislation, the NQF and its three articulated NQF Sub-Frameworks, as well as their implementation based on the Department of Performance Monitoring and Evaluation (DPME) Improvement Plan, which stipulates criteria against which to report progress.

In addition, reflections on national and international lessons could contribute to the agility and relevance of the national quality system within broader regional and international contexts. If quality frameworks are to be living documents, then the processes to include new forms of recognition for education and training offerings, as well as quality assurance processes, should be considerably simplified and shortened. Currently, however, quality assurance processes complicate curriculum responsiveness by being slow and rigid. SAQA and the Quality Councils will need to be capacitated so that they can respond rapidly to the demand for more flexible, agile, responsive qualifications and credentialing systems. A parallel critical requirement to overhauling systems of quality assurance will be to undertake ongoing capacity-building of staff in the Quality Councils to align their skills with the requirements generated by the kinds of reform outlined above. Overhauling the credential and quality assurance landscape will require very different skills within the Quality Councils than those that are needed currently to maintain existing systems.

Beyond reforms in the quality landscape, a range of challenges relating to learners traversing horizontally and vertically within and between sectors could potentially impede progress if left unaddressed. Among others, these challenges relate to the functioning of the basic education system, inadequate infrastructure, resources and support for technological advancement, underperforming SETAs, and persistent skills gaps between PSET graduates and the labour market. Consequently, pursuing a renewed vision for the education and training system to align with the 4IR demands would only be successful if it is implemented in parallel with strategies to address digital and socio-economic inequalities, infrastructure challenges, and rooting out corruption and increasing accountability measures.

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PAPER 7

Rebooting the Skilling System for Youth in the Fourth Industrial Revolution (4IR): What is needed to make the South African Post-Schooling Education and Training (PSET) System Responsive to a 4IR World

Mr Rob Urquhart and Ms Sharmi Surianarain

ABSTRACT

Digitisation and technology are widely regarded as having the potential to spur economic growth, with opportunities for youth in digital jobs a key consideration. But South Africa is not producing the human capital needed to ride this wave. While there are a number of different private and public sector initiatives that have been undertaken to capitalise on this opportunity, there are a number of challenges that constrain the realisation of this digital dividend. Most notable is a Post-School Education and Training (PSET) system that is not producing digital skills in the numbers that are needed, and is characterised by a number of barriers that exclude many young South Africans. The experience of digitalisation and the ability to access its opportunities is thus uneven and runs the risk of creating a widening gap between a minority of 'youth insiders' who can seize these opportunities and a majority of 'youth outsiders' for whom the likelihood of being able to do so becomes increasingly smaller over time. To address this challenge, post-school skilling needs to change in five particular ways: skilling must be more demand-led, skilling outcomes must be achievable, accreditation must happen more quickly, access to the learning needs to be more open, and funding needs to be more agile.

INTRODUCTION

This paper discusses the opportunities presented by the 4IR, including some South African initiatives that capitalise on technology and seek to grow employment. It also discusses the challenges that constrain the realisation of the potential digital dividends, and the ways to create a more agile skilling system.

SOME OPPORTUNITIES

The advent and impact of the Fourth Industrial Revolution (4IR) is pervasive in convulsing and reshaping industries, firms, governments, and societies. In particular, it is widely expected to result in shifts from labour-intensive production to knowledge and skills-intensive production for which countries will need a ready pool of digital, technical, commercial and management expertise to harness and benefit from the adoption and use of the associated emergent technologies (Trade and Industrial Policy Services [TIPS], 2018:11).

In South Africa, digitisation and technology are widely regarded as having a high potential to spur economic growth. McKinsey and Company (2019:4) argue that it could triple South Africa's productivity growth, more than double growth in per capita income, and add more than a percentage point to South Africa's real Gross Domestic Product (GDP) growth rate. The Industrial Development Corporation (IDC) estimates that Information Technology (IT) spend in South Africa will grow to R175 billion by 2022 (IDC, 2018). A number of different private and public sector initiatives have been undertaken to capitalise on this digitisation and technology wave and grow employment. Some of these initiatives are highlighted.

Some South African initiatives that capitalise on technology and seek to grow employment

- **The Presidential plan** - seeks to accelerate youth pathways into the economy over the next five years. A key element of the plan focuses on ensuring that economically excluded youth are absorbed into new jobs created in growth sectors. For example, 20,000 new jobs are envisaged to be created in the digital and Information Communication Technology (ICT) sector through this initiative over the next five years (Presidency [RSA], 2020).

- **The Presidential Commission on the 4th Industrial Revolution (4IR)** - established in 2019, the commission coordinates the development of South Africa's national response action plan to deal with the 4IR in the form of policies, strategies, and plans that are needed to position South Africa as a leading country in the evolution and development of the 4IR. Its objectives include, amongst others, enhancing economic transformation and job creation and improving education outcomes and skills. The government's 4IR strategy has been accelerated and reprioritised since the Coronavirus (Covid-19) pandemic and seeks to create employment for over 100,000 young people by prioritising broadband access to promote learning and earning; providing digital upskilling and work experience, and securing globally traded service jobs such as IT-reshoring.

- **The Public-Private Growth Initiative (PPGI)** - a sector-based collaboration between government and business has earmarked 19 projects across various sectors of the South African economy for priority implementation. Work from the ICT sector group encompasses:
    - ICT curriculum - working with the government to introduce new legislation and policies for ICT to become formally part of the schooling curriculum to support the digital economy;
    - skills development - enabling the ICT industry to direct Sector Education Training Authority (SETA) spend and skills levies to drive critical skills development;
    - a joint investment programme to create a sector fund for ICT start-ups that would provide preferential access to technologies and intellectual properties;
    - the establishment of an advisory council to work with ICT-related ministries to improve the collaboration, execution, and monitoring of how the sector and government partner to achieve economic and social impact; and
    - initiatives to introduce the relevant incentives to attract local and foreign investment that promotes innovation and drives skills development objectives and programmes. (Engineering News, 2019)

- A partnership between the **Ministry of Communications and the Media, Information, Communication and Technologies (MICT) SETA** seeks to create one million new jobs by 2030 through the promotion of Small and Medium Enterprises (SMEs) within the 4IR space. The pilot phase of the project seeks to train and equip 1,000 unemployed youth with the 4IR skills necessary to secure employment or start their businesses. The skills development programme is segmented into seven streams: data science, digital content production, cybersecurity, cloud computing, drone piloting, three-dimensional (3D) printing and software development (Ramaphosa, 2019).

- **The Western Cape Economic War-room** is an initiative set up by the Western Cape government to lift growth and job creation through direct engagement between government and the job sector. The War-room has five priority sectors, one of which is the information technology and business process outsourcing (*Financial Mail*, 2019). Feeding into this initiative is the **Western Cape Digital Skills Shared Agenda for Action** project, which has been conceptualised with the main objectives of positioning the province as a leading digital hub in the global economy by 2030, helping stimulate employment, and embedding digital skills across all sectors of the Western Cape economy (Craffert and Visser, 2020:4).[22]

- **South Africa in the Digital Age (SADA)** is a multi-sectoral, economic strategy development process to chart South African pathways for inclusive growth in the digital age. It seeks to identify inclusive economic opportunities for job creation, and the enablers and actions required to take these opportunities to scale significantly.

Opportunities for youth in the digital era are a key consideration, some of which are highlighted in Box 1.

Box 1: Opportunities for youth in digital jobs

What does the zone of opportunity for youth in digital jobs look like? Some job areas are identified in this Box.

- **Data analysis and data mining:** in a comprehensive 2016 LinkedIn South African top skills study, data analysis and data mining (the process of sorting through large data sets to identify relationships and solve problems) was ranked as one of the top skills wanted by employers in South Africa. This skill is required across multiple disciplines, e.g. marketing, finance, strategy, business intelligence, legal, customer service (BusinessTech, 2017).
- **Software development:** software development (especially in Java and C#) is the most sought-after skill set on job portal *CareerJunction*, with the *CareerJunction Index* showing a six percent jump in demand for software developers from July to August 2017 (Ibid). Java programming also came in at number two on LinkedIn's South African top skills study.
- **Network and information security**: with businesses moving their capabilities and data onto digital platforms, the need to protect this information is becoming increasingly urgent. This skill featured highly in LinkedIn's global list of in-demand skills (Ibid).
- **Multichannel contact centres:** Harambee, an NGO that focuses on youth employment, placed over 3,000 excluded youth into contact centre opportunities in the global business services (GBS) sector over the last ten years, demonstrating that these jobs are viable pathways for young people. More recently, inputs made from Harambee and Business Process Enabling South Africa (BPESA) suggest that there is scope to grow the number of new jobs in this sector in at least two ways. Firstly, there is a need to expand digital components, for example, reshoring domestic activities, such as testing and developing the digital/ICT outsourcing propositions. Secondly, capitalising on the evolution of contact centres to offer multiple delivery channels of engagement, could increase jobs.

[22] The Western Cape is one of nine provinces in South Africa.

SOME CHALLENGES

There are, however, a number of challenges that constrain the realisation of the potential digital dividends. Firstly, demand both outstrips and is misaligned with supply. The traditional pipeline for digital jobs has been Computer Science or related IT qualifications obtained through universities. Estimates suggest that annually there are between 6,000 and 10,000 places for qualifications of this nature (Harambee Youth Employment Accelerator, 2018), but that there are only between 3,500 and 6,000 graduates each year (with 37% of students managing to complete their degrees within four years and 58% within six years [Africa Check, 2016]). In the Western Cape, for example, there were 1,183 university graduates, and 166 Technical and Vocational Education and Training (TVET) graduates with ICT-related qualifications in 2016, against the demand in one month in 2018, for 7,501 entry-level jobs (Craffert and Visser, 2020).

Moreover, the costs of obtaining a computer science degree are significant and prohibitive for excluded youth – fees alone for four years of a Bachelor of Science (BSc) in Computer Science degree at the University of the Witwatersrand cost R280,000 (University of the Witwatersrand, 2020).[23]

The pipeline into universities in South Africa is also insufficient. An analysis of educational throughput rates shows that for every 100 young people starting school, 60 will write their school-leaving examinations, 37 will pass, 12 will access university, and only four will complete a degree within six years of leaving school (Department of Higher Education and Training, 2017).

A second challenge is that success in mathematics is often regarded as a requirement for entry into computer science or IT-related work, or entry into degree programmes. The assumption is that mathematics is a good proxy for the attribute of logical reasoning – often regarded as a foundation for digital work. Employers also use mathematics as a screening mechanism when faced with large pools of unemployed work-seekers who apply for jobs whether they meet the criteria for the jobs or not, although it should be noted that mathematics marks are an insufficient proxy to denote competencies for certain occupations.

[23] The University of the Witwatersrand is one of South Africa's 26 public HEIs.

However, South Africa does not produce school leavers in the quantities and with the required quality of mathematics required. In 2015, only 7,791 distinctions in pure mathematics were obtained in the National Senior Certificate (NSC), with roughly 30% of learners sitting for the pure mathematics examinations and roughly 40% of learners sitting for the mathematical literacy examinations, passing these assessments (Department of Higher Education and Training, 2015).[24] This combination of expensive educational investments and high educational achievement entry requirements leads to an inequitable distribution of opportunities that stack towards youth from high-income households who have benefitted from good schooling.

Importantly, the traditional university skills pathways are not agile or aligned with business needs with respect to the content, instruction, duration, or new ways of working. A roundtable event convened in 2019 with a number of employers looking to hire young people exiting universities with digital qualifications, noted that not only did graduates have limited practical skills training, but that they lacked fundamental behaviours – such as the abilities to communicate and collaborate – as well as the ability to integrate 'hard' and 'soft' skills (for example, problem identification, data manipulation, and communication of the outcomes with the business [Harambee Youth Employment Accelerator, 2019]). This lack often results in either the need to provide additional training at the start of employment or in employers not hiring at entry-level when digital competences are required. Employers do not have the management capabilities to close these work readiness gaps. With an insufficient supply of graduates to meet demand, the response has increasingly been to offshore digital jobs, which ultimately runs the risk of South Africa experiencing a growing digital sector with zero job growth.

A further challenge is that not just jobs and skills are changing, but also the way in which work is done. Digital technologies are giving rise to more short-term work, often via online platforms, that make certain types of work more available on a more flexible basis. Access to digital infrastructures – such as laptops, tablets, and smartphones – provides an enabling environment in which work of this nature can thrive (World Bank Group, 2018:3). 'E-lancers', for example, perform relatively sophisticated tasks such as web page design and market research that is contracted through digital platforms such as Upwork, whilst a growing

[24] Simply explained, Mathematics deals with theories and concepts and problems not necessarily encountered in everyday life (e.g. trigonometry, algebra and basic calculus). In contrast to this, mathematical literacy deals with common practical problems like budgeting, interest calculations etc.

number of workers are also engaging in microwork – online work to complete a series of small, less skill-intensive tasks through platforms such as *Amazon* Mechanical Turk (Solutions for Youth Employment, 2018:8).

The impact of 4IR is uneven

The 4IR presents both opportunities and risks; one of which is the unequal distribution of its impact. Technology has the potential to improve living standards, but its effects are not evenly distributed across society. Workers in some sectors benefit from technological progress, whereas those in others are displaced and have to retrain to remain employed. Industries are taking different routes to the adoption of new technologies such that the nature of work performed in different sectors will result in disruptions to jobs and skills that will require industry-specific responses (World Economic Forum, 2018b:9). At the firm level, employers' responses to these shifts are not uniform, and their retraining and upskilling efforts tend to focus on a narrow set of highly skilled employees. In other words, those most in need of reskilling and upskilling are least likely to receive such training. There is, therefore, a need to disaggregate an understanding of the impact of 4IR for different cohorts of the current and future workforce in South Africa, by asking some key questions such as the following.

- What skilling responses are needed for those people entering the workforce? What are the reskilling needs of those that are already employed? What do they need to keep learning throughout their lifetimes?
- For those entering the workforce from the schooling system, what are the short-term responses needed (a) to address the current priority skills demand, and (b) to enable people to respond to opportunities in the economy and ensure that the economy has the talent that it needs in the next five years?
- In the medium term, how can the agility of the skilling system be increased to serve youth exiting it in the next ten years?
- In the longer term, how can young people not yet in the skilling system, be prepared and equipped for the future world of work?
- How can young people, in particular, be placed at the front of the queue as 4IR creates new opportunities?

Demand-supply misalignment

From a human capital perspective, as a country, South Africa is not producing the human capital needed to ride the 4IR wave. A World Economic Forum (WEF) report looking at the readiness for the future of production, ranked South Africa 67th out of 100 countries surveyed in terms of human capital, and 94th in the sub-component 'digital skills among population' (World Economic Forum, 2018b). In the Economic Intelligence Unit Automation Readiness Index, South Africa is ranked 22nd out of 25 included countries (Economist Intelligence Unit, 2018).

South Africa spends approximately R200 billion a year between the private and the public sectors, on Post-Schooling Education and Training (PSET) and employment programmes. Approximately R77.5 billion is directed towards PSET (TVET Colleges, university subsidies, the National Student Financial Aid Scheme [NSFAS], the National Skills Fund [NSF], Sector Education and Training Authorities [SETAs]); R17.5 billion to employment programmes including Expanded Public Works Programmes (EPWP), the Youth Employment Tax Incentive, and Public Employment Services, amongst others; and approximately R100 billion is spent on training directed towards Broad-Based Black Economic Empowerment (BBBEE) compliance by the private sector (Donaldson, 2017).[25] Yet, the youth unemployment rate continues to remain immovable at over 50% (Statistics South Africa [StatsSA], 2019) – skills expenditure is not translating into a high conversion of income-generating pathway opportunities for excluded youth, largely due to an unresponsive skilling system that is measured mostly on inputs and not on outcomes.

Moreover, educational outcomes are poor at the level of foundational competencies developed at school level. Only 26% of students in South Africa meet the international benchmark for basic proficiency in secondary school when looking at country-level average test scores benchmarked using the Programme for International Student Assessment (PISA), as compared to 98% of students in Singapore (World Bank Group, 2018:58). Only five percent of all Quintile 1–3 (wealthier) schools, which serve just 3% of the total learner population, perform on average at a level that could lead to obtaining a school-leaving pass that enables access to degree studies at university (Eldridge, van der Berg, and Rich,

[25] Broad-based black economic empowerment (BEE) is a government policy to advance economic transformation and enhance the economic participation of Black people (African, Coloured and Indian people who are South African citizens) in the South African economy.

2017:16).[26] An agile skilling system could lead to equitable ways to address some of these challenges. The rapid change of 4IR, combined with a lagging education system, can perpetuate and increase inequality and the social divide. Therefore, while part of the response to the 4IR must address the efficiency and functionality of a ‘rebooted’ skilling system, it must also address issues of inequality and access.

FIVE WAYS TO CREATE A MORE AGILE SKILLING SYSTEM

So, how then to respond to 4IR in the South African context? Skilling needs to change in five particular ways: skilling must be demand-led, outcomes must be achievable, accreditation must happen more quickly, access to learning needs to be more open, and there is a need for agile funding models that are better and faster. These five aspects are explained in the sub-sections that follow.

Skilling must be demand-led

The WEF (2018a) makes the point that the economic and societal challenges of 4IR mean that employers will increasingly need to collaborate with other stakeholders to manage the large-scale skilling challenges ahead and build talent pipelines. Being demand-led requires developing customised initiatives that respond directly to the needs of groups in terms of both skills and attributes of work-readiness, of similarly focused employers, that result in the employment or self-employment of young people (Making Cents International, 2017:13).

First and foremost, being demand-led is about finding the zones of opportunity where (a) entry-level skills are absent, (b) entry-level skills are needed in the industry, and (c) there is a sizable demand for the skills. Understanding demand-led skilling requires partnerships and collaboration between employers, industry bodies, public and private skilling providers, and government. These partnerships and collaboration are needed to identify where and what the opportunities for young people are, the *status quo* of existing pathways to those opportunities, the barriers in those pathways that constrain young people from taking up these opportunities, and what is needed to unlock these pathways. This work then provides the basis for the co-creation and joint adoption of curricula aligned to the needs of the market (Ibid:10). The Western Cape Digital Skills Shared Agenda for Action is a good example of such a demand-led approach. Following extensive engagement with the private sector, the

[26] In South Africa, wealth levels are described in terms of quintiles where the wealthiest fifth of the population is in Quintile 1 and the poorest in Quintile 5.

report provides a sectoral demand-side analysis of digital skills needs in the Western Cape that is coupled with an identification of the supply-side challenges that need to be addressed (Craffert and Visser, 2019).

A useful mechanism for determining whether a demand-led response to the need for skills for jobs is feasible or whether further work with the various partners is required, is to consider whether the conditions in response to the following questions are true.

- Is there a well-defined value proposition/business case for a sector or job family, the broader economy, and the public good, as well as the ability to create youth jobs?
- Is there an organised and well-run industry body or other organisations to convene, coordinate and drive the necessary planning?
- Can job targets be set and accountability for skills delivery assigned?
- Can interventions be scaled to ready the supply side?
- Can actionable/measurable interventions to activate demand, including the necessary enabling environment, be defined?

The Global Business Services (GBS) sector is another good example of a demand-led response using the above approach. The GBS sector is a growth sector, with its export segment growing at over 22% and expected to double in size over the next five years. Much of this growth has been driven by the increasing attractiveness of South Africa as a destination for offshored global business services, such as the availability of a large-scale English-speaking talent pool, costs that are 60% lower than source markets, and a robust enabling environment. In identifying how to respond to this opportunity by growing the available pool of talent (particularly at the entry-level) and the skilling solutions that are required, stakeholders in the sector convened a series of action labs to produce an action-oriented agenda to catalyse growth. This work has culminated in the formalisation of a partnership between Business Process Enabling South Africa (BPESA), an operator providing skilling solutions for the sector; Harambee, Youth Employment Accelerator; the Department of Trade and Industry (DTI), and employers, which has committed to the creation of new jobs in the sector over the next five years (20% of which are earmarked for excluded youth). This partnership has been formally ratified through a Memorandum of Understanding into a set of policy guidelines for the sector, with the partnership and commitment being presented and accepted at both the Presidential Jobs Summit (Republic of South Africa, 2018) and Public-Private Growth Initiative in 2018 (Engineering News, 2019).

Credentialing must happen quickly

The velocity of 4IR requires rapid credentialing. Typically, credentialing has three features: it must define what skills attribute is needed on the demand side, identify and confirm the presence and level of proficiency of that attribute on the supply side, and it must direct the spend of money appropriately towards skilling interventions that can produce that attribute. However, in much the same way as the ability to provide an agile skilling response depends on the achievability of interventions, an agile skilling response depends on the ability for accreditation to happen quickly. Where there is a mismatch between what the industry defines as a necessary skill and what the credentialing authority does, where the time taken to achieve the credential is lengthy, and where the credential is all-encompassing and not compartmentalised, this agility is lost.

Micro-credentialing – the ability to learn and be accredited for the acquisition of a particular skill – has merit. Keevy et al (2019:246) note that:

> from the perspective of the learner and the employer, micro-credentials offer the possibility of both granularity and flexibility. Rather than relying on traditional university degrees as a proxy for employability, micro-credentials allow employers to determine, in more precise detail, whether candidates have demonstrated specific knowledge, skills, and competencies of interest. As employers' needs evolve, micro-credentialing opportunities can as well, in a relatively rapid manner. Unlike the traditional academic pedigree, the low cost with which many micro-credentials can be acquired, also potentially opens new doors for individuals from lower-income households.

Additionally, micro-credentialing offers 'ubiquity and interoperability' – transversal applicability across industries and jobs, shorter learning pathways, the possibility to overcome time and resource constraints, the potential to enable the Recognition of Prior Learning (RPL), and more transparent recognition of skills and qualifications required by employers (Ibid:243). However, for micro-credentialing to be effective, a number of issues need to be addressed, as follows.

- Access to connectivity, equipment, and digital skills (Ibid:246). Heavy reliance on technology for micro-credentialing creates a risk of perpetuating digital insiders and outsiders, and further locking out those already excluded from the labour market.

- Pathway visibility, or the ability to 'connect the atoms' (Ibid:239) so that work-seekers have a line of sight and can develop marketable portfolios of credentials that stack.
- Quality assurance so that skills are portable, and there is trust in the signal provided by the micro-credential. Systems are needed to help learners and employers identify which learning opportunities and micro-credentials are valid and of quality (Ibid:246).
- The risks include that 'the whole is not the sum of the parts' and that learning becomes too fragmented, failing to result in a meaningful whole that is unrecognisable to employers (Ibid:243).

Skilling systems and credentialing authorities themselves need to shapeshift: to provide quality assurance and governance systems that are more responsive to this changing landscape; to make credentialing information from multiple sources more accessible; to provide the methodologies for comparing credentials; and to understand how credentials stack. Whilst these aspects need to be addressed across the skilling system, the imperatives and pace of 4IR suggest that sector-based responses could offer the agility needed.

Skilling outcomes must be achievable

The ability to compartmentalise skilling through micro-credentialing is one way in which skilling outcomes can be achievable, and this is further enabled by open learning systems that offer flexible learning modalities. Being specific regarding the skills required for work is another, and is a feature of successful demand-led skilling interventions. Work readiness interventions such as Harambee's bridging programmes, which provide on-demand and just-in-time skills, are a good example of this: they are designed to provide young work-seekers with the specific skills required to perform and succeed in entry-level jobs in as little as four to six weeks. Finally, on-the-job learning approaches offer workers opportunities to learn while they earn, and integrate theory and practice for better learning outcomes than traditional learning approaches.

Access to learning needs to be more open

The 4IR runs the risk of creating insiders and outsiders, where insiders are positioned to seize the economic opportunities on offer in 4IR by virtue of their work readiness, and outsiders are locked out of the new economy. To avoid this scenario, learning needs to be opened up so that all workers are in a position to take advantage of the opportunities on offer. Doing so, however, must recognise that not all workers have the same baseline levels of functional competence, and so investments in addressing foundational gaps for digital literacy, for example, are required as a first step (Pathways for Prosperity Commission, 2019:31).

Technology-enabled platforms are making education more available, especially for those with historically low access. The five largest distance-learning programmes, for example, are based in lower- or middle-income countries with India being the second-largest consumer of Massive Open Online Courses (MOOCs), and China's biggest MOOC and blended learning portal, *XuetangX*, serving ten million students in 2018 (World Bank Group, 2018:79). However, as much as MOOCs democratise education and offer flexible and personalised learning pathways, their efficacy is constrained by the following aspects.

- **Access to the technology and infrastructure required to access online learning**. Creative solutions are needed to enable access, such as using available public infrastructure in communities like libraries and community centres.
- **The absence of a means to assess quality, and ensure that offerings are demand-led and have currency and relevance for employers**. The New Zealand Qualifications Authority (NZQA) for example, vetted and approved a self-driving Car Engineer Nanodegree Programme that Udacity had developed with Mercedes Benz, BMW, NVIDIA, McLaren Applied Technologies and other global automotive industry leaders in support of the skills needed to support transportation in a digital world. These companies have recognised the Udacity Nanodegree Programme as a credential for hiring young people ready to join the workforce (NZQA, 2019).
- **Portability.** Learning undertaken through such channels must collectively stack to something meaningful for a learner that allows her or him to progress along a learning-and-work pathway.

Open access to learning will also have limited impact if learners are not part of an integrated ecosystem that connects learning with opportunities, pathways and a spectrum of the workforce and support resources; these aspects need to be accessible and include those at risk of exclusion from the labour market in the context of the 4IR (Kanfer and Blivin, 2019:257).

If the promise of 4IR is one of continuous disruption to work and skills over time, then there is a need to ensure that open learning embraces lifelong learning systems that help workers continuously to upgrade the skills needed for work and provide pathways for inclusion in the labour market. This is a joint responsibility that requires the active engagement and support of the government, employers, workers, and educational institutions (International Labour Organisation [ILO], 2019:31).

Agile funding models that are better and faster

Disruptive innovations and changes brought about by the 4IR require disruptive responses that can be achieved through collaboration, risk-sharing, and incentives that shift behaviour and accelerate 4IR adoption and scaling within the context of skills development. In the context of the rate of change the 4IR introduces to the world of work and, by extension, the skilling system, there is both a requirement and an opportunity for innovations in the financing of skilling, which can lead to changes in how skilling occurs. To meet the opportunities and challenges that the 4IR presents, alternative pathways to skilling are required, which are cheaper, quicker, more accessible, and require funding to scale. These alternatives should not seek to introduce new money into the system, but instead, direct some of the existing R200 billion spent on skills to cost-effective models that can quickly and efficiently upgrade the employability of youth and transition them into income-generating opportunities that the 4IR presents.

Pay for performance models (funding skilling initiatives, in this instance) which pay for performance (specific outcomes), could be valuable instruments in this context, by focusing skilling initiatives to produce clear and tangible outcomes that matter. Social impact bonds (SIBs) are one such example of a pay for performance model. SIBs typically involve a contract between investors and the public sector in which a commitment is made by the public sector to pay for improved social outcomes only when these outcomes have been achieved. SIBs normally involve investors who provide upfront working capital for the achievement of a social outcome, which is then directed via an intermediary to operators or service providers to deliver the outcome. When these outcomes have been achieved and verified, then the outcomes payer (typically the public sector) pays investors back.

Pay for performance models applied to skilling are attractive for a number of reasons. They are outcomes-focused, drive performance, and incentivise and build a culture of collaboration (Gustafsson-Wright, 2019). They encourage innovation in the skilling sector. They increase the returns (outcomes) achieved by making operators more outcomes-focused. (Consider for example a scenario where instead of trying to transform the role of TVETs, performance-based contracting is concluded for the placement of their graduates into jobs; thereby linking graduates' access to jobs to funding operations dependent on curricula and learning outcomes that meet the needs of the market). Pay for performance models offer a better return on fiscal spending on skills, and they provide a credible platform through which spending can be coordinated and channelled at scale to more efficient and impactful solutions that work ineffective/inefficient programmes out of the system over time.

CONCLUSIONS – OPPORTUNITIES FOR EVIDENCE

This paper discusses the opportunities presented by the 4IR, including some South African initiatives that capitalise on technology and seek to grow employment. It also discusses the challenges that constrain the realisation of the potential digital dividends, and the ways to create a more agile skilling system.

In terms of the way forward for job creation, various signals are pointed out in the South African Presidential Plan (Presidency, RSA, 2020). This plan seeks to accelerate youth pathways into the economy over the next five years and offers an opportunity to learn about a re-engineered skilling system that better serves youth. The Presidential Plan embraces outcomes from the Presidential Jobs Summit (Republic of South Africa, 2018), multi-sector growth initiatives such as the Public-Private Growth Initiative (PPGI) (Engineering News, 2019), and the Re-imagined Industrial Policy, which have identified a number of growth sectors with scope for job creation and the absorption of economically excluded youth. These growth sectors include:

- analytics and technology jobs where existing pipelines through universities are exclusionary, inadequate in terms of the volume of skills produced, expensive, and are not agile or aligned with business needs;
- installation, repair, and maintenance jobs where existing throughput is limited by misalignment of curricula to industry needs, increasingly unattainable entry-level requirements, and poor socialisation of learners into technical jobs; and

- opportunities in global business services where employers are reluctant to hire excluded youth with no prior work experience, and there is a limited pool of entry-level resources but a high demand.

In all three instances, scalable solutions are being developed and implemented that provide new pathways to employment and opportunities to test new proxies for competence.

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PAPER 8

Entrepreneurship in the Future South African Workforce: What is Happening in Emerging Markets?

Ms Lize Moldenhauer, Mrs Cindy Londt, Mr Greg Beyer and Ms Demi Melton

ABSTRACT

As the world enters a new decade, it can be seen that the world of work is going to change dramatically as the Fourth Industrial Revolution (4IR) becomes more apparent to larger proportions of the world's populace and the Coronavirus disease of 2019 (Covid-19) affects various sectors. There are instances where job security will be under threat, but there will also be sectors where opportunities arise for new roles in which human beings must integrate to benefit from the changes happening all around the world. Understanding market dynamics goes hand-in-hand with accurately predicting the market direction and being able to foresee the individual avenues of opportunity that will require attention. With this in mind, this paper examines the processes and the sectors through which entrepreneurial activity has been successful or unsuccessful. Historical and international contexts are examined, but the special focus highlights the South African sectors in which entrepreneurs have operated, and where there are future opportunities for entrepreneurs to find success. Understanding the dynamics of these sectors is key, and this paper not only looks at opportunities within these sectors but also underlines the difficulties and challenges regarding resources and the 4IR. In addition, the paper also examines government policies and activities that have helped or hindered entrepreneurial activities in certain sectors of the South African economy. Rather than being a full interrogation of factors for entrepreneurship in emerging markets, the paper represents an exploratory work that touches on some introductory aspects relevant to the topic.

INTRODUCTION

An increasingly interconnected world is having profound effects on humanity in a plethora of ways, some more easily understood and more apparent than others. Not only is technology acting as a driver of change, but also political and societal upheavals are contributing to new dynamics, which need to be considered in the quest to understand, define and redefine labour markets in a number of areas. Shifting epicentres of political and economic domination in the global scene show that developing nations are producing increasing proportions of the world's Gross Domestic Product (GDP). Central to this trend is the dynamic of entrepreneurship, which serves as a vital factor in contributing to the economic backbones of a myriad of nations in the developing world.

With this in mind, this paper examines several of the key factors contributing to the mindsets required for entrepreneurial activity in the future. Forming a foundational body of literature on the subject is noted as being an important step in assessing subjects of entrepreneurial intention. As such, this paper offers a series of perspectives to add to the existing body of knowledge, as well as to initiate discussions on various topics related to the promotion of entrepreneurial activity in developing markets.

LITERATURE REVIEW

The purpose of this paper is to form an introduction to various factors that are important aspects influencing the formation of entrepreneurial activities in emerging markets. As such, the research has been restricted to that of a broad investigation to form a basis for further research that intends to inform academic efforts towards more detailed analysis.

A great deal of research is required to understand contemporary entrepreneurship from a holistic perspective, which includes a wide range of factors, some of which have been addressed in this paper. Looking at the historical basis for entrepreneurship forms a foundation for further study in the field. For this, several sources were examined. In the paper entitled *Entrepreneurship, Strategy, and Business Philanthropy: Cotton Textiles in the British Industrial Revolution* by Shepherd and Toms (2019), the text provides a solid understanding for linking entrepreneurship to the historical context by way of examining entrepreneurial philanthropy during the Industrial Revolution.

Shepherd and Toms (2019:507) note that “social problems caused by rapid and unregulated urbanisation created a range of entrepreneurial opportunities to adopt secular, business-related, philanthropic policies beyond the workplace”. The authors (Ibid.) also note that “entrepreneurial philanthropy relates to employment conditions, including the application of ethical codes to vulnerable groups like women and children”. These points are particularly salient for the South African context and indeed for most developing nations’ contexts.

What was also examined were the correlations between the First and the Fourth Industrial Revolutions. Mokyr (2006:188) notes that “The Industrial Revolution, in the final analysis, was propelled by technological progress but to succeed its propagators (entrepreneurs, engineers, merchants, financiers, and technical consultants) needed contracts, credit, and credible commitments”. A similar dynamic exists today. While entrepreneurship, or any business venture, involves some degree of risk, there needs to be assurances to mitigate these risks and make the venture seem pragmatic and safe enough to attempt.

Moving forward from the First to the Fourth Industrial Revolution, this paper examines markets that have emerged, and which promise to have huge impacts over the course of the next decade. Some of these markets are already established and look set to continue their upward trajectories, while some markets are predicted to emerge as a result of technological progress and the need for them to be integrated into the common market.

Li Guoping et al (2017) examine in some depth, the drivers and impacts of technology on the Fourth Industrial Revolution. Mentioned in their paper, are technological drivers arising in such realms as the digital, the physical, and the biological. Some of these drivers are discussed in more detail in other papers. Amongst these specific markets, Xia et al. (2012) explain the ‘Internet of Things’ and its growing relevance and pervasiveness in modern technology. The Internet of Things can simplistically be described as the networked interconnection of everyday objects such as computers and mobile phones which increase the ubiquity of the Internet by integrating every object for interaction via embedded systems, leading to highly distributed networks of devices for communicating with human beings as well as other devices (Xia et. al, 2012). Through this, the internet becomes universal as it is extended into more and more everyday items, which communicate with the users as well as with each other (Xia et al., 2012).

Tarnacha and Maitland (2006:590) examine entrepreneurship in the field of mobile applications, positing that “the nascent nature of mobile applications market provides ample opportunities for entrepreneurial activity”. Ahamat and Chong (2020) examine factors that influence entrepreneurs in the field of biotechnology. These factors include passion, prior knowledge/ experience, business networks, international support forces and sociocultural forces. Another promising avenue is that of three-dimensional (3D) printing, which is addressed by Soomro et al. (2016:7), who presented a paper on the “Background and Potential of 3D printing technologies for incumbent firms and entrepreneurs”. As a disruptive technology, 3D printing creates opportunities (and threats) for business organisations and entrepreneurs and as such could have significant effects on the world of work (Soomro et al., 2016).

Specific markets are legion, and the above examples, although salient, only represent a small example of the potential markets that require entrepreneurial investigation. A full list of markets that promise financial reward for entrepreneurs would require a scope that cannot be implemented within the limitations of this paper, and as such, this paper highlights some potential avenues as they relate to a South African context, on which this paper focuses after identifying these markets.

The South African context, while unique, can draw upon international examples in assessing its need for entrepreneurial activity. South Africa has a large portion of its population who live below the poverty line. Poverty can be defined in a number of ways but for the purposes of this paper, we will make use of the definition of Goedhart et al. (1977), which explains that the poverty line can be defined as the level of command over resources below which an individual is considered poor. From a social policy perspective, these authors define the poverty line as a criterion, which can be used to decide which citizens need special benefits from the government to supplement their own incomes (Goedhart et al. 1977). Using the poverty line as a factor, correlations can be drawn as to entrepreneurial activities across geographic borders, and in terms of class rather than nationality. The works of Mukwarami and Tengeh (2017) are noted as being relevant in terms of South Africa's social dynamic, poverty, and the need for small and medium enterprises (SMEs).

Understanding the historical contexts

The world is undergoing what is termed 4IR. The 4IR was defined by Schwab (2015:para. 2), as "a fusion of technologies that is blurring the lines between the physical, digital and biological spheres". It is characterised by increased automation as well as better communication and rapidly increasing speeds at which business and transactions can be done. Understanding the history of entrepreneurship as a holistic concept that existed in prior industrial revolutions is helpful for the contemporary study of entrepreneurship activities within the 4IR. Those who are able to compare historical to contemporary activities are better equipped to be able to accurately predict trends that will lead to financial success. As such, attention to the historical contexts should not be dismissed because while the individual factors may vary, the philosophies arguably remain the same.

In brief, the First Industrial Revolution was predicated largely on the textile industry, which underwent a massive shift towards cheap and easily produced cotton products. The desire to exploit this opportunity brought about the inclusion of machinery and new techniques with which the product could be more rapidly created (Agarwal and Agarwal, 2017). Rapid urbanisation ensued as factories were erected and workers were needed to work the looms. However, many social ills were realised as workers struggled to survive, living in squalid, cramped conditions. Factory owners unscrupulously exploited these workers, including children. As a result, the need arose for unions and new laws designed to protect the rights of workers.

Many similarities can be drawn between the First and the Fourth Industrial Revolutions and these similarities are particularly pertinent for this paper. The debates around technological unemployment remain as relevant today, as they were a century and a half ago. In the 19th Century, Economic philosophers such as David Ricardo and Karl Marx both shared concerns over technological unemployment (Piva and Vivarelli, 2017). These concerns are similarly registering again during the Fourth Industrial Revolution.

As Piva and Vivarelli (2017) note with examples such as 3D printing, self-driving autonomous cars, and agricultural robots, there is a widespread fear of massive technological unemployment. Whether these concerns are founded or not is still debatable; however, another factor to consider is that the perception of job losses also has a profound effect on social behaviour. Perceived risks of job losses can lead to changes in consumer behaviour, thus affecting the propensity to save money or take precautionary measures. Likewise, perceived risks in job losses can also affect political behaviour as workers look for reassurances (Sacchi, Guarascio and Vannutelli, 2020).

Equally salient is the question of who benefits the most from industrial revolutions. It can be argued that very little has changed with regards to the main beneficiaries. Li Guoping et al. (2017:632) note that "[t]he great beneficiaries of the Fourth Industrial Revolution are the providers of intellectual or physical capital: the innovators, the investors, and the shareholders". This must be considered if entrepreneurs wish to make a holistic success of their ventures.

What is also true, however, is that entrepreneurship exists, and has benefitted from industrial revolutions. Mokyr (2006:17) notes regarding entrepreneurship in the First Industrial Revolution that the "gentlemanly enterprise was an informal institution, but one that supported the integrated soon-to-be national market in Britain. That market may not have created the Industrial Revolution, perhaps, but it was an essential complement to it". With the challenges of the Coronavirus (Covid-19) impacting the world, various retrenchments have been implemented in South Africa and the need for finding ways to innovate is critical.

Potential profitable markets

It cannot be denied that electronics form a fundamental basis for growing markets around the world linked to the Fourth Industrial Revolution. It is noted that almost all of the advancements and technological innovations are made possible through the power of digital technology (Schwab, 2016 in Li Guoping et al, 2017). Li Guoping et al. (2017:627) further note that the digital technology cluster is made up of four aspects, "namely the Internet of Things, Artificial Intelligence [AI] and machine learning, Big Data and cloud computing, and digital platforms". Attention to these four aspects forms a fundamental avenue of investment when considering entrepreneurial activity. What this means, however, is not that entrepreneurial activity needs to be centred around these markets, but that entrepreneurial activity should take these technological advancements into consideration, to exploit them for the benefit of the business. A good example of the use of these foundations is in the education sphere where online platforms are used to bring education to learners online, doing away with the need for students to be physically in classrooms to learn. Another example that includes such capabilities is the online shopping used to augment retail options.

The Internet of Things has far-reaching applications which are being implemented across a wide variety of services and activities. Expanding the Internet of Things is a market in and of itself, as well as being a factor that affects other markets. The realms of AI and Big Data are also areas that will undoubtedly be intertwined with potential for entrepreneurship. AI can be defined as "that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment" (Nilsson, 2010:13). Big Data can be defined as "a term that describes large volumes of high velocity, complex and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information" (TechAmerica Foundation's Federal Big Data Commission, 2012:10).

Obschonka and Audretsch (2019) provide examples of areas that will be affected by AI and Big Data, namely economics (Acemoglu and Restrepo, 2018, in Obschonka and Audretsch, 2019), economic policy (Agarwal et al. 2019, in Obschonka and Audretsch, 2019), innovation (Aghion et al., 2017, in Obschonka and Audretsch, 2019), management (George et al., 2014; Ransbothan et al. 2017, in Obschonka and Audretsch, 2019), and psychology (Kosinski et al. 2016, in Obschonka and Audretsch, 2019). Also mentioned are the application fields often associated with entrepreneurship, which include industry, business management and innovation (Cockburn et al. 2018, in Obschonka and Audretsch, 2019). The same authors also predict the effects to be profound in that not only will AI and Big Data "enrich and transform future entrepreneurship research, [but] they might also transform at least some aspects of the actual real-world phenomena that entrepreneurship researchers usually study when they try to understand determinants and effects of the entrepreneurial process" (Obschonka and Audretsch, 2019:532). In other words, the business opportunities these fields promote are not the only factors. AI and Big Data will influence research on entrepreneurship itself in an epistemological fashion.

Along with digital transformation within the industry, comes a host of digital platforms. 'Platformisation' offers the ability to disengage from traditional methods of business interaction and offers a multitude of opportunities for new methods. From a fundamental perspective, digital platforms provide a common "venue for a wide range of entities to converge in creating and delivering value to their customers'' (Evans and Schmalensee, 2007, in Nambisan et al. 2018:355), and in the process, generate both economies of scale and scope in innovation (Gawer, 2014, in Nambisan et al. 2018).

Covid-19 has demonstrated that the digital platforms and 4IR have the potential to provide entrepreneurial opportunities to the technologically enabled people who can provide products, skills and services across platforms.

THE SOUTH AFRICAN MARKET CONTEXT

The market dynamic is unique for every nation, and indeed, every area. Moreover, research is required to determine what, how and where entrepreneurial activities will be profitable in particular contexts. A comprehensive study on the South African market could yield hundreds of academic papers, but there are certain areas where noticeable entrepreneurship has taken place, and where the potential lies for further growth.

Herrington and Kew (2015, cited in Mamabolo et al. 2017:1), note that South Africa is a developing market that is “challenged by low entrepreneurial activity and high unemployment compared to other sub-Saharan countries". In addition, according to the National Youth Development Agency (NYDA) Annual Report of 2014, 41% of the population were classified as youth, and the number of youth involved in entrepreneurial industries could be regarded as notably low at just 6% (Mbuya and Schachtebek, 2016). There are also areas where attempts at growth have failed.

Mukwarami and Tengeh (2017) note that despite efforts on policies implemented by the South African government, specifically policies aimed at supporting Small, Medium and Micro Enterprises (SMMEs), certain quarters show a distinct absence of growth in terms of entrepreneurship. Moreover, the poorest of the poor have not benefited.

The factor of empowering SMME operators and expanding the market for such is the critical foundation upon which economies in developing nations rest. Without a healthy SMME sector, there is unlikely to be a positive economic outlook for any nation. The World Bank (2020) reports that the majority of businesses worldwide are SMMEs, representing 90% of all businesses with 50% of the world’s total employment. Additionally, the World Bank (2020) estimates that globally, 600 million jobs will be needed to absorb the growing workforce by 2030, and with SMMEs creating seven out of 10 jobs, it remains imperative for SMME development to remain a high priority for governments around the world. This dynamic cannot be ignored in a country such as South Africa which currently has a 34% unemployment rate and a number of challenges regarding employment in numerous sectors.

However, on a more positive note, there are accredited learning options that help to provide the various knowledge and skills required to formalise entrepreneurial concepts and the related learning. The Sector Education and Training Authorities (SETAs), the national bodies linked to specific economic sectors and learning therein, have noted the critical need for entrepreneurs. Qualifications like the National Certificate in New Venture Creation (South

African Qualifications Authority [SAQA] Identity [ID] 49648), were developed to be delivered as full qualifications or learnerships to help to get support from various skilled sectors.

Similarly, there has been a focus on transitioning adult learners from the stage of having thoughts linked to entrepreneurial concepts, to actions in which they complete a business plan over three months. They also complete a skills programme which provides them with opportunities to understand small and medium businesses and providing workforces for large retailers - with the possibility of employment afterwards. Le Grange et al. (2018) focus on the Wholesale and Retail Sector Education Authority’s (W&RSETA’s) approach to providing skills for the W&R sector, either by enabling people to work in the sector or to consider developing and evolving their entrepreneurial ideas into action.

Other examples include the growing necessity for entrepreneurship within the tourism industry in South Africa. McGladdery and Lubbe (2017) state that over the course of the past few decades, there has been an increasing proliferation of tour operators and travel agencies offering educational tourism packages to school groups and tertiary education students. With the rise of ideas such as lifelong learning and the growing numbers of retirees taking an interest in the industry, there has been healthy economic growth in this sub-sector of the tourism industry (McGladdery and Lubbe, 2017).

In the tourism sector as a whole, there is a special focus where it is seen by the government to be important for the economic development of South Africa. Matsiliza (2017:1) argues that “emerging tourism entrepreneurs must tap into various programmes to develop their entrepreneurial skills so that they can address challenges they experience while practising sustainability in their businesses”. Tied in with the tourism sector is also the hospitality sector. Matsiliza (2017) notes that increased global competition and the demand for hospitality to become more technologically advanced further increases the demand for highly skilled workers.

Apart from the aforementioned, there are a plethora of industries that represent opportunities. These industries include products-as-services, the digital economy and the sharing/collaborative economy and exports. These markets are underdeveloped in Africa, but because of Africa’s geography, demography, and increasing urbanisation, there is substantial potential for growth. Moreover, as new technologies are brought in, small-scale manufacturing stands to become more efficient and competitive (Naudé, 2017).

CURRENT AND POTENTIAL CHALLENGES

There exist a number of challenges that currently affect prospects for the South African workforce over the next decade. As seen most recently at the end of 2019 and the beginning of 2020, the continual supply of electricity is a major concern. The recurrence of rolling blackouts (termed “Load Shedding” in South Africa) exists as a major obstacle to the ability to provide goods and services in consistent ways. As such, it is a major concern that affects investor confidence. This inconsistency “can be directly linked to poor service delivery which is often associated with poor corporate governance” (Miles, 2019:viii). Public confidence (or lack thereof) in governance is a by-product of poor service delivery.

Also affecting investor confidence are social issues such as perceived crime rates, including actual violence and xenophobic attacks. These cannot be ignored from either the national or international perspectives, and the level of connectivity these factors have with the ability to create sustainable enterprises is worth considering at all levels of the system including that of the individual. This point is particularly true in the case of recent xenophobic attacks. Xenophobia against immigrants is consistent with the attitudes and perceptions of the successes of small businesses owned by immigrants (Mamabolo, 2015).

Continued issues surrounding xenophobia in South Africa could have a significant effect on investor confidence in the country from an international perspective, as the issue is shown to be a popular thread and widely reported in local and international media. Other more subtle factors could be argued to be equally relevant despite not receiving international media attention.

Levels of computer literacy and the more general factor of technological aptitude should be considered for research and potential application in depth. The ability to use technological resources such as the internet is critical for the growth of economies around the world. Labour forces that insist on traditional methods over more efficient modes of delivery risk being overwhelmed by increasingly efficient competitors, and it is important for technology skills to be widely adopted across the board. In terms of the application of technology in education, it is noted that it holds the promise of increased academic success for students

(Israel, 2018). Technology in this sense provides "opportunities to integrate the physical and virtual, to learn from experts in distant places, and to choose the time and place for such learning to occur" (Schuck et al. 2017:121). Computer literacy is not only valuable for access to the educational methods in which it is used but in many markets that require it. Industries noted as important in this regard are mobile connectivity, AI, the Internet of Things, next-generation robotics, 3D printing, wearable technologies and machine learning (Rasool and Rasool, 2020).

Moila et al. (2019) note with regards to technology usage in South African government school classrooms, that a variety of challenges exist. Some of these challenges include limited budgets, inadequate professional training, teachers' resistance to change, inadequate network infrastructure, unreliable devices or software, no systems to use technology for curricula, and the factor of education districts not seeing an immediate need for the integration of digital technology in teaching and learning (Smith, 2015, in Moila et al. 2019). Some of these factors, if not all, can certainly be regarded as being present in the spheres of entrepreneurial activity and the abilities of individuals to be entrepreneurs. Without the ability and confidence to use technologies like conferencing software such as Skype or Zoom, or learning platforms such as Moodle or Blackboard, many are significantly disadvantaged. South Africa attempted to address these difficulties when trying to provide learning in the country during the Covid-19 pandemic. The extent of economic privilege is linked to the ability to access learning or otherwise.

There are several other factors that can be considered as challenges, many of which are interconnected. As such, it is recommended that further research be undertaken to produce a comprehensive map of these challenges as well as suggestions as to how they may be overcome.

RECOMMENDATIONS

The alleviation of poverty remains a prime concern in South Africa. With more than a quarter of the population unemployed (StatsSA, 2016), entrepreneurial education in these sectors is a high priority. This is not simply a challenge to be overcome, but an opportunity to grasp.

Understanding the challenges is key. For example, Mukwarami and Tengeh (2017) note the difficulties of spaza shop (small business) owners. Firstly, the entrepreneur needs to have a clear vision of what they want to achieve. Secondly, crime needs to be dealt with collectively. Thirdly, both the private sector as well as government agencies need to work to address the skills gaps, and lastly, technology needs to be adopted to mitigate the issues around bulk purchases and transport costs (Mukwarami and Tengeh, 2017).

It is vital that each entrepreneur understands the context in which they see themselves setting up operations. Personal abilities, social dynamics, external aid, and technology all need to be considered.

It is therefore recommended that holistic education programmes are implemented which take into account the assessment of challenges in these areas for the entrepreneurs to be better equipped to survive financially in whichever contexts they choose to operate. There also needs to be continued government support and cooperation to help entrepreneurs to succeed; factors that are outside the entrepreneurs' control, for example, could be addressed by appropriate government initiatives. As Mokyr (2006) notes, entrepreneurship may not have been the cause of the Industrial Revolution, but it was an essential complement to it. The way in which this is relevant speaks to how we perceive and treat entrepreneurship. Business ventures will exist regardless of whether they have society's approval. As times change, opportunities arise for financial gain in both conspicuous and inconspicuous manners that may or may not benefit society as a whole. It is thus suggested that educational institutions, as well as the government, take an active and serious interest in promoting and guiding successes within entrepreneurial ventures.

Considering the brevity of this paper, however, it is highly recommended that more in-depth research be done on all the relevant aspects, including entrepreneurial skills, philosophies, and markets.

CONCLUSIONS

There is much work to be done in turning South Africa into a society in which entrepreneurship can be easily accessed with positive results. Covid-19 has accelerated this need and has made it a critical learning opportunity. Covid-19 highlighted the challenges that data and the cost of industrial activities linked to electronic platforms pose, and the fact that these exclude some while including others. The factor of poverty weighs heavily on entrepreneurs, and in turn, the lack of entrepreneurship contributes heavily to poverty. The results of government aid and guidance, although present, have not been as effective as hoped. The outlook, however, is far from bleak. South Africa is a dynamic country with a foundation of economic activity that crosses many fields of industries and required skill sets. This diversity not only stimulates opportunities but also makes the economy more stable. Moreover, while the 'Fourth Industrial Revolution' may result in job losses, new technologies will open the door for many new ventures and job creation. It makes sense that South African society, including the government, must accurately predict and prepare for the opportunities that will arise.

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THE ROLES OF PROFESSIONAL BODIES IN SOUTH AFRICA IN THE CONTEXT OF THE FOURTH INDUSTRIAL REVOLUTION (4IR)

PAPER 9

Archaeology and the Fourth Industrial Revolution (4IR): Reflecting on the Role of the Association of Southern African Professional Archaeologists (ASAPA) in Stimulating Public Interest and Enhancing Access to Archaeological Education and Training

Dr Jane Adigun, Professor Sarah Wurz and Dr Annie Antonites

ABSTRACT

By focusing on the archaeological profession, this paper reflects on the role of the Association of Southern Africa Professional Archaeologists (ASAPA) in facilitating access to archaeology and promoting education and training in the discipline. As an association, ASAPA operates within South Africa's heritage sector and serves to further knowledge and stimulate debate about our shared archaeological heritage and the rich past of South Africa and southern Africa. In South Africa, the current employment landscape for professionally trained archaeologists has limited opportunities at provincial and national heritage agencies, universities, museums and contract archaeology work. From the perspective of the Fourth Industrial Revolution (4IR), there is consensus that the 4IR will bring about unprecedented changes in the world of work. Although archaeologists are predicted to be the least likely to have their jobs automated in the future, they do have to navigate the same challenges as other professions in terms of preparing the next generation of archaeologists for a technologically-driven employment landscape and new job opportunities that do not yet exist. ASAPA recognises the importance of facilitating and supporting innovative ways of doing archaeology in the context of the 4IR and, in this paper, we share our challenges and experience in creating opportunities to nurture and develop archaeology for the future.

INTRODUCTION

This is the age of Zoom meetings, Netflix, online shopping, automated banking and self-driven cars. It is undeniable that new technologies have, for the most part, replaced traditional ways of social interaction. From the way we communicate and interact with each other to the way we learn, work and shop (Doucet et al. 2018). Currently, there is a digital application for almost every aspect of daily life: from social messenger applications that include WhatsApp and Snapchat to transportation applications such as Über. Other applications like Tinder for social networking and other applications remind one to drink enough water and stay hydrated. While this is only the beginning of what one can imagine on the cusp of the 4IR, it is clear that technology has fundamentally changed daily life (Schwab and Davis, 2018).

Discussions around the ways in which technological advances and developments will continue to impact economies, labour markets, and education, are the subject of ongoing research. It is predicted that as the 4IR unfolds, it will bring about changes that will create new jobs and cause involuntary job losses (World Economic Forum [WEF], 2016). As a consequence of these technology-driven changes, the global socio-economic landscape is anticipated to experience exponential skills divide between the skills required for future jobs, and those that are set to become redundant as job automation lowers the demand for human labour (WEF, 2016; Gleason, 2018). It is further estimated that the majority of seven-year olds currently starting primary school will eventually work in jobs that do not yet exist (WEF, 2016:1). Whether or not this scenario is plausible remains unclear but what is evident is that technology has fundamentally changed daily life. Gleason (2018:vii) aptly describes this as an "exciting time of real change and transformation". How does one best prepare this cohort of students for education in the context of the demands of the 4IR? Most importantly, how does one nurture talent and develop skills for an employment landscape that has not yet emerged?

Within this ambit, we reflect on the experiences of ASAPA. The objective of this paper is two-fold. Firstly, to share the ways in which we have tried to stimulate public interest in archaeology and secondly, to highlight ASAPA's efforts towards laying the foundations to enhance access to archaeological education and training.

THE ASSOCIATION OF SOUTHERN AFRICAN PROFESSIONAL ARCHAEOLOGISTS AND THE JOURNEY TO PROFESSIONALISATION

Simply put, archaeology is concerned with people in the past. Archaeologists use various scientific techniques and methods and work systematically to unearth almost anything discarded and buried: stone tools, animal bones, ochre pigment, marine shells, fishbone, gold and metal, animal skins, coprolites, ancient human burials and tombs, cave paintings, jewellery, figurines, artwork, and so forth. The goal is to better understand the aspects of the daily life of those who discarded these kinds of objects. By looking for clues and interpreting the material, we try to answer questions about diet, lifestyle, behaviours, social activities and rituals. Ultimately, it is an endeavour into philosophical inquiry trying to answer the fundamental questions that humanity continues to grapple with: Who are we? Where do we come from? Moreover, what makes us human? As archaeologists, we cannot claim to have any of the answers, but through the lens of what James Deetz (1977) calls the 'small things, forgotten' we get a glimpse into our biological and cultural origins.

In South Africa, archaeology emerged as an academic discipline during the 1970s with the formation of the Southern African Association of Archaeologists (Ndlovu, 2009; Ndlovu and Smith, 2019). Prior to this, it was largely the domain of hobbyists and volunteers (Ndlovu and Smith, 2019). In the decades that followed between the 1980s and mid-to-late-1990s, trained archaeologists graduated from various universities across South Africa, most notably, the University of Cape Town (Ibid.). In the years that followed, membership was widened to include archaeologists from other African countries and the rest of the world, and by 2004, the Southern African Association of Archaeologists was re-branded as the Association of Southern African Professional Archaeologists (ASAPA). A decision was then taken to apply for the South African Qualifications Authority (SAQA) recognition as a professional body. This initiative was spearheaded by Dr Catherine Namono, a rock art researcher at the University of the Witwatersrand in Johannesburg. ASAPA had fully embarked on the road to professionalisation and, by late-2017, this was gazetted in a government notice. By March 2018, ASAPA had received the official certificate of recognition from SAQA.

ASAPA operates within South Africa's heritage sector and serves further to enhance knowledge and stimulate debate about the country's shared archaeological heritage and the rich past of both South Africa and Southern Africa (ASAPA, 2016). ASAPA endeavours to meet its objectives through (1) the development of archaeological research, (2) the management, conservation and curation of archaeological heritage, (3) archaeotourism, (4) community and education outreach, and (5) the exchange of archaeological expertise and information (ASAPA, 2016:3). The association is governed by a Constitution, and its administrative functions are overseen by the ASAPA Council, which is headed by the ASAPA Chair with the support of the Secretary and Treasurer.

ASAPA membership is open to all archaeologists working in South Africa and further afield. In terms of membership, ASAPA has three broad categories: professional, technical and affiliate. Professional members with suitable experience may also hold concurrent accreditation as cultural resource management (CRM) practitioners. This status is conferred by the ASAPA Council, the decision-making body of the association, and serves as an unofficial endorsement to work in the South African heritage sector. Each membership category is informed by a specific set of membership criteria listed in the ASAPA Constitution. As a minimum, each application for membership should be accompanied by a completed application form and curriculum vitae. At the time of application, applicants should also meet the additional requirements stipulated for their chosen membership categories. For professional membership, prospective members should hold the National Qualifications Framework (NQF) Level 8 qualification in archaeology, be actively engaged in archaeological employment, or be involved in full-time research in Southern Africa. At the most recent Biennial General Meeting (BGM) held at Sol Plaatje University in July 2019, a decision was taken to refine the requirements for this category to include the SAQA compliance criterion for Continuing Professional Development (CPD).

Technical membership is for those that have earned a Bachelor's degree in Archaeology or a nationally recognised Certificate in Archaeology or related fields. Prospective applicants should demonstrate possession of technical life skill experience in archaeology through full-time employment as an archaeological technician for at least three consecutive years, or part-time employment for at least five consecutive years, and have been supervised during these periods by professional archaeologists.

The affiliate category is for those who have earned an NQF Level 8 qualification or equivalent in archaeology but who are not actively involved in archaeology although they have demonstrated their continued interest in Southern African archaeology. This category of professional would, for example, include retired archaeologists. Persons qualified in other professions with the ability to advance archaeological research, provide management or outreach, and demonstrate continued interest in Southern African archaeology, are also eligible for affiliate membership. As an example, those working in the built environment would be invited to join as affiliate members. Once an application is approved, the applicant is notified of the outcome and invited to join ASAPA.

All members are also expected to sign a Code of Conduct and adhere to the minimum guidelines stipulated in the ASAPA Constitution. In addition, members are also responsible for ensuring that they comply with the relevant national legislation governing archaeological work, which may vary by country and region (ASAPA, 2016).

At the time of writing this paper, ASAPA had 300 members across the professional, affiliate and technical membership categories and, of these, only professional membership is a SAQA registered designation. There are approximately 287 active members with designations, and 139 of these 287 members had their data loaded onto SAQA's National Learners' Record Database (NLRD). Figure 1 shows that ASAPA's 2019 membership was dominated by professional members (91%), including those with CRM accreditation (three percent), while technical memberships accounted for the remaining six percent.

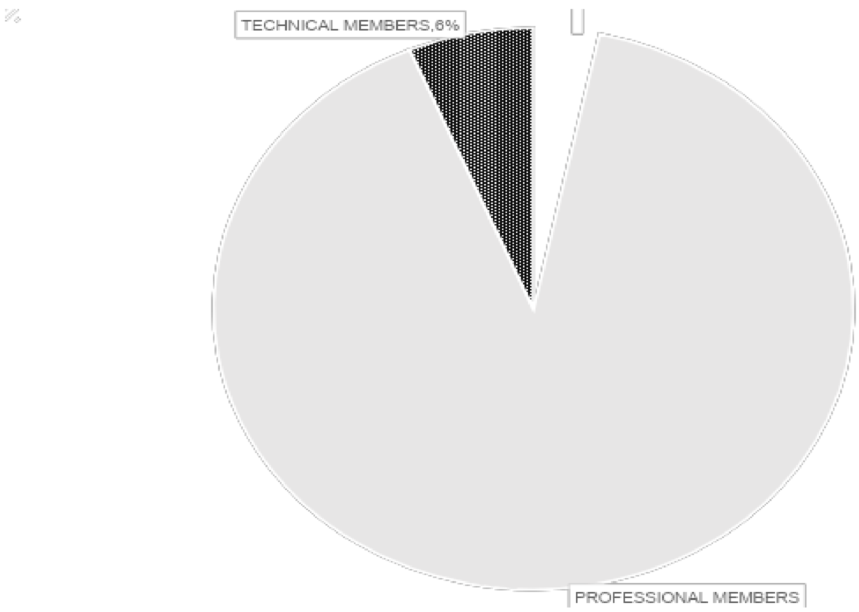

Figure 1: ASAPA membership profile across membership categories (Wurz, 2019).

Figure 2 shows the ASAPA membership distribution based on nationality. Within the professional membership category (91% of the total membership), South African citizens form the largest group (64%) while members from other Southern African Development Community (SADC) countries such as Zimbabwe, Botswana and Lesotho, comprise 16% of the total professional membership. Professional members from other African countries and the rest of the world account for the remaining 10%.

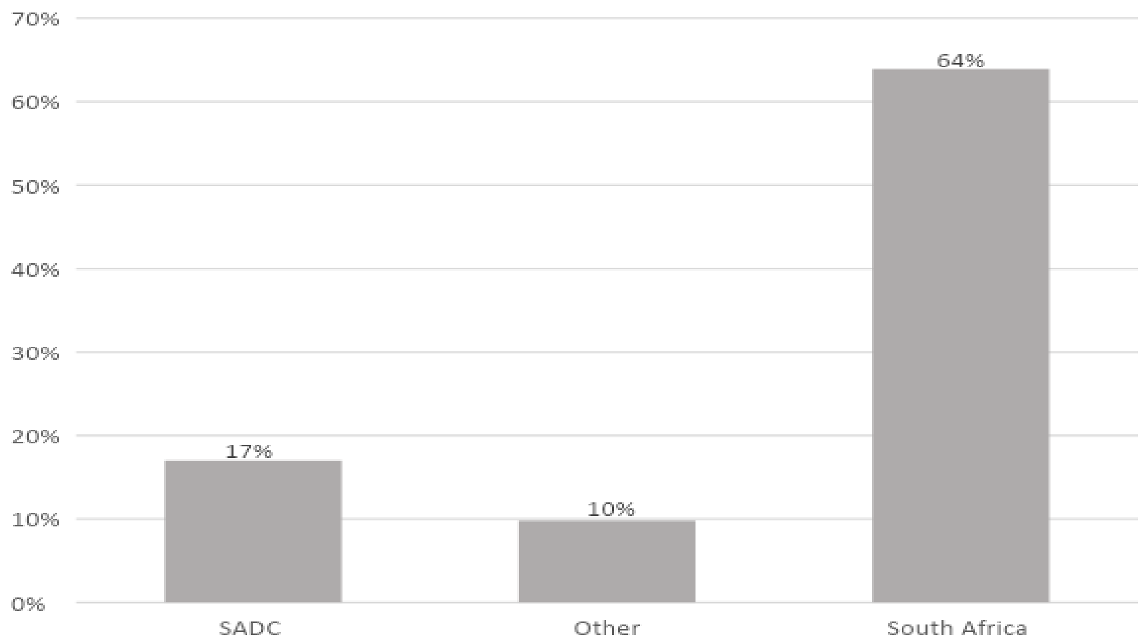

Figure 2: Nationality profile for ASAPA members with professional designation comprising 91% of total membership based on 2018 membership data (Wurz, 2019).

In the context of the 4IR, job automation has progressed out of the domain of science fiction and is fast becoming a reality. Although it is estimated that archaeologists are the least likely to have their jobs replaced by robots in the future (Fey and Osborne, 2013), they have to navigate the same hurdles as the professionals in other sectors that are being threatened by the challenges of a rapidly changing technological landscape. From an archaeological perspective, archaeologists will need to adopt strategies that will enable them to create new opportunities for lifelong learning to meet the job expectations for a future generation of archaeologists. The section that follows reflects on previous work undertaken in an effort to scaffold ASAPA's vision for South African archaeology with a long-term vision that caters for the 4IR.

Contesting the Past: A brief background to the South African archaeological landscape

During its formative years as the South African Archaeological Association and long before the advent of democracy, the cohort of archaeologists that pioneered the formal establishment of the discipline in South Africa worked within an ideological framework infused with colonial and apartheid-era[27] rhetoric. The paucity of professionally trained black archaeologists working in the heritage and education sector at this time further entrenched

[27] Apartheid was a South African policy or system of segregation or discrimination on grounds of race.

a long-standing view that archaeology is the domain of South Africa's white minority. While ASAPA has come a long way since then, the road to professionalisation and more specifically the efforts to promote public interest in archaeology, and enhance education and training opportunities, has been peppered with challenges.

In mid-2007, and at least a decade prior to obtaining SAQA recognition as a professional body, Dr Ndukuyakhe Ndlovu, a South African archaeologist and, at the time, a doctoral (PhD) candidate at the University of Newcastle, was active in his criticism of the ASAPA Council. Dr Ndlovu has extensive experience working within the South African heritage sector and previously worked as a Collections Manager at the University of the Witwatersrand. Frustrated with the slow pace of transformation in terms of inclusivity and representivity of black (South) African archaeologists within the association, he championed the ASAPA transformation agenda (Ndlovu, 2009; Ndlovu and Smith, 2019). Supported by a small cohort of young black members, this culminated in the development of the ASAPA Transformation Charter, which was promulgated in 2008, and a Transformation Officer position was established in/ as part of the ASAPA Council (Ndlovu and Smith, 2019). Dr Ndlovu was the first person to hold this position and subsequently became the first person of African descent to be appointed as the Editor of the South African Archaeological Bulletin (Ibid.). This internationally accredited journal is owned by the South African Archaeological Society[28] and edited by ASAPA. The editorial responsibilities are underpinned by a Memorandum of Agreement between ASAPA and the South African Archaeological Society.

The ASAPA Transformation Charter for Archaeology in South Africa was intended to guide decisions and inform strategies within ASAPA to ensure that the demographics of its members became a genuine reflection of South Africa's rich ethnic and cultural diversity (ASAPA, 2008). There was, however, a disconnect between the optimistic ideals of the Transformation Charter and the pace of transformation within ASAPA itself. Figure 3 shows the equity profile of ASAPA's current membership according to gender (male and female) and population group (African and European descent). In 2008, people of African descent accounted for less than seven percent of ASAPA membership while those of European ancestry dominated. While it is evident that in the decade since the adoption of the

[28] The South African Archaeological Society is a registered non-profit organisation. Membership is open to anyone with an interest in archaeology. The Society promotes archaeological research in southern Africa and makes the results available to its members and the public through lectures, outings, tours and publications.

Transformation Charter there has been a significant improvement in the representation of members from designated groups (Figure 3), the proverbial wheels are turning very slowly.

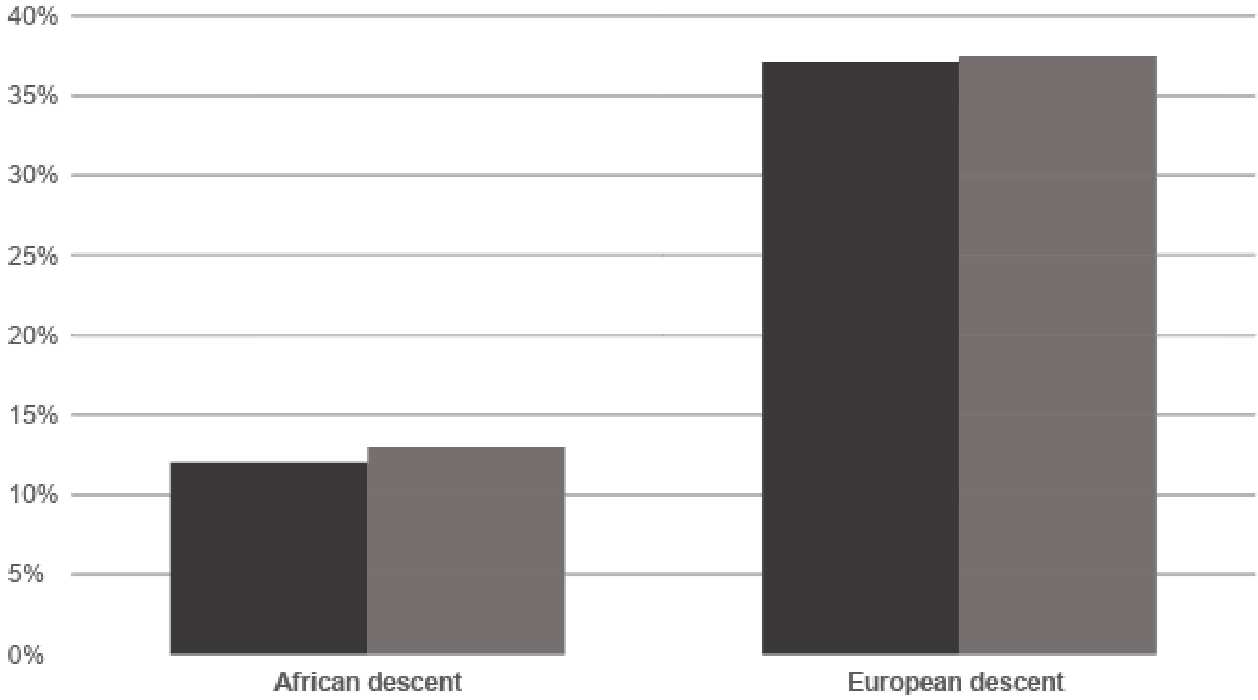

Figure 3: ASAPA's 2018 membership profile for designated members based on sex (male and female) and ethnicity (African and European descent). African refers to the racial classifiers used by Statistics South Africa and includes Black, Coloured and Indian (Adopted from Wurz, 2019:82).

Calls for transformation and diversity within archaeology have stimulated robust debate amongst archaeologists since the late 1980s, a time of growing political unrest across South Africa (Ndlovu 2009). Post-1994[29] and into the early 2000s, archaeologists have recognised the calls to promote diversity and inclusivity within the discipline. This matter has been discussed in various settings: round table discussions at the ASAPA Biennial General Meeting in 2017, and in review papers on the state of transformation in South African archaeology led by, amongst others, Dr Ndlovu (Ibid.), Professor Lyn Wadley, an internationally recognised South Africa archaeologist (Wadley, 2013), and more recently in an editorial by Professor Sarah Wurz, the ASAPA Chairperson and Head of Archaeology at the University of the Witwatersrand (Wits) (Wurz, 2019).

The growing calls of the student-led protest movements that took place from 2016, for free, 'decolonised' higher education, also highlighted the need to accelerate the pace of transformation across the South African education landscape, including the discipline of

[29] The year 1994 saw the onset of democracy in South Africa.

archaeology. In their review paper on the status of transformation in South African archaeology, Ndlovu and Smith (2019) discussed barriers within higher education institutions (HEIs) that hinder progress towards transforming the discipline. These challenges include recruiting undergraduate students in archaeology, difficulties in retaining graduate students for further study, and limited employment opportunities within the sector. Changing perceptions amongst black students that archaeology was the domain of the white minority, was also an issue that needed to be addressed (Ndlovu 2009).

According to Ndlovu and Smith (2019), until the mid-2000s, there was a paucity of employment opportunities for the few professionally trained black archaeologists. Since the adoption of government initiatives such as the National Policy on Archaeology and Palaeontology (2011) and, more recently, the Department of Basic Education (DBE) Ministerial Task Team report on the reintroduction of history as a compulsory subject in the South African school curriculum (DBE, 2018), it is anticipated that transformation will be enhanced in the South African archaeology profession.

In the DBE (2018) report, the importance of archaeology in providing unique insights into South African and, by extension African history, is highlighted. It is therefore not unreasonable to anticipate growing interest in archaeology at undergraduate levels as a result of the subject being included in school history curricula. The National Development Plan (NDP) 2030 vision also includes a focus on promoting arts and culture-based curricula (National Planning Commission, 2012). In the broader African context, Article 5 of the African Union Agenda 2063 envisions "An Africa with strong cultural identity, common heritage, shared values and ethics" (African Union, 2014:7). Guided by these ideas, ASAPA is, therefore, ideally positioned to realise this Pan-African vision, which is embedded in the Association's mission.

Enhancing archaeological education through community engagement

Prior to obtaining SAQA recognition, ASAPA made a conscious effort to focus on promoting archaeology, but there have always been concerns that archaeologists operated in silos and acted as gatekeepers of community heritage. These views were largely rooted in the discipline's murky past that was entrenched in the late-19th and early 20th Century Eurocentric ontology of knowledge production and thinking. In the South African context, historically, those of African descent were relegated to the periphery and occupied roles as labourers on archaeological sites (Ndlovu and Smith, 2019). While it is widely acknowledged that many important archaeological discoveries would remain elusive without the contribution of these black workers, many of these people were and are still not given the recognition they deserve (Vilakazi, 2020). There is also a growing need to have an archaeologically literate public in South Africa. This is particularly relevant as archaeologists interrogate the ethics surrounding proposed developments on cultural heritage sites such as Mapungubwe[30].

ASAPA has increasingly played an important role in debunking misconceptions about archaeology through activities such as the ASAPA Biennial General Meeting, which attracts stakeholders from the public and private sectors. ASAPA also hosts student development workshops (SDWs) that aim to provide opportunities for young aspiring archaeologists to develop their communication, presentation and excavation skills. The SDWs attract students from various universities across South Africa and the SADC region. The workshops provide valuable opportunities for students to network and engage in environments less formal than those of conferences.

In addition to these initiatives, ASAPA members are also actively involved in community engagement projects. One of ASAPA's young black archaeologists, Mpho Manaka, is a PhD candidate at the University of Pretoria and a lecturer at the University of South Africa (UNISA). She established the Pretoria Archaeology Club for Schools (PACS), and this non-profit organisation is active in promoting archaeology to school learners in Mamelodi, a historically impoverished black township in the City of Tshwane (Pretoria)[31]. At PACS, students learn about archaeology through play. These fun activities include an archaeology-themed treasure hunt and archaeology Olympics. The PACS team also provides opportunities for students to develop basic computer literacy skills through a tutoring programme offered by the *IkamvaYouth Training Department* (Manaka, 2020). Through collaboration with ASAPA members affiliated with universities and museums, ASAPA can participate in various community outreach and educational initiatives. This includes, for example, the Wits Origins Centre community outreach workshops, public lectures and holiday programmes. The South African Archaeological Society also frequently hosts

[30] Until its demise at the end of the 13th century AD due to climate change, Mapungubwe was the most important inland settlement in the African subcontinent and the cultural landscape contains a wealth of information in archaeological sites.
[31] A city in the most populous of South Africa’s nine provinces.

activities such as day excursions and public lectures. Through these kinds of activities, ASAPA aims to enhance archaeological literacy while striving to achieve its transformation objectives. However, as Ndlovu and Smith (2019) have cautioned, these kinds of efforts may not be sufficient to bring about real transformative change across South Africa. It is, however, a step in the right direction.

Archaeology and the Fourth Industrial Revolution

Although ASAPA's community engagement activities do not currently incorporate skills development for the 4IR, members that are employed in HEIs have embraced technology in new ways to continue with teaching through e-Learning, online conferences and virtual training activities in the context of the Covid-19 pandemic. Dr Tammy Hodgkiss, an ASAPA member and curator of the Wits University Origins Centre Museum for example, recently launched a virtual museum tour. The authors' colleagues at the UNISA Department of Anthropology and Archaeology Museum have produced a digital archive of the Junod Missionary Collection[32], which is available on open-access (Mehnert, 2014).

In terms of the technological demands of the 4IR, digital technology is not new or unchartered territory to archaeologists. The earliest use of computers by archaeologists dates back to the late 1950s with the development of an electronic database for data recording, archiving excavation documents and site information records (Wallon, 1972; Wilcock, 1989). Since the mid-2000s, archaeologists have actively explored digital ways of disseminating research through social media sites such as Twitter, personal blogs and Facebook. Technologies such as geographical information systems (GIS), computer-aided design (CAD) and 3D reconstructions are integrated into cultural heritage conservation efforts to map site features and detect artefacts. Drone technology is used to survey prospective sites that may be inaccessible due to practical or logistical constraints. Minimally destructive sampling methods such as zooarchaeology by mass spectrometry (ZooMS) have made important contributions towards advancing and improving the analytical techniques used in archaeological methods and practices. Virtual reality and re-enactment simulations represent innovative ways of exploring the past through digital time travel.

[32] Henri Alexandra Junod (1863–1934) was a Swiss-born South African missionary and anthropologist. His collections comprise papers, books and artefacts.

While it is clear that the archaeological profession has long involved digital technology, the available literature on the future of archaeology focuses primarily on the ways in which archaeological method, theory and teaching pedagogy have evolved (see, for example, Wiseman, 1980; Mizoguchi, 2015; Pikirayi, 2015). While our paper offers a nuanced perspective on the barriers of archaeological practice, what is lacking in the current discourse is a critical reflection on what archaeology in the 4IR will look like and most importantly, the types of skills that will be required by the future cohort of archaeologists.

In South Africa, the current employment landscape for professionally trained archaeologists offers limited opportunities. Professional archaeologists are mainly employed as heritage practitioners at provincial and national heritage agencies, in academic positions at universities and as researchers or curators at museums. Contract archaeologists with specialised knowledge in cultural resource management may also be contracted by private or public enterprises to conduct site surveys prior to construction or land development projects being undertaken. Technical members, in contrast, are mainly employed on a temporary basis as field assistants and labourers, and work under the supervision of professional archaeologists. Although archaeologists are least likely to have their jobs automated in the future (Fey and Osborne, 2013), it is crucial that the archaeological community starts to look at innovative ways of doing archaeology digitally even if it cannot predict what archaeology of the future will look like.

Morgan and Scholma-Mason (2017) in their online paper on *Internet Archaeology,* argue that digital technologies can be creatively adopted by archaeologists to facilitate innovation in archaeological practices. However, Beale and Reilly (2017:para.1) argue that although digital technologies are promising and provide new opportunities to enhance archaeological practices, they "…failed to have the impact upon archaeological fieldwork that might have been expected." This is in part because archaeologists are not fully informed about the types of emerging technologies that are available to them and also do not have adequate knowledge about the suitability and application of these various technologies. Beale and Reilly (2017:para.8) advocate for archaeologists to reassess the scope of their digital literacy so as to be better positioned to critically, "… actively and consciously participate in this discussion about …the forms that technology take within [archaeology] … [for] recognising, exploiting and mitigating the influence of technology on our work".

As an Association, ASAPA recognises the importance of facilitating and supporting innovative ways of doing archaeology through interventions that will assist members to hone their existing digital skills or develop new ones. However, ASAPA is not currently engaged in developing the digital skills that will inevitably become part of the professional archaeological research and excavation toolkits in the 4IR. Although ASAPA has members who are digitally savvy before joining the Association, it does not assist members in developing specific technology-based skills. Based on what we have gleaned from the growing body of literature on *virtual* and *digital archaeology*, it is evident that the adoption and integration of various technologies by professional archaeologists such as GIS, virtual reality, digital imaging, 3D-modelling, and computer graphics, social media, and e-Learning, does provide us with insight into the types of skills that ASAPA members should be encouraged to nurture or develop further.

With a long-term vision towards enhancing archaeological practice and in response to the technology-driven complexity that is expected to shape the world of work in the 4IR, ASAPA does aim to invest in and facilitate skills development for members. The extraordinary circumstances of the coronavirus pandemic also demand that we accelerate the pace at which ASAPA members are provided with these opportunities. While every professional member is computer literate and has a working knowledge of basic statistical software, the complex digital technologies of the 4IR require more specialised knowledge that extends well beyond the scope of knowing how to use a computer and pre-installed proprietary software to produce documents, spreadsheets and presentations. The first step towards this area of development would be to create awareness amongst ASAPA members about the various types of digital technologies that are available and relevant. This process could be achieved by hosting virtual workshops and webinars around the theme of *Digital Technologies for Archaeologists* with guest speakers with specialist knowledge in the application of digital media. It could also include a round-table discussion forum at the next ASAPA Biennial General Meeting to start the conversation about how to best facilitate, create and adopt opportunities for members to enhance their digital archaeology literacy skills.

Technical membership: A stepping-stone to opportunities in archaeology?

ASAPA's Technical membership category provides membership to those with experiential skills, knowledge and training in archaeology, such as archaeological technicians and fieldwork assistants that have been supervised by a professional archaeologist. Since archaeology's formal inception as an academic discipline in the 1970s, those individuals with these kinds of practical skills but lacking formal archaeological training were almost exclusively of African descent (Ndlovu and Smith, 2019). Since the adoption of the ASAPA Transformation Charter for Archaeology in South Africa, Dr Sam Challis, a British trained archaeologist working as a senior researcher at the Rock Art Research Institute at the University of the Witwatersrand, has been at the forefront of championing for technical members to be recognised either through articulation[33] after completion of an accredited short learning programme or via alternative learning pathways such as Recognition of Prior Learning (RPL).

Dr Challis believes that by providing formal opportunities for upward skills development to these non-professional members, they will be in better positions to access higher-paying contract archaeological work. This, in turn, has the potential for tangible consequences to improve their quality of life.

Through the current applicant registration process, ASAPA accepts members into the technical membership category based on the criteria outlined in the ASAPA Constitution. However, this is not a SAQA registered designation. At the recent ASAPA Biennial General Meeting held at Sol Plaatje University in July 2019, members voted in favour of structuring a new RPL policy that will enable Technical members to qualify as Professional members. However, after consultation with the SAQA delegation during ASAPA's mid-term review visit, a decision was taken to consider the possibility of registering the Technical membership designation rather than attempting to RPL people with NQF Level 4 qualifications against NQF Level 8 qualification requirements, with the latter being pre-requisites for professional

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[33] 'Articulation' is another term for 'learning pathway' in South Africa. Articulation can be 'systemic' (at system level), 'specific' (involving inter- and/ or intra-institutional agreements) or 'individual' (involving individual learner support) (See for example, Department of Higher Education and Training [DHET]. 2017. The Articulation Policy for the Post-School Education and Training System of South Africa. Government Gazette No. 40545, 13 January 2017. Pretoria: DHET and South African Qualifications Authority [SAQA]. 2020. Policy and Criteria for the Registration of Qualifications and Part-Qualifications on the NQF [as Amended]. Pretoria: SAQA.).

membership. This policy was drafted in consultation with the ASAPA Transformation Officer, as RPL will also play an important role in enhancing the representation of designated groups within the discipline and the professional body. The draft policy was scheduled to be presented to members for approval at the next ASAPA Biennial General Meeting scheduled to be hosted by the University of Lesotho. Unfortunately, the extraordinary circumstances of the Coronavirus (Covid-19) pandemic have resulted in the conference being postponed.

According to Beale and Reilly (2017), digital technology has not been widely adopted by archaeologists during fieldwork and excavation, and the traditional methods of manually recording site information and drawing diagrams by hand are still used. Archaeological fieldwork relies heavily on physical labour, and these kinds of activities include digging test pits, carrying sandbags and sifting buckets of excavated material and sorting by hand. Technical members provide much of the labour on-site.

In the context of the 4IR and informed by ASAPA's long term vision of transformation and diversity in South African archaeology, we believe that the Association has a unique opportunity to develop new skills and foster lifelong learning amongst the cohort of Technical members. Because of the transient nature of archaeological fieldwork, Technical members, in particular, need to be equipped with transferable skills that will benefit their personal development and boost their employment prospects within archaeology. This could be achieved by, for instance, creating training opportunities that will equip Technical members with the skills required for them to adopt and integrate technology-based methods in their fieldwork activities. Morgan and Scholma-Mason (2017), for example, advocate for the novel use of existing digital media technologies such as animated graphics interchange format (GIF) files, which are widely used on social media platforms. Today, most people are familiar with at least one social messenger application such as WhatsApp, which have embedded GIFs, internet memes and animated emotion icons ('emoticons') which are used to visually communicate the sender's information. Morgan and Scholma-Mason (2017:para. 2) argue that GIFs allow for "…a more creative integration of visual media into archaeological practice", specifically in terms of visually communicating information about site stratigraphy. For Technical members who are already active users of social media and messenger platforms, appropriating these skills as part of their archaeology toolkits could be promising in terms of promoting the use of existing digital technologies at work. In addition, ASAPA could facilitate the provision of training opportunities in digital photography, a useful skill for site recording that may be used within and outside archaeology.

According to Doucet et al. (2018:i), while future cohorts of archaeology students need to have understandings of how to use technology in the 4IR, they also need to develop "…profoundly human skills such as leadership, social-emotional intelligence and critical thinking…" The authors (Doucet et al. 2018:ii) further state that education in the 4IR will be defined by "…collaboration, empathy and teamwork". As a discipline that is fundamentally about understanding the human experience, assisting technical and professional members with opportunities to enhance their social and leadership skills is important in this community of practice.

CONCLUSIONS

The 4IR is increasingly being described as a period of disruptive technological change, but it also presents a unique opportunity for the discipline of archaeology to recalibrate its focus to nurture existing talent and develop the skills that will be required to adapt to the demands of this period of unprecedented change. If current estimates are correct, then archaeologists are the least likely to be directly impacted by job automation but what is clear is that there is a need to accelerate the pace at which practitioners prepare the next generation of archaeologists to capitalise on the new employment opportunities that may exist beyond the ambit of our profession. We believe that transformation is key to achieving this, and that ASAPA should be at the forefront of scaffolding South Africa's archaeologists for the 4IR.

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PAPER 10

The Role of the Association for Skills Development in South Africa (ASDSA) in Facilitating Technical and Vocational Education and Training (TVET): Confronting the Challenges of the Fourth Industrial Revolution (4IR) and Covid-19

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ABSTRACT

This article aims to highlight the challenges presented by the Fourth Industrial Revolution (4IR) and the Coronavirus (Covid-19) pandemic to the Technical and Vocational Education and Training (TVET) sector in South Africa and the contributions that the Association for Skills Development in South Africa (ASDSA) is making in confronting these challenges. The paper consists of four main sections. The first spells out what ASDSA is, its composition, role and activities. It shows that the ASDSA's Skills Development Providers (SDPs) have to work closely with the Sector Education and Training Authorities (SETAs) in the country. The second section briefly elaborates on the benefits to one of the SETAs, the Local Government SETA (LGSETA), of having entered into a partnership with ASDSA. The third and major part of the article spells out the multiple challenges presented by the 4IR and Covid-19 to TVET and what needs to be done to deal with these challenges as a matter of urgency. Finally, the article pulls together an overall view of the underlying shortcomings of the present system of Post-School Education and Training (PSET) and points to where support and solutions can be found.

INTRODUCTION

The major contribution of this article is to consider changes that have resulted from the Fourth Industrial Revolution (4IR) and Coronavirus (Covid-19) pandemic to the nature of work and the new skills required as a result. Covid-19 has catapulted us into the 4IR, and both the pandemic and the revolution are contributing to the rapidly changing workplace, as Arthur Goldstuck (2020:para.1 and 23) writes:

> Coronavirus will speed up 4IR (by) forcing the worlds of business and education to embrace many of the tools that will drive the fourth industrial revolution… It is clear that the coronavirus crisis will have at least one positive outcome. It will provide a dramatic, global and unavoidable case study of the fourth industrial revolution in action ...

Klaus Schwab (2015) from the World Economic Forum (WEF) describes 4IR as a transformation unlike anything humankind has experienced before; one that will fundamentally change the way people live, work and relate to one another. The disruptive and exponential nature of the changes thrust upon entities and individuals by 4IR are equally true of Covid-19. Some of these changes are highlighted below.

- The velocity of change: the speed of current breakthroughs has no historical precedent, and changes are happening exponentially rather than in a linear way.
- The scope of change: 4IR is disrupting almost every industry in every country.
- The impact on systems: the changes brought about by 4IR are so extensive that entire systems of production, management and governance will be transformed.

This article sketches the role that the Association for Skills Development in South Africa (ASDSA) is playing in facilitating the technical and vocational education and training of employees in South Africa. ASDSA is a Section 21 company registered as a non-profit organisation (NPO) and non-statutory professional body[34]. Its members are Skills Development Providers (SDPs) that play learning and development roles. ASDSA assists members with relevant information and industry updates when they submit grant applications to SETAs[35] on behalf of their clients. Consequently, ASDSA is well-placed to observe the changes in the nature of work brought about by 4IR and the new kinds of skills required by firms and other organisations.

The article starts by explaining what ASDSA is and does. In short, it provides for professional designations and continuing professional development (CPD) for its members. It seeks to ensure that standards of professional conduct are upheld and provides sanctions when these standards are not met. ASDSA has been contracted by the Local Government SETA (LGSETA) to enhance the professional expertise amongst LGSETA Skills Development Facilitators (SDFs). The LGSETA works closely with ASDSA in this project. Consequently, this article also includes a brief focus on the contribution of LGSETA to ASDSA's work. The article closes by drawing together its major points and their broader implications. It notes

[34] Section 21 companies are 'not for profit' companies. They resemble business oriented (for profit) companies in their legal structure, but do not have a share capital and cannot distribute shares or pay dividends to their members. In South Africa, there are statutory professional bodies with their own legislation, and non-statutory bodies.

[35] In South Africa, there is a SETA per economic sector. What SETAs are and do is covered in detail later in this paper.

the underlying shortcomings of the present system of Post-School Education and Training (PSET) and where support and solutions can be found.

ASSOCIATION FOR SKILLS DEVELOPMENT IN SOUTH AFRICA (ASDSA)

As an NPO, ASDSA represents the major role players in the learning and development community, including SDPs and administrators as well as facilitators, assessors and moderators. It also represents all associated and related professions engaging in and undertaking skills development, in South Africa.

ASDSA has members in all nine provinces of the country with its strongest chapters being in Gauteng, KwaZulu-Natal, the Western Cape, the Southern Cape, and the Eastern Cape. Achieving professional body status has given ASDSA's registered members recognition as leading professionals in the skills development landscape[36].

ASDSA was founded in 2001. It was registered in 2006 as a company and converted in 2010 into a non-profit organisation. The professional body was recognised by the South African Qualifications Authority (SAQA) in 2013 and, subsequently, the following three professional designations were created and registered with SAQA (see Table 1).

Table 1: ASDSA's SAQA-registered professional designations

●	SAQA ID 493	SD.Tech	Skills Development Technician
●	SAQA ID 494	SD.Pr	Skills Development Practitioner
●	SAQA ID 770	SD.M	Skills Development Master

Vision and mission of ASDSA

ASDSA seeks to establish and maintain the credibility of the skills development practitioners' profession, regardless of the industrial sector concerned, through:

- representation in business and labour forums;
- supporting career paths via a professional designation framework;

[36] The South African Qualifications Authority (SAQA) recognises professional bodies in the context of the National Qualifications Framework (NQF) in the country, when these bodies meet the required criteria (SAQA, 2020c).

- representing members' skills-related interests;
- supporting, assisting, and providing the knowledge and information required by members to fulfil their corporate socio-economic and community responsibilities; and
- upholding a strict code of conduct.

ASDSA activities and achievements

Before commencing an exposition on ASDSA's activities, it is useful to provide some background information regarding various aspects of the skills development landscape.

Sector Education and Training Authorities (SETAs)

At this point, it is worth outlining what SETAs are and how they operate. SETAs were set up under the Skills Development Act No. 97 of 1998. There is a SETA for each of the major sectors of the economy; currently, 21 SETAs cover the whole economy. One of the main purposes of SETAs is to fund skills development in enterprises and other organisations.

The SETAs themselves are funded by a compulsory levy of one per cent of the wage bill of enterprises with a total payroll of at least R500,000 per year. For enterprises to claim back a proportion of their levies to train their employees, each enterprise has to submit a Workplace Skills Plan (WSP) and Annual Training Report (ATR) to the relevant SETA. A WSP outlines the training and education the enterprise intends to provide for its employees. The ATR provides details of the training that was delivered in the previous year. If successful, the enterprise qualifies for a mandatory grant that constitutes 20 per cent of the levy they paid (Coetzee 2013:63-64, 70). A mandatory grant is a grant that must be awarded to an eligible applicant; that is, any organisation that pays the compulsory wage levy. ATRs require detailed statistics and information. Completing these documents is time-consuming and requires resources that small firms do not have. Small firms, therefore, have to appoint a qualified Skills Development Facilitator (SDF) to complete the WSP and ATR on their behalf. In large companies, Human Resource (HR) managers may be appointed as SDFs, but they can also outsource the task to an SDF.

This is where ASDSA enters the picture. It has just under 500 members of whom approximately 15% have professional designations and most of whom are SDFs (ASDSA refers to them as Skills Development Providers [SDPs]). It also has a database of approximately 1500 industry-related professionals with whom it engages.

Table 2 below presents a recent survey of five ASDSA members who had submitted WSPs and ATRs that were due to the SETAs by the end of May 2020. It shows that 154 WSPs and ATRs were submitted. Funding applied for by one company with multiple staff members amounted to between R10-20 million. Unfortunately, ASDSA has not kept regular records of the number of WSPs that have been submitted under its auspices. It intends to rectify this omission.

Table 2: 2020 WSP and ATR submissions from ASDSA SDPs

RESPONDENT	R1	R2	R3	R4	R5	TOTAL
SETA	Gauteng	KZN	WC	SC	KZN	
MERSETA	4	3	65	7		**79**
ETDP	2		1	3		**6**
ServicesSETA	4	4	2	8	4	**22**
MICT	4			2		**6**
CETA	2	1	1	2		**6**
CATHSSETA	1					**1**
MQA	1		1	2		**4**
W&RSETA		3	6	4		**13**
FP&MSETA		2		3		**5**
SASSETA			1	3		**4**
FASSET			2	5		**7**
TETA				1		**1**
INSETA					1	**1**
	18	**13**	**79**	**40**	**4**	**154**

Key: SETA=Sector Education and Training Authority; MERSETA= Manufacturing, Engineering and Related Services SETA; ETDP=Education, Training and Development Practices SETA; ServicesSETA; MICTSETA=Media, Information and Communication Technologies SETA; CETA=Construction Education & Training Authority; CATHSSETA=Culture, Arts, Tourism, Hospitality and Sport SETA; MQA=Mining Qualifications Authority; W&RSETA=Wholesale and Retail SETA; FP&MSETA=Fibre Processing and Manufacturing SETA; SASSETA=Safety and Security SETA; FASSET=Financial, Accounting, Management, Consulting and other Financial Services SETA; TETA= Transport Education Training Authority; INSETA= Insurance Sector Education and Training Authority.

Stipends paid by the SETAs for Learnerships[37] generally vary from R1500.00 to R6500.00 per learner per month. There are a number of reasons for these variations, including the following factors that determine the stipends paid. Short skills programmes, for example, do not usually have a stipend payment to learners. However, the Construction Education and

[37] A learnership is a work-based learning programme that leads to an NQF registered qualification. Learnerships are directly related to an occupation or field of work, for example, electrical engineering, hairdressing or project management. Learnerships are managed by Sector Education and Training Authorities (SETAs).

Training Authority (CETA) pays stipends of R1500 for Learnerships; Insurance SETA (INSETA) pays stipends of R3500; and the Culture, Art, Tourism, Hospitality, and Sport Sector Education and Training Authority (CATHSSETA), R4500. The varying stipends show that each SETA has different criteria for Learnerships.

The skills development landscape is made up of any persons or organisations that contribute to the improvement of the skills of the learners employed as well as those of unemployed people. ASDSA has contributed to calls for comments, surveys, papers, and responses that have emerged in the skills development landscape. Its members have given expert opinions that contain a wealth of knowledge to influence policymakers and policy. The diversity of ASDSA members, namely HR Practitioners, Learning and Development Professionals, Facilitators, Assessors, Moderators, and Skills Development Providers, gives ASDSA the ability to provide strategic solutions to the many problems being faced by the skills development community across the board. ASDSA continues to be an active contributor when legislation and policy are being reviewed and engages with policy-makers. The ASDSA approach is to be proactive, responsive, and inclusive when and where there are issues that need addressing. In short, ASDSA members play a critical role in the financial interface between management, labour and government in the implementation of learning and development.

National Qualifications Framework (NQF)

To provide contextual background for the remainder of this paper, a brief outline of South Africa's National Qualifications Framework (NQF) is presented. The NQF was extensively revised by the NQF Act No. 67 of 2008, which was enacted to enhance the integration of education and training in South Africa. The NQF comprises 10 levels of education and training, and includes Basic Education, Adult Education and Training, and academic, vocational, occupational and technical qualifications. There are NQF Level Descriptors for each NQF level (SAQA, 2012). The NQF provides a single, integrated national framework for learning achievements, thereby ensuring an integrated system that encourages lifelong learning. It also facilitates access to, and mobility and progression within, education, training and career paths (SAQA, 2020a).

The development and implementation of the NQF is overseen by the South African Qualifications Authority (SAQA) that reports to the Minister of Higher Education, Science and Innovation (MHESI) through the Department of Higher Education and Training (DHET). The NQF is organised into three distinct, but integrated, NQF Sub-Frameworks, each overseen by a Quality Council, namely:

- the General and Further Education and Training Qualifications Framework (GFETQSF), overseen by Umalusi;
- the Higher Education Qualifications Sub-Framework (HEQSF), overseen by the Council on Higher Education (CHE), and
- the Occupational Qualifications Sub-Framework (OQSF), overseen by the Quality Council for Trades and Occupations (QCTO).

The Quality Councils report to the DHET and Department of Basic Education (DBE) respectively[38]; SAQA coordinates the three NQF Sub-Frameworks. However, it has been found by ASDSA SDPs that the NQF is not understood by the learners, companies, and many SDPs in its ambit. It is also not properly understood by the workforce, in particular, as workplaces do not necessarily have access to this information. Qualifications and part-qualifications are duplicated across the QCTO and SETAs. There is also a lack of quality in education in some sectors, or a variation in quality in the training undertaken across the sectors, and in many cases, the providers are not held accountable for the quality. This leads to a poorly trained and skilled workforce and missed work opportunities.

Nonetheless, the NQF provides an opportunity to educate the workforce, business, and SDPs, as the NQF merits far outweigh the challenges. What is required is to ensure accountability and to upskill the providers and companies to understand the system and utilise it to its full capacity. There must be accountability for those not holding themselves to higher standards. Greater monitoring and accountability of the landscape will support the development of a well-educated workforce to assist in the growth of the economy.

Phenomenological account of an ASDSA member's experiences

The experiences of a member of ASDSA are described in Box 1.

[38] Umalusi reports to the DHET and DBE for different aspects of its work; the CHE and the QCTO report to DHET.

Box 1: ASDSA member's experiences

Skills development journeys take many shapes and forms. Although ASDSA [operates in the context of the South African NQF] … its challenge is that many learners are not educated enough in how the qualifications framework underpins a learning pathway. Most employees gain their knowledge through work experience and have no formal qualifications to underpin this experience. At the beginning of the ASDSA member's working career, and throughout her working career, the only opportunities she had to learn were [in the course of learning] as she worked. In addition, the company she worked for offered short courses that were paid for as a means for her to improve her competence. The challenges are that many people do not get the opportunity [to learn], as they are not in positions in the company that allows for learning and development. Through her experiences, the employee in question learned that the NQF is a robust system that is supported by the Quality Councils, by SAQA and the SETAs, as well as learning and development and skills development specialists. The member opened her own company in 2013, undertaking consulting and training in occupational health and safety. The experience of learning how to be a compliant small business and accredited training provider was a long and difficult procedure. There are a number of requirements that have to be met before becoming an accredited training provider. The company has to be registered and comply with all the relevant laws and regulations for the industry. It must also have subject matter experts with the required skills and experience to deliver, assess and moderate the training in order to be registered with the Education, Training and Development Practices (ETDP) SETA. It took the member around three years to get the accreditations and registrations required for the courses that the company had targeted. The member regards the experience as an exceptionally large learning curve for a small business owner. Through the experience, she became aware of ASDSA and the reason why she is involved in the professional body's activities on a voluntary basis, is to assist others in resolving the systemic issues she experienced. The member's first accreditation for three-unit standards[39] was with the Services SETA. It took nine months and involved considerable financial costs. She has since extended her scope to CETA, Transport Education and Training Authority (TETA) and the QCTO. This box shows an example of the realities that are part of the context in which organisations are adapting to the 4IR.

LOCAL GOVERNMENT SETA PARTNERSHIP WITH ASDSA

The phenomenological account of the HR development journey of an ASDSA member provides a reflective lens to understand the strengths and weaknesses of the skills development system. The role of the SDP is critical to supporting skills planning and implementation of skills development within the workplace and across all sectors. As noted, SETAs have a supportive function to facilitate skills planning and skills development within respective sectors. As such, the capacity of SDPs and HR development is instrumental in the *implementation* of skills development.

[39] Unit Standards are legacy (old) part-qualifications that have been superseded in the context of the NQF Act, however, there are still Unit Standards on the NQF for recognition purposes as many current learners and workers possess these part-qualifications.

The Local Government Sector Education and Training Authority (LGSETA) is one of the 21 SETAs in the country mandated to facilitate skills development in their respective sectors in accordance with the regulations, as outlined in the Skills Development Act (Republic of South Africa [RSA], 1998). In the case of the LGSETA, the focus is on supporting skills development in the local government sector, which includes 257 municipalities (local, district and metropolitan), and local government organisations and entities that are paying levies to the SETA. Local government plays a pivotal role in ensuring that service delivery to citizens is achieved. The LGSETA's main role is to facilitate skills development aimed at supporting local government to achieve its five key objectives as outlined in Chapter 7 of the South African Constitution (RSA, 1996).

Partnerships play a key role in enabling the success of any SETA. Successful partnerships help to create the synergies needed to support skills development initiatives that are aimed at better-utilising resources, maximising strengths and capabilities, and creating greater impact in the sector in a collective manner (LGSETA, 2020:56). The South African Local Government Association (SALGA)[40] has also highlighted that municipalities need to learn to manage skills development collaboratively as opposed to the outdated compliance-driven centralised approach that is not working (SALGA, 2018 as cited by LGSETA, 2020:47).

The LGSETA established a partnership with ASDSA. The partnership between the LGSETA and ASDSA has evolved over the last five years. Over the last two years, the focus of the partnership has been to support 155 municipal skills development facilitators or practitioners to achieve one of the three professional status designations. To date, 22 designations have been conferred on successful candidates. This initiative has helped stakeholders to recognise the important role played by skills development practitioners in the local government context.

LGSETA and the 4IR

At the same time, there is continual pressure to deliver services; municipalities need continuously to adapt to change, which means embracing technology that encourages learning and new ways of doing things. The 4IR is a catalyst to transform the way

[40] The role of SALGA is to represent, promote and protect the interests of local government and to raise the profile of local government, amongst other objectives.

organisations, including municipalities, operate and it requires these organisations to be flexible and adaptable to address new challenges and identify opportunities.

The 21 SETAs in the country have identified the five main change drivers that influence the different economic sectors under their jurisdiction, either positively or negatively (DHET, 2020:16). These five change drivers comprise technology, the economy, legislation, politics, and competition, with technology being the most dominant in the context of 4IR.

As part of the research conducted to develop the Local Government Sector Skills Plan, the LGSETA included a question on the identification of the forces driving changes in technology due to 4IR so that municipalities/organisations could identify the relevant skills needed over the next two years. The interview sample for local government stakeholders, which addressed part of a request by the DHET, included three metropolitan-, five district-, and eight local municipalities as well as two local government entities. The data from the interviews were used to validate or identify changes to the existing skills change drivers that form part of the chapters of the Sector Skills Plan. The top six changes in technology were reported by 18 employers to be:

- Basic Digital Platforms;
- Internet of Things (IoT);
- Big Data;
- Cloud Computing;
- Cybersecurity; and
- 5G technology.

In addition, data analytics and HR analysis, Artificial Intelligence, 3-D printing, virtual reality (VR), automation and robotics, and augmented reality were other future skills identified. Collaborative initiatives with different stakeholders can promote and enable better support and implementation of skills development. The roles of ASDSA and the SETAs are vital for ensuring that the appropriate skills are available for the rapid changes ahead as outlined in the next section.

IMPACT OF 4IR AND COVID-19: THE IMPERATIVE OF RESTRUCTURING THE SKILLS DEVELOPMENT SYSTEM

The 4IR and Covid-19 have forced the world into new realities, a ‘new normal’, that demands the re-examination of many long-held beliefs about work and the interactions between colleagues in virtual ‘offices’. The changes also demand a rethinking of ingrained beliefs around preparing the workforce for a new world of work.

This section of the paper focuses on the post-school skills development system for occupation-directed training, in the ‘new workplace’. It suggests some of the changes needed to prepare current and future workforces for the new world of work.

Why the skills development system must be restructured for the 4IR economy

If the main features of South Africa’s post-school skills development system are analysed in the context of the pandemic and the 4IR, there are indications that the system is failing to prepare the workforce for the new world of work. For example, Clem Sunter (2015:para. 5) warned that “we are still preparing students for the market that prevailed fifty years ago, educating students for the job market of the middle of the last century”.

The occupations on the Organising Framework for Occupations (OFO) form the central pillar of the skills development system in South Africa (DHET, 2020). The OFO is a coded classification system that aims to encompass all occupations in South Africa. It is used by the DHET as the key tool for identifying, reporting and monitoring skills demand and supply in the South African labour market (Government Gazette. No 43062:11-12). The OFO is used for:

1. collecting information on skills needs in the sectors of the economy by requiring employers to provide information annually in the WSPs and ATRs on staff profiles, training needs and training delivered per OFO category;
2. compiling the sectoral and national lists of occupations for which employers find it hard to recruit staff;
3. developing qualifications for specific occupations as well as specialisations in occupations;
4. the quality assurance of training delivery; and
5. determining funding priorities.

Some of the challenges of using the OFO within the context of the changing nature of work and the workplace are described below.

- The OFO may not be the most appropriate tool for planning skills priorities for the world of work that is fundamentally changing, primarily driven by the 'disruptive technologies' of the 4IR. The OFO is not designed to encompass the new types of jobs that are less structured, less permanent and continuously changing.
- The emerging jobs, especially of workers in non-traditional, ground-breaking companies, often have fewer formal job titles that relate to innovation and creative disruption – and the work done within these jobs may be only vaguely related to the job titles, which may or may not be included in the OFO. New occupations emerge, mutate and/or disappear completely before HR departments have an opportunity to develop job descriptions, and the occupations can be listed on the OFO.
- The difficulty that employers face in matching their job titles to the OFO occupations is likely to increase as occupations become more fluid. Therefore, the current skills planning to stimulate economic growth may be based on inaccurate and incomplete information – and more importantly – the truly scarce skills needed for the 4IR economy may not be included in sectoral and national skills strategies and plans.

Workplace skills planning

The WSP mechanism may not be ideal for collecting accurate and reliable information on the skills needed across the sectors of the South African economy, for the following reasons. Firstly, employers submit this document annually to the SETAs as part of their applications for mandatory grants. It is a time-consuming process that requires the employers to provide the demographic information and skills needs of all staff members per OFO occupation. As this submission is not mandatory, smaller organisations do not submit it as the cost of compliance considerably outweighs the possible financial benefits. Therefore, SETAs may miss the skills of the emerging, innovative 4IR organisations, which are likely to be the driving forces behind initiatives such as the Googles, Teslas or Facebooks of South Africa's competitive economy. In addition, the data SETAs receive may not always be reliable as employers have to report against the OFO occupations that do not always relate to their organisations' job functions.

Secondly, SETA funding for occupation-directed training is almost exclusively allocated to programmes leading to full- or part-qualifications registered on the South African NQF and – to a minor extent – shorter accredited skills programmes. Many of the qualifications were developed for specific OFO occupations five or more years before the present, so they may no longer address current needs.

Work placement

Most of the occupation-directed qualification programmes in South Africa include placement in a workplace as an integral part of the qualification to enable learners to apply their learning in actual workplace contexts. However, a substantial percentage of learners – especially those in areas far from the urban centres and poor communities – do not find work placements to complete their qualifications. This situation may be exacerbated by the Covid-19 pandemic and its economic consequences for the country. Employers may not be willing to take in and support learners after this epidemiological and economic crisis.

Focus on large employers

An unintended consequence of the current skills development system is that it mainly benefits large companies and public entities. As noted, these organisations have the staff needed for compiling WSPs, supporting training in qualifications for their staff and/or unemployed learners, providing workplaces for learners, and the time-consuming processes of engaging with the SETAs. It was also noted that the smaller, innovative 4IR-driven businesses generally do not have the extra staff to do this work; consequently, the skills development system lacks sufficient input from these smaller businesses.

The power of small businesses is critically important for the economy, as the following excerpts show:

> The real power of a successful economy does not lie in big corporates but in the thousands of small businesses led by entrepreneurs (Land, 2018:para.1).

The estimate is that,

> Small and medium-sized enterprises (SMEs) make up 90 per cent of formal businesses; contribute roughly 34 per cent towards Gross Domestic Product (GDP), and provide employment to about 60 per cent of the labour force (Land, 2018:para.2).

A 2018 study by the Small Business Institute found that about 250 000 Small, Medium and Micro Enterprises (SMMEs) constituted 98,5% of the number of formal firms in the economy and accounted for 28% of formal jobs in the economy (Vuba, 2018).

What needs to change?

Six aspects of the system need to change if the requirements of the 4IR context and recovery from the pandemic are to be achieved.

Enabling 4IR and smaller businesses

In view of the challenges of the 4IR, the skills development system needs to accommodate the skills needs of innovative 4IR businesses, SMEs and SMMEs. These organisations are generally more loosely structured and less permanent than their larger counterparts; the training of their staff does not qualify them for SETA grants; and – most importantly – their skills needs are not addressed through the registered qualifications and part-qualifications currently registered on the NQF.

Revisit the use of the OFO

There is a need to evaluate whether the OFO is an appropriate instrument for collecting information on skills needs, and for developing qualifications for very specific occupations. This evaluation should include an objective, external review of the occupational qualifications model of the QCTO. This model has resulted in the proliferation of qualifications, which are developed for occupations on the OFO. For example, separate qualifications have been registered for bus, taxi, train and truck drivers, and there are six qualifications for footwear machinery operators[41]. However, some of the jobs for which occupational qualifications have been developed may be replaced by robots.

Consider other qualification models

It is recommended that during the review of the skills development system, the QCTO should consider engaging with stakeholders on how to deal with the 'legacy qualifications' to ensure that elements of these qualifications that could still be relevant to employers are retained.

[41] See a list of registered qualifications on the QCTO website: https://www.qcto.org.za/about-us/vacancies/registered-qualifications (Accessed 20 July 2020).

An alternative qualification model that could be considered is one that includes a generic core together with elective streams in different specialised areas. This model was used for qualifications that are still registered on the NQF, such as the National Certificate: Generic Management (SAQA ID No. 59201). This qualification has generic core, and entry-level management requirements together with electives for the unique requirements of the banking, mining, security and other work contexts. The core of such a model could cover the 4IR skills that will be essential across industries, alongside electives relating to different industries, thereby reducing the number of qualifications and making the qualifications more relevant to the 4IR work context.

Rethink the skills planning process

Anecdotal evidence suggests that the WSP is too cumbersome to complete and that the information it produces may not be reliable or verified and might not reflect the skills needs of all types of businesses – and especially not those of 4IR or other smaller businesses. The more information employers are required to submit in the WSP, the greater the chance of resistance to completing the extensive reporting required, or employers completing it thoughtlessly for compliance sake. A simplified needs analysis – not based on OFO occupations – should ask essential questions on skills needs, and the plans to address the needs, such as: 'What skills does your organisation need now and in the foreseeable future? What training or other types of learning will develop these skills? How can the SETA assist the industry to develop those skills? What funding incentives will help the industry to be more competitive?'

Address the problem of work experience in qualifications

The QCTO model of Occupational Certificates includes compulsory work experience modules with knowledge and practical skills modules. While all three relate to components of competence, the work experience modules are an obstacle to learners who cannot find employers where they can complete these modules. This is especially problematic in rural areas and small towns where there are limited work opportunities, particularly in the specific occupations for which these qualifications are developed, e.g., Solar Photovoltaic Service Technician, Chemist (Surface Coatings Technologist), Electrical Substation Operations

Technician (Power System Controller) and Wind Turbine Service Technician.[42] The result is that thousands of learners remain partly qualified and still unemployed. As businesses reduce staff, streamline processes and focus expenditure on survival strategies, or close down due to the lockdown, there will be even less work placement opportunities for learners to complete their studies.

The integration of learning and work will become even more important in the 4IR world of work. Therefore, appropriate models will have to be explored. However, these models should not, in our view, include work experience *inside* qualifications as this qualification model poses particular challenges for learners within the South Africa context when they have difficulty finding employers with which to complete the work experience modules.

Work with industry leaders

In restructuring the post-school skills development system, policymakers in the DHET, the QCTO and the SETAs should engage with industry leaders and professional bodies to make the changes necessary to prepare the workforce for the 4IR economy. This will require rethinking the assumptions and ingrained beliefs underlying the current system, exploring new paradigms and models, and restructuring the skills development system so that it is fit for purpose to prepare the current and future workforces for the rapidly changing, unpredictable world of work.

CONCLUSIONS

This paper provided an overview of the experiences of ASDSA and its members, particularly the SDPs, in facilitating and advancing TVET in South Africa. In particular, it has gone into depth about how 4IR and Covid-19 are disrupting the traditional and standard models of training and education. It points out that Covid-19 has accelerated the changes brought about by 4IR and spells out steps that need to be taken as a matter of urgency to make sure that South Africa has a competent and appropriately trained labour force.

[42] See registered qualifications on the QCTO website: https://www.qcto.org.za/about-us/vacancies/regsitered-qualifications (Accessed on 20 July 2020).

The nature of ASDSA's work brings it into close contact with many of the SETAs in the country. In the process, it has developed a close working relationship with the LGSETA. The article provides a brief glimpse of this partnership and the advantages that come with it.

From a bird's eye view of the whole PSET sector in South Africa, we have found that the system is full of complexities and shortcomings. The eight most significant PSET systemic challenges, in our experience, are highlighted below.

1. On the one side, DHET is responsible for overseeing the whole PSET system, whilst on the other side, SAQA is mandated through legislation to coordinate the three NQF Sub-Frameworks. Currently, all the PSET-related statutory agencies are established by one or other Act (including SAQA, CHE, QCTO, UMALUSI, National Skills Authority [NSA], SETAs) and are independent of each other and operate in ways that best align to their organisation's vision, mission, and goals. However, there is greater need for ensuring the system can be better navigated and accessed to address socio-economic issues as well as implementation issues relating to the PSET system's complexities and inconsistencies.
2. The QCTO *qualification model* is still not gaining real traction in the *non-trades* space. On the other hand, the SAQA Unit Standard model (incorporating Fundamental, Core, Elective and Critical Crossfield Outcomes) is continuing to hold its own in this space, despite being a legacy model.
3. The QCTO is expected to take over all matters related to quality assurance from the SETAs. But SETAs have built up substantial quality assurance competencies and have the necessary funding and resources to continue to operate *in close collaboration* with the QCTO.
4. SETAs are set up to serve an economic sector; however, they must also take note of and work to resolve the real skills needs of *unemployed people*. The public Community Education and Training (CET) Colleges and good non-government organisations (NGOs) serving this community's critical skills development needs, must be given all the support to make a real and significant impact.
5. In the PSET system, the classroom is no longer the primary space where learning takes place (Covid-19 fast-tracked this change). Future classrooms may be primarily online (or involve blended learning) and, in the workplace (or simulated workplace).

The regulations relating to *models of delivery* need to be adapted to address this new reality.

6. Up to now, organisations with turnovers greater than R50 million have been the entities best able to maximise SETA grant funding. This is not the case at all for smaller operations that can grow rapidly. The latter simply do not have the resources to cope with the bureaucracy and effort required to access the funds. Policy and regulatory changes must be made to turn this around.

7. One of the South African PSET's greatest assets is the National Learners' Records Database (NLRD), because it holds records of, "Quality Councils; NQF Sub-Frameworks; qualifications and part-qualifications (including unit standards) registered on the NQF; accredited quality assurance bodies and their accredited providers; registered assessors; and individual learners and their achievements (SAQA, 2020b:para.1). The NLRD provides decision-makers with comprehensive information, especially in the fields of labour market trends and education and training, as well as proof of qualifications obtained by individuals in South Africa" (Ibid.). Unfortunately, the NLRD is not given the support it needs for all the provider entities that must do the data uploads, to become a really useful data source.

8. The role of fully operational and established professional bodies recognised by SAQA and the associated designations (often confused with qualifications) is not universally seen as a core part of the PSET system.

In conclusion, the country faces immense challenges in the provision of sufficient quality technical and vocational education and training. It is hoped that this article has provided an insight into how ASDSA is doing its best to make a contribution to deal with the challenges.

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PAPER 11

Preparing Chartered Accountants who are Fit for Purpose in the Fourth Industrial Revolution (4IR)

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ABSTRACT

The changing roles of Chartered Accountants (CAs) in the world of work and the impact of technology have come to the fore. Professional accountancy bodies are aligning their competency frameworks to reflect the skillsets demanded by the Fourth Industrial Revolution (4IR). Digital skills needed by CAs are being challenged to the point where CAs' future usefulness is being questioned. The study on which this paper is based used a qualitative research method through semi-structured interviews with various stakeholders (such as assurance providers, technology experts, futurists and executive management) to investigate the digital skills needed by CAs to remain relevant in Industry 4.0. The findings indicate that digital skills such as data analysis, interpretation and visualisation, modelling and coding skills, the use of new technologies (including blockchain, robotics and Artificial Intelligence [AI]) as well as a digital mindset, are critical to remain relevant. Not developing these skills, could result in CAs becoming unfit for purpose.

INTRODUCTION

Competence is a highly prized currency in the contemporary professional accounting context. Professional accountancy bodies are aligning their competency frameworks to reflect the skillsets the Fourth Industrial Revolution (4IR) needs (American Institute of Certified Public Accountants [AICPA]), 2015; Association of Chartered Certified Accountants [ACCA], 2016; Chartered Global Management Accountant [CGMA], 2019). The 4IR, including the physical hardware that supports cyber systems, and the Internet of Things and cloud computing (Richins, Stapleton, Stratopoulos and Wong, 2017), and chartered accountants' (CAs') digital skillsets are being challenged (Birt, Wells, Kavanagh and Bir, 2018) to the point where CAs' future usefulness is being questioned (Borthick and Pennington, 2017; Moll and Yigitbasioglu, 2019)[43].

[43] The term 'accountant' in this paper refers to all accountants in general, while 'chartered accountant' or 'CA' refers to an accountant with a professional designation who meets all the requirements to retain this designation.

The impact of automation on the work of CAs is intensifying and accelerating (Bellman and Göransson, 2019; Huang and Vasarhelyi, 2019; Kokina and Davenport, 2017): they will no longer primarily act as 'score-keepers'" and 'number-crunchers'. Traditional accounting functions, such as preparations for tax submissions and most aspects of financial reporting will undergo radical reshaping (CGMA, 2018a) as they evolve into integrated consultative functions that support value-based decision-making (CGMA, 2018b; 2018c). Automation and smart software systems (such as cloud computing) are replacing clients' current work methods, and CAs are increasingly using sophisticated smart technologies (e.g., data analytics, robotics, Artificial Intelligence [AI] and Blockchain) to enhance their traditional methods (Birt et al. 2017). The use of Big Data, statistical analysis and mathematical modelling (all computer-based) (Appelbaum, Kogan, and Vasarhelyi, 2017) present many opportunities for businesses, but their accountants need advanced digital skills to generate value from these technologies (Richins et al. 2017).

Against this background, the following question became compelling: What are the digital skills that CAs need to remain fit for purpose in an 'Industry 4.0' world?

The study, which is the focus of this paper, followed a qualitative research approach in addressing the aforementioned question. It used data gathered from 44 interviews with informed individuals about changes they saw as essential for CAs' future skill sets. The contribution of this study lies in its practical value: accounting professional bodies, practitioners, educators and trainers could use the findings to refine their programmes to ensure that CAs obtain the digital skills and mindsets required to retain their relevance to 4IR entities.

The remainder of the paper is structured as follows. The next section highlights CAs' need for digital skills. Thereafter, the data collection and analysis methods are described, and followed by a discussion of the findings. The paper concludes with the identification of areas for future studies.

NEED FOR DIGITAL SKILLS

Competence is commonly viewed as the ability to perform a role to a defined standard, within the working environment (International Accounting Education Standards Board [IAESB], 2015). Professional accounting bodies already acknowledge that the future roles of accountants will be significantly different from their present roles and various professional accounting bodies have already refined their competency frameworks to emphasise digital skills; Moll and Yigitbasioglu (2019) synthesise this literature.

The accelerating digitisation of accounting functions (more advanced enterprise resource planning [ERP] systems, increasing use of online transactions and the cloud, and exponentially increasing use of data [AICPA, 2015]), means the demand for accountants (and CAs) with digital skills is growing (Birt et al. 2017). These professionals need enhanced analytical skills, including the ability to handle both structured and unstructured data (Cao, Chychyla and Stewart, 2015; Vasarhelyi, Kogan and Tuttle, 2015), select appropriate analytical tools and interpret the results (Huerta and Jensen, 2017). Thus, CAs need Big Data competence: this includes a deep understanding of the data; creativity and insight to appropriately interrogate the data; and the ability to use data science applications including Big Data analysis, business intelligence and text and process mining (Griffin and Wright, 2015; Huerta and Jensen, 2017; Richins et al. 2017). The ability to use Big Data visualisations proficiently can reveal useful patterns and provide increasingly valuable information to inform decision-making (Rose, Rose, Sanderson and Thibodeau, 2017). When deciding on the appropriate type of Big Data to use, CAs also need to assess the risks associated with Big Data repositories and evaluate the legal and commercial consequences of potential breaches (Huerta and Jensen, 2017).

Big Data and cloud computing facilitate the use of AI, offering great cost reductions (Bellman and Göransson, 2019; Huang and Vasarhelyi, 2019). AI is increasingly being seen in business systems, evidenced in decision-making intelligence and predictive behaviour (Kuenkaikaew, 2013). Accountants are already using business intelligence and visual analytics to communicate analysis results, and by using hypothesis-based predictive analytics, they can predict the likelihood of financial events (Kokina and Davenport, 2017). Routine accounting tasks that require minimal professional judgement are already being automated, and with improvements to AI systems, the complexity of automated tasks will increase, thus challenging the relevance of CAs in the future (Huerta and Jensen, 2017, Moll and Yigitbasioglu, 2019). Robotic process automation (RPA) automates tasks according to sets of rules that are in line with the business processes (Bellman and Göransson, 2019). These ‘robots’, consisting purely of code, can perform humans’ tasks and with the addition of AI, RPA can be developed into intelligent process automation (IPA) that performs both the analysis of unstructured data and higher-order decision-making tasks (Bellman and Göransson, 2019). Although future CAs might not necessarily need to be proficient in programming language, they will be dependent on RPA, and should, therefore, have a general understanding of code structure.

Blockchain, regarded as “a type of distributed ledger technology where multiple copies of the same ledger are shared among the members (nodes) of a large network” (Moll and Yigitbasioglu, 2019:7) makes data intrinsically reliable and verifiable in real-time (Rozario and Vasarhelyi, 2018). While Blockchain systems have great potential for accounting because they can operate largely autonomously (Dai and Vasarhelyi, 2017), their uptake is “slow and steady” and they are not yet considered disruptive (Moll and Yigitbasioglu, 2019:7).

In all, the current literature supports the view that accountants need to demonstrate digital skills (e.g., Huerta and Jensen, 2017) and amplifies calls for research “to determine the new skills and competencies accountants may need to master to remain relevant and add value” (Moll and Yigitbasioglu, 2019:1). The study on which this paper draws is a response to this call.

RESEARCH METHOD

A qualitative research approach was adopted for the study, which forms part of a comprehensive research project tasked with revising the competency frameworks of the South African Institute of Chartered Accountants (SAICA) and the Independent Regulatory Board of Auditors in South Africa (IRBA). Ethics approval (for the comprehensive research project) was obtained from the university conducting the research. Interview participants were selected purposively and invited to share their perceptions of the digital skills that future CAs will require, amongst other issues. Participants represented multiple stakeholder views (refer to Table 1) (ensuring triangulation) and were identified by the SAICA and the IRBA.

Table 1: Participant information: Categories and the number of participants

Categories	Description	Number
Assurance providers (AP)	Big 4 partners	6
	Non-Big 4 partners	10
	Auditor-General South Africa	4
Technology experts (TE)	Technology experts in business, also working in consulting divisions of audit firms	7
Executive and high-level management (EM)	Financial services	4
	Other industries	4
Futurists (F)	Individuals with a speciality or interest are futurology	2
Academia (A)	Private and public higher education institutions	3
Other prominent figures (OPF)	Governance experts	4
TOTAL		44

Forty-four (44) interviews, lasting approximately an hour each, were held between November 2017 and November 2018. All participants gave their consent to be interviewed (their anonymity was assured); interviews were recorded, transcribed, and checked; and transcriptions were then reviewed by the participants.

The interviews were semi-structured and based on questions informed by a review of the relevant literature and feedback received from the steering committee of the comprehensive research project. The lead researcher analysed the interviews (using Atlas.ti qualitative data analysis software) and the analysis was independently reviewed by the other authors.

FINDINGS AND DISCUSSION

In answering the research question (*What are the digital skills that CAs need to remain fit for an Industry 4.0 world?*), three themes emerged from the data: (1) the role of CAs in the changing business environment; (2) technologies impacting the work of CAs, and (3) digital skills for CAs. The discussion of the findings addresses each of these themes.

Theme 1: The role of CAs in the changing world

Participants generally agreed that the business world is changing. They recognised the disruption caused by 'the whole digitalisation of the world' (TE), 'the fact that everything is run off the cloud' (TE), the 'hype about Big Data' (AP), and the 'emergence of Blockchain and similar technologies' (AP). The statement 'it's all about IT' (TE) succinctly summarises participant thinking. The literature confirms that automation is already impacting CAs' work (Bellman and Göransson, 2019; Huang and Vasarhelyi, 2019; Kokina and Davenport, 2017). One participant cautioned that 'people talk of disruption and digital as though it is something in the future, but it's here already' (EM). An assurance provider participant illustrated this acceleration: 'At our world cup in 2010 not a single photograph was taken on an iPhone'.

All participants realised that 'machine learning will also start encroaching on the world of CAs' (EM) as 'a lot of work' (EM) usually done by CAs is already automated, and the trend will continue. Birt et al. (2017) report that accounting functions have been impacted by the automation offered by machine learning systems; and businesses are increasingly leveraging robot/ bot-technologies to perform calculations and data analyses. Some participants illustrated the current automation of their accounting work: 'you could have snapshots of your income statement or your financials every day' (TE); 'the push of a button pull[s] everything from the bank directly into a system … capturing a bank recon one by one line item … will disappear' (EM).

Participants thus acknowledged that for CAs to retain relevance, their (CA) roles need to change, ('you'll have to outsmart the machine' [EM]), which supports the view of Birt et al. (2017). In addition to demonstrating that CAs still 'have a strong understanding of finance, accounting and reporting … and risk and governance' (EM), they must also have 'the ability to assimilate information', be 'future-oriented', 'understand data, trends and themes', and be able to 'digest that [data analysis] to help an organisation navigate through complexities in businesses' (EM). Emphasis will increasingly be on an ability 'to still interpret that [information] and then explain [it] to people' to influence their decision-making (EM). A CA needs to become more strategic (EM), he/she has to 'help people look at the complexities and simplify them', to inform decision-makers on 'taking that [business] forward' (EM). This corresponds with recent professional literature claiming that new data sources and analysis methods, and cognitive computing, will assist accountants to interpret information and influence others more effectively (e.g., CGMA, 2018a). Another EM participant linked CAs' knowledge of 'financial data and the importance of historical data' with newer skills to get 'the history [to] tell us about the future' and analyse its implications for the future. CAs will be key 'to get the systems in place … make sure the system generates the correct data in the correct format and according to the correct legislation, and then from there, the CAs will be used to interpret that information in making decisions' (EM).

Theme 2: Technologies impacting the work of CAs

The second theme emerging from the data relates to technologies impacting the work of CAs, such as cloud computing, robotics, AI, bitcoin and cryptocurrencies. These technologies are all related through their reliance on Big Data. The following discussion highlights participants' views.

A futurist participant observed that 'financial data [are] arguably the most important data in the business … [these are] the data that tells you that the other data [are] correct' and therefore 'CA's of the future should be extending themselves beyond the financial sphere'. This participant viewed CAs as 'data scientists within the business', the 'custodians of the data, [and] data integrity, and also making sense of the data' (F). An executive/ management participant believed that CAs are 'technically very strong' and when they 'can use exponential technologies to do scenarios' they will be able to 'guide the [direction] of business', thereby adding value and influencing decision-making. Accountants, already well-positioned to analyse financial data, are, as automation increases, expected to analyse data with greater insight and understanding (Borthick and Pennington, 2017).

The use of cloud computing (especially its ability to make vast quantities of data readily accessible) has become common in business and gives accountants the "horsepower they need to crunch data with cognitive tools" (Kokina and Davenport, 2017:116). Nevertheless, cloud computing highlights the need to address 'how data will be maintained, how regulations of different jurisdictions will be followed and how infringements will be prevented and detected' (AP). An executive/ management participant illustrated the pervasiveness of cloud computing, pointing out that 'when you are on your phone right now you are in the cloud … every website you visit, everything you do … you have given me access [to your data] … by actually just logging into my Wi-Fi' (EM).

Kokina and Davenport (2017) believe that the accounting function is likely to be enhanced rather than replaced by technology. While a few participants were more pessimistic about the future of CAs, most participants were optimistic. Participants recognised that robotics is already impacting CAs' work, taking 'hours out of an accountant's day' (TE). However, robotics is not seen as a long-term solution, but rather a short-term solution as '… it is helping bridge the gap until you get to the bigger Blockchain' (TE). Thus, 'an accountant [who] has to [consolidate] information from five or six different places' can … 'click a button and the robot does that in two seconds now, where it used to take the guy three, four hours' (EM). There was consensus that 'from an accounting perspective the bookkeeping angle is a good place for AI' (F). Participants thus believed that AI, 'when we tell machines what we would have done, and then the machines just copy us' (F), has the potential to disrupt CAs' work, especially 'where things … are run on specific rules' (F). According to Bellman and Göransson (2019), the technology is in place, but businesses still need to increase the functionality of these advances within AI to effect a complete digital disruption.

Some participants believed that 'Blockchain will become more relevant' (TE), a notion which is in line with the literature (Dai and Vasarhelyi, 2017). An executive/ management participant believed Blockchain 'will evolve' and be used in a 'different form, eventually, that will be more regulated than what it is allowed currently'. Another participant illustrated the wide applicability of Blockchain, thus: 'title deeds, property ownership, all of that stuff will be done by Blockchain where you can't really fool the system. If it says you own it, you own it … [Department of] Home Affairs, passports, all of that stuff is going to land upon Blockchain technology'. Furthermore, 'in a world where machines talk to machines, you need new programmable and automatable money' (EM). And this paves the way for the general use of cryptocurrencies as 'the technology is there; … and if cryptocurrencies replace currencies, it will have a significant impact on business and the work of CAs' (AP).

Theme 3: Digital skills for CAs

The third theme, namely the digital skills CAs require, is closely related to Themes 1 and 2. In general, participants supported the following comment: 'The skillset of the CA has probably [be]come narrower compared to what the business environment today demands' (AP). There is a growing demand for accountants with advanced technical knowledge and skills (Birt et al. 2017) and analytical skills (Huerta and Jensen, 2017). Even at entry-level, employers now demand that their accountants have analytical skills (Borthick and Pennington, 2017). Digital skills enable CAs to move outside of their traditional functions and deal with data, using modelling and coding skills. In the context of lifelong learning, such foundational skills will facilitate the mastering of new technologies that are still in development within businesses (Bellman and Göransson, 2019; Dai and Vasarhelyi, 2017).

Prior studies show that accountants are already using advanced technology and data analytic skills (e.g., Pan and Seow, 2016; Sledgianowski, Gomaa and Tan, 2017). Participants' views on digital skills for CAs are summarised in Table 2.

Table 2: Digital skills for CAs

Skill	**Participants' views – illustrative and representative quotes**
Dealing with data, analysis, interpretation and visualisation	'[It] deals with the whole way that you access data, process data, analyse data and make decisions around that' (EM). 'Understanding what's meta/Big Data … you must define all those things, but with a relevant practical understanding of the business' (EM). 'You've [a CA] got to be able and proficient and comfortable with big volumes of data. So you need to understand how to look at all those data and analyse it, interpret it, make the best use of it' (TE). 'It's identifying patterns and correlations in data and why they produce these particular patterns' (TE). 'It is what you do with that information … [identifying] data correlations and patterns and process flows is going to be an important skill rather than simply running an analytic' (AP). 'The use of data, data analytics … all of these kind of concepts need to be understood by a CA' (ME). 'I take history for example: anything that you want to know you can Google within a couple of seconds, but it's analysing historical events which lead to a certain outcome. So if you take that, you can apply that to anything: so analyzing is more important … critical thinking and analytics they go hand in hand' (EM). 'CAs in the team could focus on financial analyses, business case development, creating tools for the rest of the finance team' (AP). 'Data visualisation, data interpretation, because that is what it is in every context of every emerging technology; you are going to have to understand that' (TE).
Modelling skills	'The other one [skill] is stats, you know; so regression analysis is actually a lot of AI. AI is actually just the clustering of data. How is that a cluster and that [is what a] programme does, but's actually

	you would then want to know its correlations, to know if it's relevant or not' (TE). 'It's up to a CA to define what analytic model should look like and it's up to a machine to punch out that model in a matter of seconds' (EM). 'Predictive behaviour of impairments and the impact on the bottom line and the ability to model so that we can manage our risks better, so risk management is also a big piece that CAs now need to consider' (EM). 'I think that CAs need to have the competency to understand what algorithms are doing which are most likely written in Python and R' (TE). 'A mathematical piece … how do you interpret and use data more is having maths skills, and again it doesn't need to be proficient at an algorithm or what kind of maths but it's almost like a language … how do I interpret that and giving me the skill to do that' (TE).
Coding skills	'I think if a CA qualifies and cannot do basic coding - I don't think that CA should qualify' (AP). '[Understanding] Python, R, (capital R) which is a language; those are both data science languages' (TE). 'The coding that I talk about is not going to write new computer games (which is the most complex coding); I am talking about being able to build business queries, being able to go into a database, take a data set, write a basic piece of code to analyse that data properly, to understand why has our sales changed. I've got the answer and then the CA can then contribute to say, operationally, this is what I am seeing in the data; financially, that is what I am seeing in the data: let's bring the two together' (AP).
Technologies: - Cloud computing - Robotics	'I would encourage at least an understanding of cloud computing' (ME). 'Ask the right questions about cyber and its risks … securing data, cybersecurity, POPI [the protection of personal information], all of these kind[s] of concepts need to be understood by a CA' (ME).
	'We are recruiting people who don't come with auditing

- AI	background, to help us understand the technology. So I think this is where it's going to go. The specialisations are going to come in, data specialisations, analytics specialisations, how to get data visualisation, robotics, understanding the application of technologies, that's where the world is going to go' (EM).
- Blockchain - Visualisation	'AI is statistical data clustering … I've got to know just a bit about the statistical correlation' (TE). 'AI capabilities or Big Data and all of that - we are going to have to refine our own skills around and understanding our confidence around these systems' (AP).
	'To teach somebody a specific technology – within three to four years that technology is gone already. By the time we come with somebody's learned technology now (and it will be Blockchain in a few years' time, and it's completely different technology) but just the concept of technology and what it does and I think that is more important' (AP).
	'If we have a look at our analytics, one of the things that we've realized is the importance of visualization and trying to visualize patterns that identifies your exceptions or your issues. … [B]ecause of the proliferation of data people can get stuck into the numbers and Excel spread sheets longer than this table, but you somehow got to present that visually in a way that people understand – ok there is a problem: let me go down there and I can drill down into the data. So the visualization is such an important part of analytics' (AP).
Digital mindset	'We've got to somehow give them the skills to manage the complexity and the rapid movement in knowledge and how things are done. Now what is that? I don't know what it is. It's not just IT skills, it's a mindset skill' (OPF). 'Future CAs …will have to think differently and display a different mindset. They need to have first, a basic understanding of operating systems; second, data science; third, know how to work with structured and unstructured data (weed out outliers), and fourth, AI (AP).

CONCLUSIONS

The study on which this paper draws set out to determine the digital skills that CAs need, to remain fit for Industry 4.0. This paper includes a discussion of the changing roles of CAs and the impact of technology in their world of work. The findings of the study support the literature in identifying that future CAs will need an expanding bouquet of digital skills to remain relevant. As the governance expert respondent quoted immediately above has noted, the specific technical skills might not be as important as the mindsets that fully embrace lifelong learning as a fundamental position. The research shared in the paper has significantly contributed to the development of a revised curriculum for SAICA, as it provides guidance for developing CAs, which will be used to inform both the academic programme and the training programme (formal Learnership period)[44]. Whilst the study was not without limitations, it does provide a platform for future research, with possibly the most important direction being how these skills should be developed at university and during the formal training contract period and tested in professional examinations.

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SCHOOLING AND THE FOURTH INDUSTRIAL REVOLUTION (4IR): AN INNOVATIVE COLLABORATIVE INITIATIVE IN SOUTH AFRICA

PAPER 12

Stepping into the Future of Learning: The Sandbox Schools Initiative

Ms Cathryn Moodley

ABSTRACT

The world in which we live is in constant flux and has often been described as 'VUCA': *Volatile, Uncertain, Complex,* and *Ambiguous.* This characterisation is apt considering the rapid developments in technology, which are converging with social, political, and economic trends to create globally interconnected challenges and conditions. In light of these developments, there is increasing recognition that education systems need to equip young people with a broad range of 'competencies for a changing world' to enable their success in an uncertain future. This paper presents an overview of the conceptualisation and design of a multi-year design-based research (DBR) project in eleven primary schools. The project seeks to explore how to develop deliberately, these competencies for a changing world in the South African public-school context. The 'Sandbox Schools Project' is being implemented and researched by the National Education Collaboration Trust (NECT), in collaboration with local and international education experts. It seeks to learn on behalf of the broader education system about which practices and approaches have the potential to foster these competencies in a 'typical' South African public school. Currently in its first year of implementation, the Sandbox Project draws on literature from the learning sciences, as well as insights from practice in the South African context iteratively to design, test, and refine a set of interventions with the ultimate aim of contributing to advancing both theory and practice in relation to education for the changing world.

BACKGROUND: A FAST-CHANGING WORLD

Rapid developments in digital technology, Artificial Intelligence (AI), and biotechnology – often referred to as the 'Fourth Industrial Revolution' (or 4IR) (Schwab, 2016) – represent one facet of a world that has been described as 'VUCA': *Volatile, Uncertain, Complex,* and *Ambiguous* (Organisation for Economic Co-operation and Development [OECD], 2018). In this VUCA world, technological developments converge with interconnected social, economic, and political trends at a local and global level to create complex opportunities and challenges.

In South Africa, for example, global trends and drivers stand to exacerbate existing challenges, such as youth unemployment[45], poverty[46], and inequality[47]. These stubborn historical challenges could be intensified, rather than alleviated, by trends such as automation, urbanisation, and digitisation. The effects of these trends can be seen in the global decline in demand for skills, which can be automated or digitised – such as routine, manual tasks – and an increase for tasks that only humans can do well – such as non-routine, interpersonal tasks (Fadel et al. 2015). Research suggests that there is an existing skills mismatch between those skills employers need and those of school-leavers in South Africa (Department of Higher Education and Training [DHET], 2019). This, given the rate of change in the workplace globally, does not bode well for the future unless significant shifts are made towards more relevant education that speaks to these demands.

In addition to the shifting demands of the workplace, the VUCA world presents society with complex and interconnected social, economic, environmental, and political trends such as widening inequality, global migration, and environmental degradation (Fadel et al., 2015). These circumstances require a broad range of social, emotional, and cognitive competencies to successfully navigate and transform the world for a more just and sustainable future. In this context, there is growing recognition of the integral role that education can play in enabling young people to fulfil their individual potential and aspirations, to think critically about the world in which they live, and to participate meaningfully in society as empathetic, ethical citizens with a concern for the 'common good' (OECD, 2018). This recognition presents an opportunity for those involved in education in South Africa to address not only the contemporary demands of the 4IR but also more fundamentally and holistically to realise the transformative role that education can play in a society damaged by centuries of injustice (Perumal, 2014).

Education in a fast-changing world

The interconnected social, economic, and political challenges being experienced around the world have led to an acknowledgement that formal education systems globally are not adequately preparing young people for life after school (Fadel et al., 2015), and that schools

[45] As at the end of Quarter 1 in 2019, in South Africa, the unemployment rate for people aged 15-24 years was 55,2% and for those aged 25-34 years, 34,2% (Statistics South Africa [STATS-SA], 2019).
[46] Approximately 55.5% of South Africans live in poverty, according to Statistics South Africa's latest report. (STATS-SA, 2017).
[47] South Africa has consistently been ranked as one of the most unequal countries in the world, with a Gini coefficient of 0,63 in 2015 – the highest in the world. (World Bank, 2018).

need to foster a breadth of competencies that will enable young people to better navigate an uncertain future (Winthrop, 2018). The term ‘competency’ is broader than knowledge or skills – it refers here to the ability to mobilise knowledge, skills, attitudes and values to meet complex demands in a given context (OECD, 2018). The education required to successfully navigate a fast-changing world requires a focus on learning relevant knowledge, as well as a deliberate focus on fostering other dimensions of education – such as skills, character, and meta-learning (Fadel et al., 2015). These broader competencies are increasingly seen as essential for survival in today’s world, which requires resilience, adaptability, and creativity from each one of us (Marope, 2017).

In addition to the high workplace demand for these competencies and their importance for active citizenship in a fast-changing world, research from the learning sciences increasingly points towards the interconnected relationship between knowledge, skills, attitudes, and values in the process of ‘deeper learning’ (National Research Council, 2012). We now know, for example, that there are strong links between learner agency, motivation, meta-cognition, and academic achievement (National Academies of Sciences, Engineering, and Medicine, 2018) and that successful learning is a social and emotional process, as well as a cognitive one (National Scientific Council on the Developing Child, 2004a). For learners to be able to transfer their learning to other situations in meaningful ways – which is, ultimately, the goal of education – this deeper learning must take place (National Research Council, 2012). Education systems have, however, tended to focus quite narrowly on teaching and assessing knowledge in isolation from these broader competencies, resulting in content knowledge that is often ‘inert’ and increasingly outdated as learners struggle to adapt to the demands of the fast-changing world beyond formal schooling (Fadel et al. 2015).

Literacy and numeracy, similarly, have been a focus of many education systems around the world – and with good reason. These skills constitute the so-called ‘Universal Basic Skills’ and are especially important, as they are strong predictors of future economic growth of a country (OECD, 2015). Historically, however, being able to understand written text and quantitative relationships was sufficient for entering the workplace. Nowadays, these skills represent only the starting points on the paths towards successful participation in the labour market and the global community (Fadel et al. 2015). Therefore, while building strong numeracy and literacy skills is essential and serves as a foundational building block for broader educational outcomes, only tackling this issue will not be sufficient to meet the needs and face the challenges of the 4IR. In light of the rapid changes already being seen across sectors, ensuring that all learners are equipped with these social, emotional and cognitive competencies becomes a social justice imperative (Gravett, 2019).

It is important to acknowledge that many of these competencies are not 'new'. Competencies such as critical thinking and collaboration have been articulated in existing policy and developed through good teaching practice for many years. Care et al (2017), for example, found that the current South African curriculum contains many of these competencies, but that there are a number of challenges at classroom-level implementation. Similarly, the National Qualifications Framework (NQF) outlines ten categories of broad competences to be developed as individuals progress through its levels (South African Qualifications Authority [SAQA], 2012). While many of these competencies align with those generally seen as being essential for today's world, they are often not realised in practice. Part of the challenge is that, globally, the essential role of these competencies in learning was not fully understood or appreciated. Where this role is acknowledged, in international studies and seminal documents like the 1996 *Delors Report*[48], this has not immediately led to the development of clear frameworks on how, practically, to realise these aims (Reimers, 2020). Instead, the teaching and learning of these competencies is left to chance and individual teacher autonomy. Given the dire need for *all* learners to develop these competencies for survival in the VUCA world, the question we are now confronted with is how to develop these competencies "*deliberately, systematically,* and *demonstrably*" (Fadel, 2019:para. 9). This is the question that the Sandbox Schools Initiative aims to contribute to answering.

INTRODUCING THE SANDBOX SCHOOLS INITIATIVE

The Sandbox Schools project is a multi-year research pilot in eleven primary schools that aims to trial approaches for developing competencies for a changing world in the South African public-school context. It aims to act as a 'research and development lab' on behalf of the broader education system by piloting and learning on a small scale and incrementally sharing learnings with the sector to inform evidence-based shifts in policy and practice. After conducting deep global and local research on various frameworks and approaches for

[48] The Delors Report, commissioned by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and published in 1996, proposed a vision of education that centred around the concept of 'learning throughout life', and proposed four goals for education: learning to know, to do, to be and to live together. (Reimers, 2020).

developing these competencies, the Sandbox project has just begun its first three-year cycle of research on school-level interventions, which target both *classroom practice* (curriculum, pedagogy, assessment) and the broader *learning environment* (including classroom culture and school culture).

An ecosystem of initiatives

The Sandbox project aims to complement work already being done in the education sector towards more relevant education for the VUCA world. This work includes initiatives spearheaded by the Department of Basic Education (DBE) in South Africa, such as:

- the Three Stream curriculum model that seeks to diversify options for the school-to-work transition through a diversification of the curriculum at Further Education and Training (FET) level;
- the General Education and Training (GET) Robotics and Coding curriculum being developed and piloted across the country;
- the Schools of Specialisation that aim to develop specialised skills in priority sectors; and
- the Entrepreneurship and Employability Education (E^3) Initiative involves rolling out project-based learning modules across all grades to encourage the development of an entrepreneurial mind-set among learners and teachers.

These DBE initiatives are being rolled out at a large scale across schools in South Africa, in an effort to bring about system-wide change. The small scale and experimental approach of the Sandbox project enables it to conduct deep research in relatively short iterative cycles, to contribute to the body of knowledge informing these initiatives and others. The Sandbox aims to explore and innovate on behalf of the broader system, to push the boundaries and ‘raise the ceiling’ of public education.

The approach

The Sandbox is a Design-based Research (DBR) project being conducted in collaboration with the University of Johannesburg (UJ) in South Africa, the Lifelong Kindergarten Research Group at the Massachusetts Institute of Technology (MIT) Media Lab, the DBE, the Centre for Curriculum Redesign (a global NPO based in the US), and a network of other local and international experts in the area of education for a changing world. The pilot entails iteratively designing, testing, researching, and refining a suite of interventions over relatively short periods of time to understand their potential to develop teacher and learner competencies for a changing world.

The DBR research approach is informed by literature from the learning sciences and allows for deep research of an exploratory nature through its focus on iteration and the rigorous documentation of processes. DBR enables the simultaneous design and testing of innovations, as opposed to the more controlled experimental approaches which require that an intervention be designed before it can be tested. As such, the DBR process has embedded reflection, documentation and iteration loops which enable short learning cycles and feedback to constantly adapt and improve the designs (Barab, 2014).

DBR is also aligned to the philosophy and goals of the Sandbox project in that it seeks to explore how interventions work in real learning environments to produce outcomes related to the development of competencies for a changing world. Rather than testing interventions in controlled environments, the project is adopting an ecosystem approach that acknowledges the complex interactions between classroom practice and the learning environment (National Scientific Council on the Developing Child, 2004b) and seeks to understand how innovations, practices, and environments can enable the development of these competencies in a public-school context. The interventions to be researched therefore target both classroom practice and the learning environment – which includes classroom and school cultures – with a view to exploring how each of these aspects can contribute to the development of selected competencies. Each of the interventions is informed by theoretically-grounded design principles and has been selected for its potential for scalability, as well as its contextual relevance for a ‘typical’ South African public school.

In recognition that more ‘radical’ changes, such as an overhaul of the curriculum, are neither feasible nor necessarily wise at this exploratory stage, the project is adopting an approach to change which could be described as “incrementally ambitious” (Fadel et al. 2015:40). The implications are that interventions have been designed so that they enable stakeholders to make significant shifts from the familiar to the unfamiliar while providing the necessary scaffolding – including tools and support – for the shifts to take place. The Competency-based Learning Programme (CLP), for example, is an intervention that uses the familiar Structured Learning Programme (SLP) format as a base from which, hopefully, to make meaningful shifts towards more competency-embedded pedagogy. Various forms of SLPs have been used for teacher professional development by the National Education Collaboration Trust (NECT), the DBE, and other organisations around the country and the world, and have demonstrated some success in improving learning outcomes (Piper et al. 2018). The CLP uses the familiar format of the SLP – including a lesson plan with daily routines, materials, and guidance on how to cover the curriculum at the correct pitch and pace – and adds an additional element, namely, the deliberate development of competencies like critical thinking, mindfulness, and metacognition. These competencies are explicitly embedded in the CLP through the introduction of new classroom routines – such as Morning Mindfulness, Weekly Goal-setting, Reflection, and Problem-identification and solving – and new stories that focus on themes relevant to education for a changing world.

Sandbox interventions

The CLP is one of six interventions being researched over the first three-year phase of the pilot. A brief description of each intervention is presented in Table 1.

Table 1: Sandbox interventions

Stream	Intervention	School grade[49]	Description
Classroom Practice	Competency-Based Learning Programme (CLP)	1	CAPS-aligned[50], competency-embedded Structured Learning Programme, including lesson plans, support materials, and training in Grade 1 Home Language[51].
	Example Lessons	R, 2, 3	Example-based learning intervention for competency-embedded teacher professional development.

[49] There are 12 school grades in South Africa: Grades R to 3 comprise the Foundation Phase; Grades 4-6 the Intermediate Phase; Grades 7-9 the Senior Phase and Grades 10-12 the FET Phase. Grade R comprises a pre-school year.

[50] The DBE's Curriculum and Assessment Policies (CAPS) for schools comprise the national policies for schooling in South Africa.

[51] South Africa's Constitution recognises 11 official languages. The term 'home language' refers to the main language with which learners are comfortable.

	Creative Coding	3	A small-scale pilot using graphical coding to deepen learning of curriculum themes in conjunction with competencies for a changing world, particularly creative thinking.
Learning Environment	Robotics Clubs	4-7	Extra-curricular club for project-based robotics and coding activities to develop competencies for a changing world alongside the formal curriculum.
	Classroom Culture	R-3	Programme to co-create a positive classroom culture in Foundation Phase, to support the development of competencies.
	School Culture	Principals, School Management Team (SMT) & School Governing Body (SGB) Chair[52]	Catalytic engagements with school leadership and SGB to improve broader school culture and create an environment conducive to learning in a changing world.

As these interventions are designed and tested with the schools, they will be adapted based on emerging learnings emanating from the research. We will also explore more deeply, questions of scalability, teacher agency, assessment, and indigenous knowledge systems, among others, as the pilot progresses. Through our approach to research, curriculum, school culture, and communication, the Sandbox project aims to explore how indigenous knowledge systems can contribute to existing theory and practice in the area of education for a changing world (Makalela, 2020). This imperative is currently being explored most practically through a highly participatory school culture intervention, which entails co-creating a contextually-relevant environment conducive to learning at each of the Sandbox

[52] Each public school in South Africa is required to have a School Governing Body (SGB) that includes members in the categories of parents, educators, non-teaching staff and learners – who work together to promote the wellbeing of the school community and thereby enhance learning and teaching.

Schools. In line with the tenets of DBR, the research team is also exploring how to increase collaboration with teachers in both the design and research of interventions, to enhance their capacity as designers of innovative learning environments. Given that many of these areas of enquiry remain relatively exploratory and undefined, the overarching aim of the Sandbox is to *learn.*

AN ORIENTATION TOWARDS LEARNING

This orientation towards making learning central requires a shift in mindset in a system that often inadvertently stifles innovation and constrains opportunities for deep learning. Because of South Africa's complex historical and contemporary context, many educators in the Basic Education system display characteristics associated with a 'fixed mindset' as opposed to the 'growth mindset' necessary for flourishing in today's world (Perumal, 2014). The Sandbox project has encountered challenges primarily in this realm of mindset as teachers and school leaders sometimes have been hesitant to embrace the opportunities for learning presented by the pilot. Fear of failure and punishment has characterised a number of interactions with teachers who were reluctant to, for example, have their lessons observed or video recorded for professional development purposes. For teachers, whose previous experience with classroom observations has generally been punitive or a nominal 'tick box' exercise, it is difficult to see the opportunity for learning and growth that this initiative presents. The strengthening of teacher agency, therefore, has become a central focus of the Sandbox project and has led us further to explore the profile and experiences of South African teachers, with the aim of understanding how we can equip our teachers better to fulfil the demands of teaching in the fast-changing world.

Who are our teachers?

Much has been said and written about South African teachers, most of it fairly critical. Engagements on the ground with teachers in the Sandbox Schools, together with recent reports on the profiles and experiences of teachers, give some valuable insights into both the truth and complexities behind some of these critiques.

Results from the 2018 Teaching and Learning International Survey (TALIS) (OECD, 2019), for example, show that teaching was the first-choice career for only 49% of teachers in South Africa, which is the lowest percentage for teachers among all participating countries. This reality, together with the fact that teaching is seen to offer a stable career path (OECD, 2019), suggests that many teachers across the country are not necessarily passionate about their chosen professions. Research also shows a negative correlation between the amount of time spent in the teaching profession and morale (Zuma et al. 2016). In other words, the longer a teacher spends in the education system in South Africa, the more likely he or she is to report feeling low morale.

With regard to classroom practice, Hoadley (2018:217) points out continuities in the flawed pedagogy and weak subject content knowledge of many teachers in contexts of poverty, even in the post-apartheid era[53]. In general, curriculum reforms and teacher training interventions have not managed significantly to shift what she calls the “cognitive horizons” of teachers in these contexts, by providing them with opportunities to engage meaningfully with alternative practices (Ibid.). Some of the effects of this continuation can be seen in the poor learning outcomes and a flattened learning trajectory for the vast majority of children in South African schools, beginning in the Foundation Phase of schooling (Grades R-3). The oft-cited Progress in International Reading Literacy Study (PIRLS) results[54] in 2017 highlighted what many are calling a ‘literacy crisis’ in the country. There is now increasing recognition that teaching reading is a specialised skill that needs to be developed explicitly in teacher education and that this is an area that has been previously neglected – especially in indigenous African languages (Mohohlwane, 2019).

In addition to the issues of initial teacher preparation, teachers often face significant contextual challenges upon entering the public-school environment, which can demoralise them further and constrain innovation. Given the historical and socioeconomic context of South Africa, teachers are often confronted with psychosocial challenges – from abusive family backgrounds to learners with malnutrition or undiagnosed special needs – many of which are beyond their capacity to handle (Panday et al. 2009). The DBE’s Educator Health Study in 2016 found that half of South African teachers reported experiencing job-related stress. The 2018 TALIS report found that 34% of teachers and principals reported incidents of bullying and violence in South African schools, which was significantly higher than any other participating country. In addition, 71% of teachers work in schools with over 30% of

[53] The term ‘apartheid’ refers to the unequal and unfair race-based political system in South Africa prior to its transition to democracy in 1994.
[54] The 2016 PIRLS study (Howie et al. 2017) found that approximately 78% of South African Grade 4 learners do not reach the international benchmarks and therefore do not have basic reading skills by the end of the Grade 4 school year, in contrast to only 4% of learners internationally.

socio-economically disadvantaged students, according to principals, and a significant proportion of principals reported experiencing severe infrastructure and staff shortages (56% and 60% respectively) (OECD, 2019). These shortages contribute to the familiar refrain of ‘overcrowded classrooms’, which we have experienced as a harsh reality in many of our Sandbox Schools. Not only is the number of learners often higher than the official primary school learner: teacher ratio of 1:40, but these learners come from a variety of socioeconomic backgrounds with a wide range of learning abilities and developmental gaps, with which teachers are expected to deal in an inclusive way.

Learning as a continuum

In the South African learning and teaching context, the need for high quality in-service professional development and training is clear – not merely to bridge existing gaps in teachers’ knowledge and skills, but as an integral part of the ongoing evolution of the teaching profession (Reimers, 2018). The literature on what constitutes ‘teacher quality’ is vast and outlines a broad range of skills and competencies that a ‘good teacher’ should develop throughout his or her career, beyond content knowledge. These competencies include general pedagogical knowledge; pedagogical content knowledge; knowledge of student context and their families; metaphors to bridge theory and practice; external evaluation of learning; clinical training; strategies to create and sustain learning environments; knowledge, skills, and dispositions to work with students of diverse backgrounds; knowledge and attitudes that support social justice; and knowledge and skills to use technology (Reimers, 2018).

Teaching, then, should be understood as a highly complex and multifaceted profession, requiring a breadth of competencies similar to those seen as essential for learners in the 21st Century. Reimers (2018:11) proposes that teaching should be viewed as “the product of a system” or a continuum consisting of many elements, including how teachers are selected into the profession; incentives and respect afforded to the profession; initial teacher education; career pathways; induction; and support all along the professional trajectory. In light of this conception, the provision of high-quality teacher professional development, as well as the ability of teachers to engage in lifelong professional learning, should be seen as a priority for a sector looking to adapt to the times.

The Sandbox project seeks to explore these aspects of teacher quality more deeply through a dual focus on (1) high-quality, theoretically grounded professional development; and (2) issues of mindset, motivation, and agency among teachers and school leaders. Experiences from other countries have shown that the most effective and comprehensive reforms in education put in place measures to support and capacitate teachers, as well as to enhance their professional autonomy in the long-term (Reimers, 2018). If, as is increasingly acknowledged, one of the critical abilities for all people in this VUCA world is the ability to 'learn, unlearn, and re-learn' (Gerjuoy, cited by Toffler, 1970), then this is a core skill and mindset to develop among existing and future teachers. Through sustained advocacy in the Sandbox Schools, the message about learning is beginning to filter through among stakeholders, and we are starting to see a remarkable level of openness from teachers. We continue to explore *learning* and *agency* as themes across all stakeholders – from parents and caregivers to learners, teachers, school leaders, and district officials – particularly in the wake of the current disruption caused by the Coronavirus (Covid-19) pandemic.

FLEXIBILITY IN UNCERTAIN TIMES

A growth mindset is one that can adapt to change, and the current inflexibility of the South African Basic Education system has been one of the areas most starkly highlighted by the ongoing Covid-19 pandemic. The widespread disruption caused by the Covid-19 outbreak is a sign of the globally-interconnected VUCA world in which we live, and it has highlighted the need for adaptable, agile systems across society.

Formal education systems around the world have been characterised by 'inertia' (Fadel et al. 2015:27) for a variety of historical, political, and structural reasons. While this stability has made a positive contribution to improving global wellbeing over the past 200 years (Winthrop, 2018) and should not be undermined flippantly or disregarded, the current crisis causes us to pause and reflect on our ability to deal with change in a manner that prioritises *learning* above all. It causes us to consider what is essential and what is superfluous; what should be fixed and what could be fluid. It raises questions about relevant 'lifeworthy' knowledge in a curriculum that has been described as broad rather than deep (Umalusi, 2014). Perkins (2014:8) proposes the idea of "lifeworthy" knowledge as a lens through which to evaluate what should be included in curricula, where 'lifeworthy' means what is "likely to matter in the lives learners are likely to live". The current disruption raises important questions about curriculum, then, including *why* and *how* we can ensure the ongoing relevance of what is taught and learned. In our fast-changing world, this is increasingly being viewed as an ongoing, agile, iterative process rather than a wholesale, once-off ‘curriculum reform’ every decade or so (Fadel et al. 2015; Perkins, 2014).

The current crisis also raises important questions about rigid assessment practices that focus on a narrow definition of competences. While formal education performs an important function in the accreditation and evaluation of learning for school-leavers (Fadel et al. 2015), this summative aspect of assessment historically has been more heavily weighted (Umalusi, 2014), and therefore more highly prioritised by actors in the education ecosystem. Despite evidence that more formative methods of assessment contribute towards improving conceptual understanding and increase the likelihood of transfer (National Research Council, 2000), education systems around the world have continued to rely on and prioritise assessments that focus on the quantity of easily testable knowledge learned (Fadel et al. 2015). Of course, one of the reasons for this bias is the relative complexity of more holistic or process-orientated assessments, as well as a lack of global consensus around how best to assess the development of broader skills and competencies, as opposed to narrow knowledge-based assessments (National Research Council, 2012). This is one of the key questions the Sandbox project seeks to explore, with the aim of contributing to the growing body of research on the role of assessment in developing competencies for a changing world and enabling deeper learning.

In addition to questions about rigid curriculum and assessment practices, this unprecedented disruption to formal schooling also causes us to consider how we are equipping all actors in this ecosystem to become drivers of their own learning. Research shows that intrinsic motivation, a growth mindset, and meta-cognitive skills are some of the most important factors enabling deeper learning for transfer (National Academies of Sciences, Engineering, and Medicine, 2018). While many school leaders, teachers, and learners around the country display these competencies in remarkable ways, the Covid-19 crisis causes us to reflect on how highly these traits are valued and emphasised in the broader education system. It is difficult to quantify the amount of learning that has taken place among teachers and children around the country during this time away from school, but engagements with teachers at the Sandbox Schools suggests that understanding the extent of this depth has not been a priority. Beyond the pandemic, it is critical that both teachers and learners develop these competencies and mindsets – not necessarily in preparation for a similar disruption, but in recognition that learning is broader than formal schooling and that the ability to drive one's own learning is one of the key competencies for success in today's world (Fadel et al. 2015).

CONCLUSIONS

In a world that is increasingly moving towards customisation, flexibility, and diversity, how can we equip teachers and young people to critically exercise their agency as lifelong learners? This is chief among the questions that the Sandbox and other initiatives are aiming to confront, and it has come starkly into focus through the disruption we are experiencing on a global scale. While Covid-19 presents a significant social, economic, and developmental challenge, it also presents an opportunity to reflect on the current state of affairs and think anew about the way we would like to build for the future. The work has already begun across the schooling ecosystem, and we are hopeful that as more evidence begins to emerge, it will contribute to informing meaningful shifts in the way that education is conceptualised and realised for all children.

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INTERNATIONAL PERSPECTIVES

PAPER 13

The Changing Policy Landscape of Learning and Teaching in United Kingdom (UK) Higher Education in the Last 25 Years: The Story so Far

Dr Helena Lim

ABSTRACT

This paper presents the policy developments in learning and teaching in Higher Education (HE) in the United Kingdom (UK) in the last 25 years. These developments in the four home nations of the UK - namely, England, Scotland, Wales and Northern Ireland - included initiatives that have raised the profile and professionalisation of university teaching; enhanced learning through better pedagogic practice and the use of technology; strengthened the student voice; and introduced teaching quality metrics. At times, different approaches have been taken in the devolved nations of Scotland, Wales and Northern Ireland, but public policy as determined by the UK government in Westminster has played a significant role in providing the stimulus to the enhancement of HE learning and teaching across the UK. The paper concludes with reflections on what the next 25 years may look like for learning and teaching in UK higher education, especially in the midst of the Fourth Industrial Revolution (4IR) and in the wake of the Coronavirus (Covid-19) pandemic.

INTRODUCTION

This paper provides an overview of policy developments in learning and teaching in the United Kingdom (UK) higher education in the last 25 years. There has been a significant transformation in higher education across the four nations – Northern Ireland, Scotland, Wales, and England – in the UK. Most notably, this has been brought about through far-reaching reform to improve higher education provision by driving teaching excellence and increasing the emphasis on learners. Even though the devolved administrations in Northern Ireland, Scotland and Wales have taken different approaches, public policy determined by the UK government in Westminster has played an important role in stimulating the enhancement of learning and teaching in higher education across the UK. This paper highlights the policy drivers and ensuing initiatives that have supported and enhanced learning and teaching, including the professionalisation of teaching, technology-enhanced learning, teaching quality, and the student voice. Where available, the evaluation of the impact of these initiatives is included. The paper concludes with reflections on what the next

25 years may bring, particularly with the uncertainties created by both the 4IR and the unexpected Covid-19 pandemic, for learning and teaching in the UK higher education sector.

BACKGROUND AND CONTEXT

The UK higher education system is complex and diverse with a long and highly regarded history. Higher education courses and qualifications are offered by a range of institutions, mostly universities and an increasing number of further education colleges. Higher education providers in the UK are often referred to as 'Higher Education Institutions' (HEIs), and they vary in size, subject focus, research interests, infrastructure, priorities and history. In recent years, the model of higher education funding has diversified extensively across the four nations in the UK, namely, England, Scotland, Wales and Northern Ireland.

The latter half of the 20th Century has seen a move from an elite basis to a mass system of education in the UK: from a 5% participation rate in the early 1960s to 30% in the mid-1990s, and 50% in 2016-2017 (Department for Education, UK, 2018). In 2018-19, there were 2.38 million students studying at UK HEIs (Higher Education Statistics Agency [HESA], 2020).

HEIs in the UK offer a range of courses and qualifications. First-degree courses, commonly known as Bachelor's degrees, typically take three years to complete when studied full-time in England, Wales and Northern Ireland, and four years in Scotland. Sandwich courses, which include periods of practical work outside the HEI, normally add a further year to the study period. Certain specialist courses and some vocational or professional degrees may take longer, for example, in medicine, dentistry and architecture.

The UK's degree classification system awards students First-class Honours (1st), Second-class Honours, upper-division (2:1), Second-class Honours, lower division (2:2), Third class Honours (3rd), an Ordinary-degree (Pass) or a Fail, rather than the Grade Point Average (GPA) often used across North America and many other countries. The UK classification system is broadly based on percentage bands as an aggregate of final year marks but has recently been labelled as outdated and unfair, favouring older and more established universities and failing to recognise the achievements and additional capabilities of individual students seeking to enter the job market or continue to study.

The Higher Education Achievement Report (HEAR) was introduced in 2013 to address these concerns. Based on the European Union Bologna Process to produce a Diploma Supplement, the HEAR is issued to students on graduation with detailed information about their learning journeys and additional personal achievements. Currently, 90 universities and colleges are implementing or planning to implement the HEAR, including 32 institutions that have already issued 427,000 HEARs to students.

Many UK HEIs offer a range of vocational ‘sub-degree’ qualifications, such as the Higher National Diploma (HND), the Higher National Certificate (HNC) or the Diploma in Higher Education (DipHE). These qualifications are usually taken over one or two years of study. Additionally, students in England, Wales and Northern Ireland can take a two-year foundation degree, which upon successful completion, can be ‘topped-up’ to an Honours-level Bachelor’s degree.

Qualifications and credit framework

Higher education qualification frameworks provide useful reference points for awards in the UK and relate to degrees, diplomas, certificates and other academic awards (other than the honorary degrees and higher doctorates) granted by HEIs. In England, Northern Ireland and Wales, the levels are contained within the National Qualifications Framework (NQF), superseded by the Qualifications and Credit Framework (QCF) in 2010. The Framework was intended to create consistency in how qualifications were recorded and recognised across a scale from entry-level up to Level 8. Higher education qualifications are contained in the Framework for Higher Education Qualifications (FHEQ) and mainly correspond with Levels 4 to 8 of the NQF. Scotland has its own education system and uses a twelve-level framework called the Scottish Credit and Qualifications Framework (SCQF), though there are many similarities between the two Frameworks, see Table 1.

Table 1: UK Higher Education Qualifications Framework

	Scottish Credit and Qualifications Framework (SCQF)		**National Qualifications Framework (NQF)/ Qualifications and Credit Framework (QCF)**	
Scotland	12	Doctoral Degree	8	**England, Wales, Northern Ireland**
	11	Master's Degree, Integrated Master's Degree, Post Graduate Diploma, Post Graduate Certificate	7	
	10	Honours Degree, Graduate Diploma, Graduate Certificate	6	
	9	Bachelors/Ordinary Degree, Graduate Diploma, Graduate Certificate	6	
	8	Diploma of Higher Education (HND)	5	
	7	Certificate of Higher Education (HNC)	4	

Postgraduate provision can be delivered in taught form, conducted through research activity, or a combination of both, with the pattern of study normally part-time or full-time with increasing levels of blended learning in place. Qualifications include research doctorates (PhD), professional doctorates which combine taught study with research activity (e.g., Doctor of Education [EdD], Doctor of Business Admin [DBA] *etcetera*) or, PhD by publication, where an existing body of research outputs, are awarded a PhD after the candidate provides a coherent summary on how their work has added to the body of knowledge concerned. Taught postgraduate masters courses typically take one year full-time or two years part-time to complete, and are rigidly based on academic content, not 'time served'. Research programmes, at the doctoral level, are typically designed to take three years for full-time students and more than four years for part-time students, but each can vary significantly. Such research programmes will require the student to complete a written thesis and present their research and findings for external scrutiny before the award is granted. Access to postgraduate courses normally requires students to have a degree-level qualification, but the academic level of the course may not always be more advanced than an undergraduate course. For example, a postgraduate law ‘conversion course’ for non-law graduates is considered equivalent to that of an undergraduate law degree course and similar qualifications in education also exist.

Policy and funding

Higher education policy is developed separately in each of the four countries making up the UK, with the Scottish Government, Welsh Government and the Northern Ireland Executive each having specific and varying responsibilities for higher education and student policies, while the UK government maintains control over the English higher education system.

While public funding remains the significant source of funding for UK HEIs, there has been an increasing divergence of national higher education funding policies across the devolved governments. Higher education funding is being channelled away from direct allocation to institutions through core grants with a move towards more indirect allocations via student tuition fee income. However, this is mainly true for England and Wales, rather than Northern Ireland and Scotland.

HEIs in England receive funding from a variety of public and private sources. Since 2012, the lifting of tuition fees up to £9,250 for English-domiciled students entering higher education means that an increasingly large proportion of funding for HEIs in England comes from these fees. Tuition fees of £1,000 were first introduced in the 1998/99 academic year, reflecting government policy to create a more sustainable higher education funding regime. Various financial support mechanisms, including loans and means-tested maintenance grants, are available to help students to pay their fees and meet living expenses while they are studying.

From 1992, the Higher Education Funding Council for England (HEFCE) distributed public money for teaching and research to universities and colleges. The 2016 White Paper (England), *Success as a Knowledge Economy,* identified the creation of a new public body, the Office for Students (OfS), which will operate "on behalf of students and taxpayers to support a competitive environment and promote choice, quality and value for money" (Department for Business, Innovation and Skills [BIS, UK]: 2016:63). The passing of the Higher Education and Research Act in 2017 saw the closure of HEFCE in April 2018 and its replacement with the OfS:

> OfS is a regulator of the English HE marketplace – designed to encourage the growth of a competitive market that informs student choice, to intervene when the market is failing in areas such as equal access, and protect the interest of its consumers (students, government, and wider society) (Boyd, 2018:para.3).

This contextual detour is important as HEFCE was the major funder of the learning and teaching initiatives covered in this paper. The Scottish Government provides funding through the Scottish Funding Council (SFC) to HEIs and colleges providing higher education courses for teaching, research, knowledge exchange and other associated activities. Scottish-domiciled and EU students studying in Scottish institutions do not pay tuition fees. Students from the rest of the UK are subject to tuition fees.

In Wales, the Higher Education Funding Council for Wales (HEFCW) distributes public funding to HEIs through annual grants, which are based on funding allocations determined each year within a policy framework set by the Welsh Government. Since September 2012, HEIs in Wales have been able to charge a maximum fee for full-time undergraduate courses of £9,250.

In contrast to England and Wales, where the largest component of higher education funding now comes from student tuition fees, in Northern Ireland, government grants still make up a significant proportion of higher education funding and contribute more than student tuition fees. These annual grants are allocated and distributed directly by the Department for the Economy (DfE). For the 2019/20 academic year, the tuition fee for full-time undergraduate students was capped at £4,275.

ONCE UPON A TIME IN LEARNING AND TEACHING: THE LAST 25 YEARS

Having provided the context of higher education in the UK, we can now begin our learning and teaching story. We start at the end of the 20th Century. The UK higher education evolution was at the point where, while there had been an unprecedented rise in the numbers of individuals entering higher learning, there were still no generally agreed standards for higher teaching. Ellis (1993:9) identified that, in spite of extensive literature on university teaching, very few teachers concerned themselves with it: "the teachers themselves are not trained, and there is a pervasive culture which believes that training is, at best, a diversion from more significant activities".

The last 25 years have seen a number of significant developments in UK learning and teaching. This has happened alongside a succession of public policy reviews that created important structural and funding changes in the higher education sector. One of the most far-reaching of these for the development of learning and teaching was the Dearing Report (Dearing, 1997). Formally known as the reports of the National Committee of Inquiry into Higher Education but named after its principal author, Sir Ronald Dearing, this report was submitted to the Secretaries of State for Education and Employment in England, Northern Ireland, Scotland and Wales in July 1997. It was commissioned by the UK Government to look into how “the purposes, shape, structure, size and funding of higher education, including support for students, should develop to meet the needs of the United Kingdom over the next 20 years” (Ibid:1).

The report’s central recommendation was the introduction of tuition fees, for which it will always be most remembered:

> This was enthusiastically taken up by the incoming Labour government. Against his advice, the new Education Secretary David Blunkett scrapped student grants and

> introduced means-tested fees. Dearing's report sent shock waves through the sector, but it set the agenda for the next decade (Spencer, 2009:para.1-2).

As time unfolded, the introduction of tuition fees, particularly in England, has had a tremendous impact on UK higher education. This will be covered in later sections of the paper that address the student voice and teaching quality. At this stage of our story, let us bring the focus back to learning and teaching.

Dearing’s (1997) vision was that higher education should contribute to the development of a learning society. Five recommendations that related directly to learning and teaching were made including, accreditation of teaching for staff; research and development funding in learning and teaching; funding for innovation; a requirement that institutions develop learning and teaching strategies; and better support for academic staff in the use of Communications and Information Technology in their teaching. Additionally, Dearing (1997:371) recommended the establishment of “a professional Institute for Learning and Teaching in Higher Education. The functions of the Institute would be to accredit programmes of training for higher education teachers; to commission research and development in learning and teaching practices; and to stimulate innovation”.

Dearing's recommendations sent a strong message to the sector: the quality of learning and teaching must be the focus of individual professionalism, institutional strategy, and national policy (Laurillard, 2007). For the first time in the history of higher education in the UK, the Government had charged HEIs with taking a strategic approach to learning and teaching. As a result of the ambitious recommendations in Dearing (1997), subsequent national and institutional initiatives have reshaped university teaching and student learning. The following sections highlight these key developments.

TEACHING AND LEARNING INITIATIVES

Teaching Quality Enhancement Funding

Teaching Quality Enhancement Funding (TQEF) was launched in 1999 to support learning and teaching development across the English higher education sector at three levels: institutional, sector-wide and individual. HEIs received funding on submitting a Learning and Teaching Strategy to HEFCE, which addressed strategic planning for teaching excellence, research and innovation in learning, teaching and technology. Institution-level TQEF was based on student numbers and provided support for the implementation of institutional learning, teaching and assessment strategies. TQEF did not apply in Scotland and Wales.

Centres for Excellence in Teaching and Learning (CETLs)

In 2005, there was TQEF investment in 74 Centres for Excellence in Teaching and Learning (CETLs) based in 73 HEIs – 69 in English HEIs and all four HEIs in Northern Ireland. Each centre constituted a consortium of HEIs and focused on one pedagogic or subject-based theme; for instance, blended learning, assessment, leadership, *etcetera*. Funding for CETLs ceased in 2009/10, and the HEFCE and the Department of Employment and Learning (DEL) commissioned a summative evaluation of the CETL programme, which came to the following conclusions:

> The activities and outputs of CETLs were diverse and included: the development of new curriculum content; diagnostic and evaluative tools and toolkits; support materials for staff; new e-Learning and communication systems designed to exploit the potential of Web 2.0; piloting of new approaches to teaching and learning (e.g. use of peer tutoring, active and interactive learning approaches); research projects and peer-reviewed publications; events, including internal development activities and wider dissemination seminars and conferences (HEFCE, 2011:iii).

Institute of Learning and Teaching in Higher Education (ILTHE)

At the sector-wide level, TQEF was used to set up the Institute of Learning and Teaching in Higher Education (ILTHE) in 1999. The ILTHE was the professional body for all who taught and supported learning in higher education. It provided HEIs with the means to help their staff achieve accredited fellowship with its national benchmark for teaching quality. By January 2003, the ILTHE had over 14,000 individual members and had accredited 133 programmes of staff development at 107 HEIs (HEFCE, 2003).

Teaching and Learning Research Programme (TLRP)

The Teaching and Learning Research Programme (TLRP) was introduced in 2000. It funded 14 projects across higher education addressing a wide range of challenges linked to learning and teaching, such as problem-based learning, social diversity and universal access. The second phase TLRP focused on Technology Enhanced Learning (TEL). The £12 million TLRP-TEL programme ran from 2007 to 2012 and supported eight large interdisciplinary projects across the UK, focusing on how technology could be used to improve learner outcomes (TEL, 2012).

Learning and Teaching Subject Network (LTSN)

The Learning and Teaching Subject Network (LTSN) was set up in 2000 to provide subject-level support for teaching innovation through 24 Subject Centres based in 21 HEIs across all four home nations of the UK and a generic centre, which was co-located with the ILTHE in York. The subject centres served as brokers of excellence, providing a coordinated service to departments, course leaders and departmental learning and teaching committees. The LTSN generic centre covered learning and teaching issues and practices common to all subjects, for instance, assessment (Allan, 2000).

National Teaching Fellowship Scheme (NTFS)

In 2000, the National Teaching Fellowship Scheme (NTFS) was established to recognise and reward academic staff who demonstrated excellence in learning and teaching in higher education in England and Northern Ireland; since 2011, in Wales; and since 2018, in Scotland. It is a competitive process with rigorous criteria for outstanding teaching at the departmental level or for institutional and/or cross-institutional contributions with a significant impact on student learning. At the outset, individual awards were worth £50,000. This was reduced to £10,000 in 2006. Since 2016, there have also been collaborative awards, recognising teams who have enabled a change in practice for colleagues or students at an institutional or discipline level. To date, there are 915 National Teaching Fellows with their own Association for National Teaching Fellows (ANTF), an active community working to further the impact of the scheme.

The Higher Education Academy (HEA)

In January 2003, the Teaching Quality Enhancement Committee (TQEC), established by HEFCE, Universities UK (UUK) and the Standing Conference of Principals (SCOP) to review the arrangements for supporting the enhancement of learning and teaching, proposed the creation of a single, central body. The Higher Education Academy (HEA) was formed in May 2004 with the amalgamation of the ILTHE, the LTSN and the National Coordination Team for TQEF into a single organisation. Consisting of 25 sites distributed throughout the UK, a head office in York and 24 subject centres based in HEIs and primarily funded by the four UK funding bodies and subscriptions from HEIs, the remit of HEA was to:

- advise on policies and practices that impact on the student experience;

- support curriculum and pedagogic development; and
- facilitate development and increase the professional standing of all staff in higher education. (HEFCE, 2009:para.1).

Advance HE

In March 2018, Advance HE was created with the merger of the HEA with the Equality Challenge Unit (ECU) and the Leadership Foundation for Higher Education (LFHE), following the recommendations of the Bell review in 2017 for a single sector agency for learning and teaching, equality and diversity, and leadership and governance in higher education (UUK, 2017). According to the Advance HE website, their priorities include:

- supporting transformative leadership and management, teaching and learning, equality, diversity and inclusion, and effective governance, including the importance of accreditation of teaching and learning programmes, Athena SWAN[55], and the Race Equality Charter[56];
- convening and facilitating continual enhancement; and
- building on our established networks and communities of practice; and concurrently building our resources, insights and knowledge in support of 'what works' and best practices in the areas our members tell us are priorities for them (Advance HE, 2020).

In an opinion piece for the *Times Higher Education*, Keenan (2018:para.6 and 19) stressed that the new Advance HE should not lose sight of the guiding 'academy principles' of its predecessor, the HEA.

> The HEA in its origins had a small-town flavour; a localism; what sociologists call a *gemeinschaftliche* or communitarian aspect. It 'spoke' to the identity and character of its early membership, primarily university academics for whom the 'teaching route' was a preferred option to the 'research route' as a point of vocational commitment and professional focus.
>
> ...Small may be beautiful; but a large transnational, multitasked organisation such as Advance HE will face considerably greater and more complex challenges than those encountered by the pioneer HEA generation.

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[55] The Athena SWAN Charter was "established in the United Kingdom in 2005 to encourage and recognise the commitment of higher education and research institutions to advancing the careers of women in science and, in 2015, it was expanded to arts, humanities, social sciences, business and law" (Kalpazidou Schmidt et al. 2020:2).

[56] The Race Equality Charter Race provides a framework through which institutions work to identify and self-reflect on institutional and cultural barriers standing in the way of Black, Asian and Minority Ethnic staff and students (Advance HE, n.d.).

National Student Survey (NSS)

Another significant development was the introduction of the National Student Survey (NSS) in 2005. As an annual survey of final-year undergraduate students’ opinions on the quality of their courses, the NSS runs across all publicly-funded HEIs in the whole of the UK as well as further education institutions in England and Wales. It consists of 27 questions covering teaching, learning opportunities, assessment and feedback, academic support, organisation and management, learning resources, learning community, student voice, the student union and an overall satisfaction question. Not without its critics, particularly in the early days, it is now generally accepted as a useful benchmark to track the success of the sector in responding to the needs of its learners.

> The results are used by senior management teams, academics, students' unions and others to drive improvements in curriculum, teaching and learning quality, learning resources and academic support. Overall satisfaction levels among students have increased steadily, and satisfaction with assessment and feedback, identified in early surveys as a major concern, has improved markedly (HEFCE, 2016:para.7-8).

Many institutions have also adopted the NSS questions for their internal student satisfaction surveys to better benchmark against national performance trends (EvaSys, 2017).

Joint Information Systems Committee (JISC) and e-Learning

In 2003, the Joint Information Systems Committee (JISC) set up its e-learning programme to enable “the development and effective use of digital technologies to support learning and teaching in universities and colleges, so that staff be aided to develop e-learning materials and students could gain benefit and enjoy a more flexible learning experience” (JISC, 2014:para.1). Since that date, JISC has supported a number of programmes including assessment, learner experience, learning and teaching practice, learning environments and mobile learning. However, rather than focusing on research as envisaged by Dearing (1997), the JISC programmes have focused on development.

PROFESSIONALISING TEACHING AND THE LEADERSHIP OF TEACHING

Mahoney wrote, in 2011, that higher education teaching is one of the few professions left in developed economies that do not have a requirement to have any qualification or license to practice. Baume (2006) noted similarly that university teachers are the last of the 'non-professions'. This stands in stark contrast to non-higher education entities, where all teaching staff across the UK are required to be qualified (or qualifying). The UK is not unusual in reflecting this picture, but the situation is changing.

The HEA introduced the UK Professional Standards Framework for Teaching and Supporting Learning (UKPSF) in 2006. The UKPSF provided a common framework for UK HEIs to benchmark, develop, recognise and reward teaching and learning support roles. Between 2006 and 2011, the higher education sector increasingly engaged with the UKPSF through the accreditation of professional development programmes, and the recognition of individuals as Fellows of the HEA. Fellowships are awarded to staff who have completed accredited programmes or have demonstrable track records of experience that can be mapped to the UKPSF.

In November 2011, the HEA published the revised UKPSF, which introduced two new categories of Fellowship: Senior Fellow and Principal Fellow. Senior and Principal Fellowships are normally awarded to experienced staff who can demonstrate impact and influence in leading and managing learning and teaching contexts. Additionally, Principal Fellows also need to demonstrate sustained and effective records of impact at a strategic level in relation to learning and teaching. In a HEA-commissioned investigation, Turner *et al.* (2013:50) concluded:

> The impact of the UKPSF on the UK HE sector has been significant in most institutions and for many individual teaching staff. Institutions have reported utilising the framework in a myriad of ways including to underpin initial and continuing professional development, to influence learning and teaching strategies, to act as a national benchmark, to provide an aspiration for staff, to underpin promotion and probation policies, and to change the language of learning and teaching.

According to the Advance HE website, as of December 2019, there are accredited teaching development programmes in 125 institutions and as of May 2020, over 130,000 Fellows in the UK and internationally.

Alongside this development, there has also been an increasing professionalisation of the leadership of learning and teaching in higher education. As the late David Watson observed in reflecting on his own teaching journey, "Academic leadership and management is a necessary (but of course not sufficient) condition of effective learning and teaching, especially in the complex relationships that characterise higher education" (Watson, cited in Brown, 2011:23).

The drive for HEIs to manage learning and teaching strategically has also increased the number of professional institutional leadership roles in this area. At the executive level, most, if not all, UK HEIs have a senior colleague, typically, Pro Vice-Chancellors (PVCs), or Vice-Principals (VPs) overseeing the learning and teaching portfolio. Typically, these roles will have the remit of leading strategic thinking around learning and teaching at their institutions including the development and delivery of institutional learning and teaching strategies and meeting associated Key Performance Indicators (KPIs). At a mid-management level, there are roles variously titled Directors, Deans or Heads of Learning and Teaching, often based in central learning enhancement units, and Associate or Assistant Deans of Learning and Teaching, often based within academic departments or schools:

> Within the UK, there has been rising activity in promoting and delivering [learning] and teaching development strategies, especially since 2003. Gibbs estimates that this area of work, which involved only around 30 active academics, mostly part-time, in the UK in the 1970s, now involves thousands of academic development personnel and substantial institutional investments (Parsons et al. 2012:11).

This growing cadre of staff lead, support and promote the learning and teaching agenda, champion ongoing innovation, all "while simultaneously endeavouring to enable and support a growing minority of enthusiastic innovators, attempting to persuade the cynical spectators and seeking to neutralise the spoilers/obstructionists" (Kift, 2007:302).

The creation of Advance HE has consolidated the HEA and the LFHE's PVC network groups for senior leaders to discuss and exchange views and insights into current topics. Staff and Educational Development Association (SEDA) and Heads of Educational Development Group (HEDG) provide similar support for middle managers. Continuing Professional Development (CPD) and networking opportunities at the disciplinary level are provided by Advance HE and also professional bodies and organisations such as the British Psychological Society (BPS) and the Association for the Study of Medical Education (ASME).

TECHNOLOGY-ENHANCED LEARNING

Technology has come a long way since Dearing's (1997) vision that all staff and students will be able to optimise the opportunities offered by Information and Communications

Technology (ICT). Major programmes like the HEFCE-funded e-Benchmarking exercise and related Pathfinder Programme (2005-08), and the HEFCW-funded Gwella, the Welsh Enhancing Learning and Teaching through Technology Programme (2007-11), have built capacity within participating HEIs in terms of understanding processes, practice and provision; increased confidence and maturity in the role of TEL; and enabled the mainstreaming of TEL activities into institutional policy and practices (HEA, 2008, 2011).

In England, the HEFCE-funded project – Changing the Learning Landscape (CLL) – which ran between 2012 and 2014, supported HEIs in bringing about change in their strategic approaches to technology in learning and teaching. CLL engaged with 145 English HEIs within the first year of the programme through an intensive six-month programme for leaders in learning and teaching; short-term-focused consultancy support for institutional teams; and CPD activities and resources for academics and Learning Technology developers. The main impact of CLL was as an ‘enabler of change’. Participating HEIs used CLL as a ‘catalyst for change’, or “a starting point for new developments which might not otherwise have happened” (LFHE, 2015:12).

Most HEIs in the UK now make use of technology to support learning, teaching and the student experience. This often includes using virtual learning environments (VLEs) as repositories for course outlines, reading lists and study material and in the case of more progressive HEIs, using VLEs interactively to enable blended learning experiences comprising classroom contact, tutorial support, peer-assisted learning and online support.

STUDENT VOICE/STUDENT CHOICE

In the past two decades, increasing emphasis has been placed on the ‘student voice’, which is listening and responding to the opinions and perspectives of students. The NSS has been running since 2005 and the HEPI-HEA Student Academic Experience Survey since 2006. The Quality Assurance Agency (QAA) has had student members on institutional audit and review teams since 2009. Student involvement in institutional structures and systems, such as student–staff liaison committees, “once highlighted as good practice in Subject review and Institutional audit, is now routine” (Kay et al. 2010:1). The introduction of tuition fees in the UK since 1998 has also had an impact on student expectations, particularly English-domiciled students. Students are no longer passive consumers of their learning.

The Higher Education White Paper, *Students at the Heart of the System* (Department for Business, Innovation and Skills, 2011), argued that with prospective students facing higher direct costs than ever before, HEIs were obliged to be more responsive to student choice and demand:

> ...the increase in tuition fees for English students will mean that the sector will need to focus more than ever on ensuring educational quality. Students, quite rightly, demand value for money, and institutions will have to concentrate on further establishing their effectiveness in order to justify higher fees – the quality of learning and teaching will be key (Mahoney, cited in Parsons et al. 2012:11).

Even though different fees arrangements have evolved in the devolved national administrations of Scotland, Wales and Northern Ireland as outlined, regardless of the funding regime, many of the pressures regarding perceptions of quality and value for money are shared, and greater weight has been given to the concepts of 'student voice' and 'student choice'.

KEY INFORMATION SETS (KIS)

HEFCE, UUK and GuildHE[57] undertook a consultation in 2011 on information that HEIs are required to publish about their courses. The Key Information Set (KIS) was developed following the consultation to give prospective students access to high-quality information about different courses and institutions, and thus enable more informed choices. From September 2012, HEIs were required to gather data for publication, and the KIS dataset is updated at least annually. The data are published through the Discover Uni website where prospective students can search for and compare data and information about higher education courses across the UK. The rationale is that better-informed students will drive teaching excellence by taking their custom to the places offering good value for money. "We expect our reforms to restore teaching to its proper position, at the centre of every higher education institution's mission" (Department for Business, Innovation and Skills, 2011:25).

WHAT IS THIS THING CALLED 'TEACHING QUALITY'?

The discourse around teaching quality has been at the forefront of UK higher education policy in recent years. The introduction of fees and subsequent increases in fees in English

[57] GuildHE is recognised representative body and official voice for UK higher education, especially for university and colleges with a tradition of learning, research and innovation in industries and professions (https://guildhe.ac.uk/).

higher education has also focused the attention of prospective students, parents, employers and taxpayers on the quality of the teaching**.** As HEIs face more informed choices by prospective students, “teaching quality emerges as a discriminator for many institutions” (Parsons *et* al. 2012:11). In the foreword to the Green Paper on *Fulfilling Our Potential: Teaching Excellence, Social Mobility and Student Choice*, Jo Johnson (2015:11), the then Minister for Universities and Science, made this emphatic point:

> For too long, teaching has been regarded as a poor cousin to academic research. The new Teaching Excellence Framework, which we promised in our manifesto, will hard-wire incentives for excellent teaching and give students much more information both about the type of teaching they can expect and their likely career paths after graduation.

TEACHING EXCELLENCE FRAMEWORK (TEF)

It, therefore, came as no surprise that in the 2016 White Paper*, Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice* (Department for Business Innovation and Skills, 2016), the Government announced the introduction of the Teaching Excellence and Student Outcomes Framework (TEF). It is designed to incentivise excellence and innovation in higher education teaching by introducing a teaching quality assessment mechanism focused on three core metrics: student satisfaction scores (NSS), graduate outcome data (Destination of Leavers from Higher Education – DLHE), and continuation rates. The TEF process is managed by the OfS, and ratings are judged by an independent panel of students, academics and other experts. Participating universities and colleges can achieve a gold, silver, bronze, or provisional rating.

The TEF is linked to tuition fees in England. English HEIs need to meet basic standards in order to make inflation increases in tuition fees. HEIs who meet expectations will be allowed to increase their fees while HEIs with a falling TEF level will be required to lower the fees they charge, including for existing students. To date, HEIs in Scotland, Wales and Northern Ireland can choose but do not have to participate in TEF.

The introduction of the TEF is a significant step in the development of learning and teaching in UK higher education as the Government is taking on “the challenge of measuring teaching quality head-on so that students can be served better in the future” (Department for Business, Innovation and Skills, 2016:13). For the first time, the funding of teaching in higher education will be linked to quality and not quantity – a principle that has long been established for research.

THE NEXT CHAPTER: LEARNING AND TEACHING POST-DEARING

It is nearly a quarter of a century since the Dearing Report was published. “Although some call it ‘nonsense’ and a ‘political fix’, Lord Dearing’s landmark report left an enduring legacy in terms of access, quality and, of course, tuition fees … [it] fundamentally changed the higher education landscape” (Tysom, 2007:para 2). Post-Dearing, public policy and funding across the four home countries of the UK have continued to promote a significant increase in both national and institutional initiatives to develop and enhance the quality and impact of university teaching and student learning.

The last 20 odd years have seen the gradual professionalisation of university teaching with an associated increase in the recognition and rewards for excellence. The more strategic management of learning and teaching and its associated KPIs have created more of an enhancement culture within HEIs, even if this is at times met with resistance or cynicism. External drivers of change include the introduction of fees creating a more marketised higher education and the drive for more and better information for stakeholders including NSS, KIS and now, the TEF. The HEA has also played a key role as an influencer and driver of change within HEIs. As the champion for teaching excellence, teaching innovation and the professionalisation of teaching, its most notable successes have been the professionalisation of individual teachers; the development of the UKPSF and its associated accreditation and recognition services; and supporting HEIs in developing this within their own organisations.

What the UK higher education sector has achieved in partnership with the HEA in the professionalisation of teaching has been internationally recognised. The 2013 European Commission report on *Improving the quality of teaching and learning in Europe’s HEIs* recognised that many of the report’s recommendations for the European Union (EU) “were inspired by activities of the HEA in the UK” (2013:56). The report goes on to recommend that the EU should support the establishment of a European Academy for Teaching and Learning. However, with HEA-LFHE-ECU consolidation into Advance HE in 2018, it is too early to evaluate the impact this has had on the earlier momentum created by the HEA.

Emerging technologies are also likely to have a profound impact on learning and teaching. The so-called 4IR technologies that are influencing higher education include the Internet of

Things, data analytics, chatbots and dashboards, with Artificial Intelligence (AI) and immersive technology providing avenues for universities to explore. Data and better user experiences on campus can be inspired by parallel Internet applications, such as those already used in the retail sector, to both create and deliver a good student experience. Andy McGregor, director of EdTech at JISC has observed that while 'the sage on the stage' is still the predominant model of teaching and education, that is, someone at the front delivering the content to people in rows, new technology will offer teachers the opportunities to focus more on their face-to-face interactions with students, and personalised adaptive learning can use AI and data insights to deliver personalised, individualised content for students (salesforce.org, 2019). As boundaries between the cyber world and the physical world become increasingly blurred, the requirement for higher education learning and teaching to be 'place-based' will diminish. Education is already being accessed through mobile devices through applications in the cloud. Physical boundaries are becoming less relevant (Mezied, 2016). The prospects for disruption and reinvention are evident.

EPILOGUE: LEARNING IN THE TIME OF COVID-19

At the time of writing, the world is grappling with the Covid-19 pandemic. As the UK went into lockdown in March 2020, HEIs have closed their physical campuses, suspended all face-to-face teaching, and quickly shifted to online and virtual teaching. We have seen in the preceding sections that new technologies (and latterly 4IR ones) and new approaches to learning have already begun to change the way teaching is delivered and how learning occurs; for instance, through distance education, online learning, blended learning and open education resources (OER), including Massive Open Online Courses (MOOCs). The advent of smartphones, tablets and other forms of technology is facilitating more flexible ways of learning, more connected and mobile learning opportunities, and paving the way for learning that goes beyond the traditional transmission of information. However, traditional, campus-based delivery had remained very much the norm.

The crisis response to Covid-19 has disrupted pedagogical approaches and models on such a scale and at such speeds, that no one could have foreseen. As Arber (2020) observed, the spark for change was in place, but what Covid-19 has done was to provide fuel and lit the match. Universities up and down the length of the country are having fundamentally to rethink both the services they provide and the academic portfolios they deliver and quickly adapt the way they operate.

The silver lining of Covid-19 has been the chance, no, the necessity to experience 4IR technologies. The pressures faced during this crisis have compelled universities to adopt new technical capabilities, harness digital technologies and evolve their pedagogical models at a pace unimaginable only months before. Universities have always been adaptable organisations, responding to changing conditions over time and at many times, proven themselves to be part of the change itself. In a 4IR world, the innovation cycle has become much shorter. Within the grip of the pandemic, HEIs have accelerated the pace of a change journey that started post-Dearing. The sector's handling of these challenges will leave a legacy that impacts university cultures and reputations as well as their financial sustainability, for years to come.

As and when the UK eases from lockdown, higher education will re-emerge to 'PPE', that is, Post-Pandemic Education. In the coming days, UK HEIs and supporting higher education agencies will need to be flexible and re-imagine the higher education offerings. Back in 2013, Gallagher and Garrett argued that "the current trajectory of ever bigger campus-based universities relying on large lectures as the core mechanism for teaching students, and increasing tuition fees to cover ever higher fixed costs including research will be rendered obsolete" (cited in ITaLI, 2015:14). Covid-19 has hastened the way. Post-pandemic, going back to the 'old ways' will not be an option. Reflecting on the report, *Rapid Response Briefing Paper: Harnessing the Winds of Change: Transformation During Covid-19*, Ikpehai (2020:10) states unequivocally:

> The reality for most universities is that this experience of managing through the crisis has simply been the start of their business transformation and change journey. A combination of financial pressures and the changing expectations of students in the wake of Covid-19 will challenge universities to refocus their businesses, diversify their income, adapt to digital-first working and service delivery, and rebalance their workforces to meet their new shape and size requirements.

It is difficult to predict the policy landscape and the drivers for learning and teaching in UK higher education in the next 10, 20 or 25 years, but it certainly will be much changed. The one thing we can be sure of is that change will be the only constant in the coming days, years and decades. There will be both challenges and opportunities for UK higher education. We might even see a new form of university emerge; one with virtual classrooms, virtual laboratories, virtual libraries and virtual teachers. This is not the end of the story for learning and teaching in the UK, but it is the end of our story here, for now.

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PAPER 14

Quality Assurance 4.0: Innovation and Development in University Quality Assurance

Professor Kerry Kennedy

ABSTRACT

Quality Assurance has become a standard practice for universities worldwide. Yet the one-off paper-based exercises that currently characterise Quality Assurance are backwards-looking rather than future-focused. This approach to Quality Assurance is being conducted in a situation where fundamental changes are taking place in the external environment, especially under the influence of the Fourth Industrial Revolution (4IR). This paper examines ways in which new 4IR technologies can be used to transform Quality Assurance better to meet the needs of the 21st Century.

INTRODUCTION

Quality issues have been on the higher education agenda for the past two decades (Ryan, 2015). Yet there is now predictability about quality assessment that can often be little more than a one-off paper-based exercise. More often than not, such assessment provides a snapshot of any university's quality processes and outcomes. Usually, assessments are conducted by an external agency and require a self-assessment (often written to a template) followed by a site visit that focuses on areas such as course accreditation, a whole-institution quality audit or programme area accreditation. There are multiple models around which these assessments have been built – excellence (Escrig-Tena, Garcia-Juan, and Segarra-Ciprés, 2019), Total Quality Management (TQM) (Nasim, Sikander and Tian, 2019) and (ISO) 9000 (refers to the International Organisation for Standardisation) (Thonhauser and Passmore, 2006). Yet this is yesterday's approach to Quality Assurance. It is conducted in an environment where Industry 4.0[58] (Schwab, 2016) is fundamentally changing employment patterns, work patterns and even the social world to which graduates will need to contribute. Quality assurance in this context needs to be transformed: it needs to become Quality 4.0.

The current approach to university Quality Assurance has been critiqued from a number of perspectives (Spence, 2019; King, 2018; Zhang and Su, 2016). Yet in the current

[58] Another expression of 'Fourth Industrial Revolution' (4IR).

environment, critique is not enough – it is not a matter of simply changing the parameters. Rather, Industry 4.0, or the Fourth Industrial Revolution (4IR) (Schwab, 2016), requires a fundamental rethinking of Quality Assurance, to allow it to meet emerging social, political and economic realities. Yet there is little evidence that higher education is responding to this challenge.

The challenge itself comes from the nature of 4IR. It is generally described with terms like 'disruption', suggesting that whatever is in place needs to make way not so much for orderly replacement but for something more cataclysmic. Kasza's (2019:119) description of the extent of the change is typical: "systemic change across many sectors and aspects of human life, with the cross-cutting impacts of emerging technologies (the effect of synergy and convergence difficult to predict), even more, important than the disruptive capabilities they represent". Universities need to prepare their graduates for this kind of world: they require Quality Assurance processes that will help students to do their jobs in this new environment.

Much has already been said in this Bulletin about the nature of 4IR. Perhaps at its core is the potential for machine-human interaction when machines themselves have the potential not just to do the work of humans (for example, robots) but to think like humans (for example, deep learning). It is the pervasive nature of 4IR technology, its capacity to influence every aspect of life, and its potential to reshape life that is the key feature to keep in mind. It is not just about devices, computers, and other forms of hardware: it is more about the potential of these to inform, to teach, to monitor and to lead. These characteristics make it essential to consider how to match Quality Assurance with this new machine-oriented/human interface.

QUALITY 4.0 – PUTTING 4IR TO WORK

Radizwill (2018:5-6) conceptualised the development of Quality Assurance through four distinct phases leading to Quality 4.0: from Inspection to Design to Empowerment to Discovery. Inspection was about removing the faults and flaws while the focus on Design was meant to eliminate the faults and flaws before they reached the production line. Empowerment strategies were developed to diffuse responsibility for Quality Assurance throughout an organisation rather than leaving it to 'inspectors'. Finally, Discovery was equated with Quality 4.0:

> In an adaptive, intelligent environment, quality depends on how quickly we can discover and aggregate new data sources, how effectively we can discover root causes and how well we can discover new insights about ourselves, our products and our organisations (Radizwill, 2018:6).

As with the large majority of articles in the literature on quality assurance, the context is the business world. Yet the rationale for what might be called the 'next level' of Quality Assurance is as applicable to the world of education as it is to the world of business. Its characteristics are generic, as shown in Table 1 below.

Table 1: Changes moving Quality Assurance to the next level (Source: Radziwill, 2018:3-4)

Availability of information	Information is available from multiple sources delivered in multiple ways.
Connectivity	As more and more devices are connected to the internet, the greater the reach of quality data.
Intelligent processing	As computing capabilities increase, the better they are able to process large amounts of data.
New modes of interaction	Information is not only available, but it is available in new ways such as through virtual reality (VR) and augmented reality (AR).
New modes of production	Driverless cars, three-dimensional (3D) printing, nanotechnology and other technologies provide new and different ways of doing business.

It might seem that some of these newer processes have been with us for some time as part of the digital age, but their presence represents something greater than themselves. What is different is that these technological processes are now embedded in devices or processes that take on almost human characteristics: Artificial Intelligence, Big Data, deep learning, machine learning, data science *etcetera* (Radziwill, 2018). These devices and processes make information meaningful, turning data into knowledge and providing opportunities for real-time responses. It is entirely possible to imagine these processes with sensors monitoring assembly lines: yet is it also possible to imagine the processes feeding into quality responses in educational contexts? The use of the new technologies is the key issue for understanding Quality 4.0 and its potential for supporting the development of quality assurance in higher education contexts.

In addressing this issue, it is important to come back to what is regarded as the essence of Quality Assurance as it applies to higher education. When Radziwill (2018) argued that there had been a progression of approaches to Quality Assurance over time from Inspection to Design, then Empowerment and now Discovery, it may be understood as moving from one paradigm to another. Yet, in reality, we can see elements of Inspection-Design-Empowerment in current day Quality Assurance processes: panels inspect, external stakeholder involvement is an essential feature of all Quality Assurance efforts, and total organisational involvement includes everyone from students to the Vice-Chancellor. Thus, current Quality Assurance efforts are, in general, an amalgam of historical foci rolled into one powerful tool that seeks to identify how institutions improve and by doing so remain responsive to society, their stakeholders and their students. What, then, does Discovery, or Quality 4.0, add to this amalgam? Yadov (2019) makes the point clearly:

> In easy to understand terms, Quality 4.0 is the digitalisation of quality, compliance, and management systems. The term is not exclusive for only the technology, but it also means improvements in collaboration, culture, leadership, and competency with the help of technology. It doesn't replace the traditional methods; rather, it betters them through technology.

The focus here on technology is helpful in suggesting the direction of Quality 4.0. The extent to which Quality 4.0 can embrace key Quality Assurance processes shows the cumulative effect of historical Quality Assurance paradigms. Yet, as Yadov (2019) goes on to point out, Quality 4.0 is not just about digitalisation. It is more about the implications that have arisen because of digitalisation in the form of human-computer interactions that invest computers with massive intelligence, allowing them to take on human characteristics. Robots are the best example of this phenomenon since they are designed on the exterior to mimic human form, and they are becoming ubiquitous. Beneath the surface of the robot is its driving force: Artificial Intelligence is defined by Hallevy (2013:xv) as "the ability of a machine to imitate human behaviour". This is the power of Quality 4.0: digitalisation that takes on what so often appears to be human capacity.

Bringing together digitalisation and human capacity can best be understood with the idea that there are ‘4IR tools’. Yadov (2019) refers to the following tools:

- Artificial Intelligence and machine learning
- Cloud technologies
- Mobile technology, virtual reality, augmented reality
- Big Data and data lakes
- Connected devices and edge devices
- Social media and blockchain

These tools have characterised the 4IR – they are used primarily in business for such things as enhancing product design, marketing, stakeholder engagement and other aspects. The issue is, how can such tools be used in the context of higher education Quality Assurance and for what purpose? A subsidiary question is, what might the use of these tools mean for quality agencies and professionals in the higher education field? These questions will be addressed in the remainder of this article.

HIGHER EDUCATION AND QUALITY 4.0

Nasim, Sikander and Tian (2018), in reviewing the use of TQM in higher education, pointed out that the weakness of such an approach has been that it does not focus on institutional performance. Rather, universities using TQM have focused on different parts of their organisations – student learning, stakeholder engagement, staff performance, research and development, alumni relationships, libraries *etcetera*. Taken together, these foci, and others, could provide an overall assessment of how well a university is doing, yet it is this overall view that TQM rarely gives.

Any new way of configuring Quality Assurance such as Quality 4.0 needs to be able to address this issue so that institutional performance as a whole rather than the performance of its parts becomes the focus. Sader, Husti and Daróczi (2019:122) have argued that this is exactly what Quality 4.0 can do when they refer to “end-to-end businesses integration, (when) departments and business units can act as one unit integrated internally and externally”. This institutional integration is powered by connectivity that provides information throughout the organisation – it can be referred to as ‘vertical integration’. At the same time, ‘horizontal integration’ links together every stakeholder connected with the main work of the organisation. Together, vertical and horizontal integration lead to “end to end integration”

(Sader et al. 2019:119), which is a means to address both internal and external priorities based on rapid and real-time information flows. End-to-end integration can enable evidence-based decision-making in connection with every aspect of a university's operation: it is Quality 4.0 supported by 4IR tools.

Chief among 4IR tools are 'Big Data' and 'cloud computing'. Chen, Mao and Liu (2014:171) have described 'Big Data' this way:

> Compared with traditional datasets, Big Data typically include[s] masses of unstructured data that need more real-time analysis. In addition, Big Data also brings about new opportunities for discovering new values, helps us to gain an in-depth understanding of the hidden values, and also incurs new challenges, e.g., how to effectively organise and manage such datasets.

Against this background, the reader is invited to consider Facebook, Instagram, Google, and Twitter or in general, what are referred to as Web 2.0 technologies. If the information in these platforms remained as scattered fragments circulating across the Internet, it would be of little value. Yet, as has been shown, these scattered fragments can now be 'harvested' or 'mined'. As Ghani, Hamid, Hashem and Ahmed (2019:418) have argued: "Big Data collected from social media are useless until properly utilised to drive decision making by turning a huge amount of social data into meaningful insights". Information needs to be turned into data that can provide the basis for decision-making. This is where cloud computing is a necessary adjunct to any form of Big Data.

Chen et al. (2014:176) pointed out that "the main objective of cloud computing is to use huge computing and storage resources under concentrated management, to provide Big Data applications with fine-grained computing capacity". Cloud computing enables massive amounts of data to be stored, structured, analysed then distributed. Data analysis techniques include both the traditional analytic modes and new modes such as machine learning, data mining, text analysis and more[59]. The main point to note is that Big Data need new computing capacity, new ways to analyse data, new forms of distribution and, most of all, commitment on the part of any organisation to use the data for improvement purposes.

In this paper, the literature so far has been drawn from the world of business and industry because it is there that Quality 4.0 has had its main effect. The issue now is to understand

[59] For a full discussion of these and other data analytic processes for Big Data, see Chen et al (2014:195-197).

how the experience of business and industry can be transferred to higher education. There are several key concepts that need to be part of any transfer process:

- 'end to end integration' meaning that all internal and external units need to be connected seamlessly in order both to send and receive information;
- 'Big Data' to provide a necessary flow of information;
- 'cloud computing' to provide both storage and analytic capacity for data processing and transmission; and
- a commitment to quality as strong as any Chief Executive Officer's (CEO's) responsibility for product development and profits.

At the heart of these processes is an understanding that feedback is the key characteristic of any quality process. The system suggested immediately above is based on the efficacy of feedback in facilitating institutional learning. This is not a new element in Quality Assurance (Shah, Cheng and Fitzgerald, 2017; Santhanam, Lynch and Jones, 2018; Winstone, 2018), but perhaps it has rarely been characterised as the key element. Yet it is the feedback that leads to new learning, new thinking and new ways of doing things. This message has shone brightly through the literature on learning in schools (Hattie and Timperley, 2007; Beaumont, Canning, and Moscrop, 2016) and it should now be understood as the centre of organisational learning in the age of 4IR.

The difference in a Quality 4.0 environment in higher education will be that feedback will be made available on an end-to-end basis through powerful 4IR technologies. This is the scenario for which universities must be prepared to make their mark in the remainder of the 21st century. It will mean an end to the current way in which Quality Assurance is conducted and an enhancement of the importance of Quality Assurance processes both within and across universities.

WHAT MIGHT THE QUALITY ASSURANCE FUTURE IN HIGHER EDUCATION LOOK LIKE?

In the first place, universities need to consider infrastructure issues. Infrastructure can mean many things – buildings, equipment, Wi-Fi, *etcetera*. Yet for the new approaches to Quality Assurance described, the issue is digital infrastructure. Williamson (2018:3) writes of an initiative in the United Kingdom (UK) designed to enhance the digital infrastructure of universities. The aim of the ongoing project, known as 'Data Futures', is to make use of Big Data to enhance teaching and learning, the experiences of students and the business positioning of the universities. Williamson (2018) acknowledges, however, that this emphasis on Big Data is as much about the marketisation of universities as it is about providing access to data. Further, among the extensive rationales given for the initiative, there is barely any mention of Quality Assurance, or the role Big Data can play in ensuring it.

Thus, as higher education gears up its digital infrastructure, there needs to be a focus on 'Big Data' and 'cloud computing' for Quality Assurance purposes. This focus does not need to be part of a neo-liberal agenda for universities: but it does need to become part of the quality agenda. Universities have multiple data sources. Data from admissions, student assessment, student feedback on teaching, resources, employers, government, curriculum, international standards and whatever else is seen to be important, can be stored in a single database using cloud computing, for analysis followed by distribution throughout the organisation. This is the vision for Quality 4.0. that builds on current initiatives for developing digital infrastructure in universities.

The extensive use of technology for seeking quality improvements might seem like placing too much emphasis on technical solutions to educational problems. Yet this view misses the essential point of using technological innovation. Technology is the medium – the message is the evidence relating to quality that is provided throughout the organisation. It is the evidence, as Beerkens (2018) has shown, that should be at the heart of Quality Assurance, and technology facilitates the availability of evidence across the organisation end-to-end. Who will manage these processes?

A quality profession has grown up over the past few decades to service the increasing demands of governments and the higher education sector. How will the profession fare in Quality 4.0? Radziwill (2018:9) asks a similar question concluding that "quality professionals are perfectly positioned to lead digital transformation efforts". Is this an overly optimistic assessment? The concept of the quality team in universities needs to be drastically rethought to accommodate the central role of technology. This will mean that Information technology (IT) units can no longer be isolated groups responsible for hardware and software. IT professionals must become the drivers of the digital infrastructure needed for Quality Assurance 4.0 and the partners of Quality Assurance teams. As shown in this paper, such infrastructure may well be emerging as part of other developments in universities; nevertheless, it is crucial that Quality Assurance is regarded as being central to these efforts. The partnerships between IT units and the Quality Assurance teams will open up the promise of Quality 4.0.

Yet Quality Assurance teams will also face challenges not just from new infrastructure but also from new ways of thinking. In the future, the focus is not so much on platforms for teaching and learning, research repositories, management systems, *etcetera*. As Williamson (2018:3) explained, the transformation of universities for the age of Big Data is dramatic.

> The collection, analysis and presentation of Higher Education data is being enabled by complex new data infrastructure systems that include both human and nonhuman actors: performance indicator metrics, data warehouses, data files, spreadsheets, information and records systems, visualisation software, algorithm-led analytics packages and institutional dashboards, plus data managers, data stewards, business managers, financial officers and deans.

This description is not of the traditional environment for quality professionals, but it is the environment needed for Quality 4.0 and the environment for which Quality Assurance professionals can be prepared. Quality 4.0 requires IT professionals, university managers, statisticians and new-age quality professionals. Quality 4.0 does not require *ad hoc* reports on different aspects of university performance: it requires free-flowing information from within and outside the institution that provides the foundations for decision making on a daily basis. There will be a broad-based quality team responsible for this process, but it will not be like a team of current quality professionals. It will be an expanded team.

The paper notes a possible solution to enable the transition of existing quality professionals to the new Quality Assurance environment. There is a need for the upskilling/ training of existing Quality Assurance professionals to enable them to function as 'new age QA professionals'.

This change in direction will not be without costs. Part of these costs will involve the retraining of existing staff to facilitate the development of Quality 4.0. Existing staff will bring experience and they will gain new ideas and new skills. University managers need to invest in this process and as part of the new approach, they need to break down the barriers between current Quality Assurance and IT teams. Such integration will underpin the development of Quality 4.0. Yet it should not be thought that financial or cost management is outside of the reach of the digital technologies driving Quality 4.0. As Augilar and Ittner (2018:3) have pointed out:

> ...digital sources are providing larger volumes of structured and unstructured data with greater speed than ever before. At the same time, advances in analytical modelling methods and technology are making it easier to transform this data into insights that dramatically improve cost management by enabling greater optimisation of existing operations and fundamental transformations in business models and cost structures.

This is a reminder that an institution's financial data are not outside the reach of Big Data analytics that can highlight relationships within the organisation that have not been known or understood previously. Cost management that eliminates inefficiencies while pursuing growth strategies is most likely to assist universities to survive and prosper (Aguilar and Ittner, 2018). Data analytics may well be the best resource they have to help them to achieve this end.

This point is not to downplay the costs involved in enhancing digital infrastructure or to pretend that some institutions or countries will not be more advantaged than others. The digital divide specifically in relation to the invention, import and export of 4IR technologies, will continue to exist, as shown graphically by Foster-McGregor, Nomaler and Verspagen (2018). As these authors argue, the issue needs to be addressed by active policy interventions perhaps similar to the 'Data Futures' project funded by the UK government (Williamson, 2018). Yet all universities will need to find ways to manage the transition to Quality 4.0 if their institutions are to meet the needs of the 21st-century.

CONCLUSIONS

This article has pointed to a future in which Quality Assurance is even more important to universities than it is currently. Yet it will not be the kind of Quality Assurance to which institutions have grown accustomed over time. It will be Quality Assurance that requires every aspect of an institution to be on display all the time and when data are used, sometimes in real-time, to bring about improvements. Vice-Chancellors will head these quality processes, and all staff will be directly involved along with external stakeholders. Information will flow throughout the institution, and reflection on it will lead to change and improvement. People and machines will work together. At times machines may seem to be providing directions through the smart work of their algorithms. In the end, however, decisions will be taken by people not because they have been directed by machines but because, after reflection, people have understood the benefits of any new direction. Quality Assurance 4.0 will necessarily be driven by technology, but its impact will be achieved by people using technology-driven information, reinforcing the fact that people, who have always been a university's greatest asset, will remain so.

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PAPER 15

University of the West of Scotland: Modern Pedagogy, Student Retention and Widening Access to Higher Education

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ABSTRACT

The University of the West of Scotland (UWS) is a Higher Education Institution (HEI) that prides itself on its approach to modern pedagogy. UWS is a global university with four campuses in Scotland and one in London, with a network of transnational education partners across the world. The university is a knowledge-rich organisation, committed to providing the best teaching, learning and research experiences for students in the 21st Century and equipping them with digital literacy, graduate talents, cognitive consonance and lifelong learning skills to manage their lives and careers through the Fourth Industrial Revolution (4IR). UWS has a long tradition of supporting returners to education, with a significant number of students from widening access backgrounds, lower socioeconomic groups, mature populations, and 'first in family' attendees to university. We believe that everyone has the right to education and that individual circumstances should not prevent them from pursuing personal aspirations to gain a degree and achieve their ambitions. This paper outlines the work UWS has done and will continue to do, in providing an exemplary education fit for a rapidly changing world. It will look at how UWS has readied its graduates for the 4IR and given them the meta-skills necessary to succeed in a technological landscape with Moore's Law rate of change. The Coronavirus pandemic has driven a revolution in our approach to education, and as a consequence, UWS has invested in a new online learning platform, developed a modern approach to work-based learning, introduced a graduate apprentice scheme and initiated a hybrid approach to learning and teaching. The paper describes how UWS has provided higher education to individuals in some of Scotland's most deprived areas and delivered on its commitment to provide education for all, with almost 50% of UWS undergraduate entrants coming from these areas.

INTRODUCTION

The UWS has been delivering degree education for more than 120 years and now has five campuses across the United Kingdom (UK): Paisley, Lanarkshire, Dumfries, Ayr and London. The university prides itself on being there for its students, delivering vocationally-focussed degrees and having a transformational impact on both its students and the economies in its surrounding townships. UWS acquired a university title in 1992 and is now ranked amongst the top universities in the world and amongst the top Young Universities in the world as described by *Times Higher Education* (THE). As the highest-ranked modern university in Scotland, UWS is renowned for its teaching quality and student experiences across a wide range of subjects.

As a research-informed and teaching-led university, UWS has a student-centred approach and aims to deliver personalised and distinctive learning with a global outlook. The student-centred approach is embedded in all teaching, courses and activities. It is evident when the 20,000 students, with nearly 75% identified as mature (over 21 years), have often returned to education later in life to experience transformational learning and pursue degree-qualified vocations.

STRATEGY 2025

Having completed its previous *Corporate Strategy 2014-2020*, the university prepared and launched *Strategy 2025* in February 2020. This new, modernised strategy focuses on growing investment, tackling world issues, valuing people and shaping societies with a global, innovative and student-centred approach. The Strategy (UWS, 2020:06) begins by highlighting the university's purpose:

> …to work in partnership with its students to deliver world-ready graduates who will design, shape and build a new future. We are pioneers in developing effective interactions with global business, industry and the public and voluntary sectors. With cutting-edge courses, modern pedagogy and practical knowledge we enable our students and staff to experience the sheer joy of learning, teaching, research and innovation, and apply their knowledge for the benefit of others.

With a long-term commitment to widening participation, student population growth, internationalisation, research excellence and a technologically enabled curriculum with contemporary facilities, the work of the university is based on five truths:

1. we are here for our students;
2. we are a global university;
3. we are a knowledge-rich organisation;
4. UWS graduates are world-ready; and
5. we value our people and UWS is a great place to work.

Fundamentally, UWS is *here for good* by creating change in our regions and investing in people, communities and industries to help create better futures. This purpose underpins Strategy 2025, which highlights three main areas: learning and teaching, distinctive research and innovation, and shaping communities and societies.

Committed to supporting students to gain their degrees and reach their full potential, UWS strives to use innovative teaching and creative learning environments with the help of technology. By investing in modernising learning spaces, using interactive learning studios, with a flipped learning model requiring students to prepare with prior reading, review, directed study or task completion, students work in small groups rather than being exposed to didactic delivery.

Because UWS is keen to impart students with Meta skills for the 21st-century workplace, using technological advances such as virtual reality, 360 cameras, robotics, three-dimensional (3D) printing, 5G and Artificial Intelligence, we are helping our students with the higher-level skills and cognitive skills that will feature prominently in the 4IR. These skills have been labelled *I am UWS* and are summarised in Figure 1 as the academic, personal and professional skills, abilities and characteristics that form the UWS graduate attributes. Acknowledging that tomorrow's leaders are often born out of university, these graduate attributes are a functional part of a learning journey, and UWS is determined that in addition to subject knowledge and skills, these attributes are demonstrably present in graduates from UWS.

I am UWS	Academic	Personal	Professional
UNIVERSAL	Critical Thinker Analytical Inquiring	Emotionally intelligent Ethically-minded Culturally aware	Collaborative Research-minded Socially responsible
WORK-READY	Knowledgeable Digitally literate Problem-solver	Effective communicator Influential Motivated	Potential leader Enterprising Ambitious
SUCCESSFUL	Autonomous Incisive Innovative	Creative Imaginative Resilient	Driven Daring Transformational

Figure 1: I am UWS: Graduate Attributes

The UWS graduate attributes were designed with students and acknowledge the requirements for graduates entering the workforce as part of the 4IR. Specifically, the digitally literate, problem-solving, autonomous and analytical attributes relate closely to workforce needs in the future following 4IR. With the pace of change continuing to impact significantly on technological advances affecting all aspects of our lives, UWS wants graduates to be ready to form part of an evolving landscape.

The universal skills sought by UWS look at the individual's personal traits. As Schwab (2016: Introduction, para.10) states, in the 4IR, "it is not only changing the 'what' and the 'how' of doing things but also 'who' we are". The universal skills focus on the ability of a graduate to connect with those around them, particularly those from diverse backgrounds. The skills teach our graduates to be emotionally intelligent, to form strong bonds with others, to think critically and to analyse information; and to work effectively with others. These traits also encourage graduates to be aware of their social responsibility. Schwab (2016: Introduction, para.15) states that "shaping the fourth industrial revolution to ensure that it is empowering and human-centred, rather than divisive and dehumanising, is not a task for any single stakeholder or sector." At UWS, we believe everyone must work together successfully and collaboratively to build for the future.

The work-ready element profiles how our graduates' preparedness for the workforce can be demonstrated. UWS graduates can be some of the most resilient members of the community, and the use of knowledge gained, ambition to drive change, and a willingness not simply to participate in society but to shape it, will make them leaders of the future in the context of the 4IR.

It is intended that successful graduates from UWS will strive to reach their full potential. Creativity, imagination, and thinking 'outside the box' are all skills, which are invaluable in a world that is evolving and progressing faster than before. At UWS, we encourage our students to 'dare to be different'. We want graduates to make trends, not to follow them. We want them to be prepared to continue their learning, every day, as new technologies provide opportunities for change.

In addition to our graduate attributes, strategic growth at UWS is underpinned by excellent, distinctive research and innovation. Academic staff produce research that is relevant to current global issues and challenges. This research informs teaching at the university and has been a significant driver in the development of the curriculum. Strategy 2025 will continue to focus attention on (a) achieving demonstrable indicators of the United Nations' Sustainable Development Goals, as well as (b) aiming for UWS to lead in climate change and resilience through research and enterprise activities. With an overt commitment to increase the scope, depth, quality and impact of research, UWS is a research leader in several academic areas, including, sensors, thin-film and advanced plasma substrates, dementia, 5G mobile developments, *acanthamoeba keratitis*[60] eye care, fish health, and school-based holocaust education, and is also a research leader in Regional Development Agencies.

UWS prides itself as a civic university, which focuses on creating change and impact in its communities. The university places value on people, and has an overt commitment to equality; diversity and inclusion demonstrable through several cross-university programmes to support the nine protected characteristics of UK life (see Figure 2).

Figure 2: UK Protected Characteristics

The university continues to develop an inclusive culture where diversity is celebrated, with the aim of making a difference in the lives of staff and students while striving for social and economic good. The university recently commenced a series of conversations with staff and students on their experiences of discrimination to find a way to ensure a transparent, equal and diverse community. The mission is to '*educate the world'* through transformational experiences, both locally and globally, by helping those who might not otherwise access higher education, to gain access to degree programmes. UWS aims to create learning

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[60] *Acanthamoeba keratitis*, also known as AK, is a rare but serious infection of the eye that can cause permanent vision loss or blindness.

opportunities, where ability and not background matters, will continue to work to widen access to education and support students in their education. The new Strategy builds on previous achievements made during the period 2014-2020 when the university:

- opened a new Campus in London, increasing student numbers and improving turnover by more than £10 million annually;
- improved global impact by developing international partnerships and collaborations, which included, amongst others, collaborations with the International Space School Educational Trust (ISSET) and National Aeronautics and Space Administration (NASA), and gaining accreditation as Scotland's first and only official training partner for China, through the State Administration for Foreign Expert Affairs (SAFEA);
- saw growth in turnover exceeding 25% from 2013, enabling investment in facilities, including opening a new £120 million campus in Lanarkshire; and
- gained international recognition from the Times Higher Education's (THE) Young University Rankings in 2016, and most recently was cited in the top 150 universities under 50 years of age and in the top 600 for the 2021 THE World University Rankings.

WIDENING ACCESS

A Scottish Funding Council report (2019) found that UWS continued to be Scotland's leading university for widening access to students from disadvantaged backgrounds, with 20.9% of the student body at UWS coming from the most deprived parts of Scotland (Table 1). This same report also highlighted that the retention of such students in the last five years at UWS had improved by nearly 10%, the biggest improvement across the university sector in Scotland.

The Scottish Index of Multiple Deprivation (SIMD) is the Scottish Government's official tool to identify areas of multiple deprivations in Scotland and looks at the extent to which an area is deprived across seven domains: income, employment, education, health, access to services, crime and housing.

Table 1: Scottish HEIs with the highest percentages of young Scottish-domiciled entrants to full-time undergraduate programmes from SIMD-20 (2015/16)[61]

Institution	Percentage (%) of students from the 20% most deprived areas
UWS	20.9
Glasgow Caledonian	17.0
Glasgow School of Art	13.5
Dundee	13.0
Abertay Dundee	11.7
Strathclyde	11.5
Stirling	10.4
Royal Conservatoire	10.3
Average for Scotland	**10.4**

In the 2015/16 academic year[62], UWS had 20.9% of its undergraduate students from SIMD20, the most deprived 20% of the Scottish population, which accounted for 27.6% of all students attending a Scottish university from SIMD20. UWS also had 49.1% of its undergraduate student body drawn from SIMD40, the most deprived 40% of the population in Scotland.[63] In 2014/15, 57.0% of Scottish-domiciled learners transferred by articulation from further education colleges to degree-level courses at UWS, with advanced standing through the Recognition of Prior Learning (RPL), compared with the national average of 47.6%.[64]

At UWS, there is considerable effort put into outreach work with schools to encourage learners to consider a university education. This aids recruitment and allows the university to play a key role in the community by supporting student success and focusing on hard to reach groups. The programmes have enabled UWS to work with nine local communities,

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[61]For more information, please see: http://www.sfc.ac.uk/PublicationsStatistics/statistics/higher_education_statistics/HE_performance_indicators/Participation_indicator_for_Scottish_HEIs.aspx.
[62] The academic year in Scotland usually starts in August of a given year.
[63] For further information, please visit: http://www.sfc.ac.uk/PublicationsStatistics/statistics/higher_education_statistics/HE_performance_indicators/Participation_indicator_for_Scottish_HEIs.aspx
[64] Scottish Funding Council. 2017. Universities: Progress and Ambitions Summary of progress 2015-16. Accessed at http://www.sfc.ac.uk/web/FILES/Funding_Outcome_Agreements_2016-17/University_Outcome_Agreements_Summary_2015-16.pdf, on 09 August 2021.

comprising approximately a third of the school-age population of Scotland. The academic schools at UWS also undertake a significant number of engagements with local primary and secondary schools. These initiatives include opportunities to visit our laboratories, participate in developmental events, experience the excitement of a university campus and be inspired by academic colleagues. Interaction with local schools also takes place with more structured programmes, such as: the Schools for Higher Education Programme (SHEP), Access to a Career in Teaching (ACT) Project, the Scottish Wider Access Programme (SWAP West), the Ayrshire Chamber of Commerce Schools Event, Pupils Exhibiting Potential (PEP), and the UWS Children's University initiative – the latter being a national programme to encourage primary-aged children to experience university campuses and be influenced into aspiring to achieve a degree.

The SHEP programme is specifically aimed at schools with low progression rates to university. The programme aims to increase the aspirations of pupils by using trained student mentors who work with the pupils in their last two years of high school to develop the skills necessary to progress to higher education. This work forms a foundation for skills relevant to the 4IR. The sessions often take place during school hours during Personal, Social, Health and Economic (PSHE) education, and are delivered by UWS staff and facilitated by student mentors. This programme, referred to as FOCUS West, is a collaboration between six HEIs. The programme has been delivered since the 2008/09 year and has enabled more than 4,000 students to experience university campuses. In 2015/16, 2.7% (129 students in total) of Scottish-domiciled undergraduate entrants to UWS came from SHEP schools, compared to 2.4% (92 students in total) in the previous year. During the programme, secondary students in their final two years learn valuable skills which are influenced by our UWS graduate attributes. Pupils learn how to set personal goals, create action plans, and undertake research. They are helped to analyse their skills and weaknesses and think creatively about how to convey concepts through interviews or utilise their abilities at university and in the workplace. The skills taught allow them to begin forming a foundation of skills that can be enhanced by attending university, or by entering further education, an apprenticeship or the workforce, in all cases taking cognisance of the skills needed in the 4IR.

The PEP programme, run in partnership with Renfrewshire Council as part of their Tackling Poverty initiative, was developed to target second-year secondary students who have shown potential but have poor engagement with learning. The programme provides access to sessions taught by graduate students followed by further work in chosen subject areas. The programme was evaluated by surveying pupils before, during and after the activities and included follow-up sessions later in the year. The first cycle of the programme in Spring 2016 involved 84 pupils from 11 schools. The post-evaluation of the programme indicated that the number of participating pupils who would consider applying to university had increased from 57% pre-programme to 74% post-programme. The PEP programme is unique in its development and allows for the targeting of specific needs as identified through the local council Tackling Poverty Programme.

In 2016, UWS partnered with Children's University Scotland to deliver UWS Children's University across all four Scottish campuses. UWS Children's University aims to develop aspiration, creativity and engagement with learning and celebrate the achievements of children aged 5-14. It is based on providing and supporting opportunities for extra-curricular learning in partnership with schools. While other Scottish universities already partner with Children's University, the UWS programme is different in scale, as the initial roll-out during 2016/17 included 35 schools across more than 55% of the landmass of Scotland in co-location to UWS campuses. This programme allowed the university to develop stronger relationships with primary and secondary schools while encouraging interest in university with students at an early age. The programme targets more hard-to-reach groups and aids in closing the socio-economic factor-related attainment gap.

UWS has also been the sponsor of a Mission Discovery programme for the past five years. This programme, run in partnership with NASA, ISSET and the Science, Technology, Education and Mathematics (STEM) Summer School, brings together 250 students from across different secondary schools in the West of Scotland onto the university campus. Facilitated by a NASA astronaut, a NASA astronaut trainer, UWS scientists and UWS students, groups of secondary school students devise and prepare an experiment that is judged at the end of the training week. Each year the winning experiment is sent into space to the International Space Station (ISS). This is a further example of our outreach activity having a direct impact on the preparation of the next generation of leaders who will form the core of the 4IR.

UWS is the leading university in Scotland regarding access by students articulating from further education colleges. It has formal articulation partnership agreements with eight further education colleges. In addition, students from ten other colleges regularly progress into courses at UWS each year. More than 1,200 students progress with advanced standing each year, entering with Recognition of Prior Learning (RPL) for either one or two years of their undergraduate degrees. Over a quarter of all students who articulate to universities in Scotland, do so at UWS.[65]

Articulating students are a central part of UWS' educational provision. The articulation of students aligns well with the university's vision of widening access and transforming lives. College Engagement Partners actively seek new articulation routes to ensure that progression opportunities are kept up to date and relevant to the workforce. UWS continues to enhance its relationships with colleges, allowing colleges to promote articulation routes to higher education in their recruitment, which in turn enables students to plan their learner journeys from school to college to university. UWS College Engagement Partners offer an induction module to students on courses that are part of UWS learner pathways. Once at UWS, Student Enhancement Development Officers continue to support direct entry students, to smooth the transition process. Ongoing support is then provided to assist students completing up to Honours level qualifications, in line with the university's strategic objective that an Honours qualification should be the norm for all students.[66]

STUDENT RETENTION

Student retention has been a significant challenge for UWS over many years. Less than 10 years ago, more than 30% of students were dropping out and not completing the degrees for which they had enrolled. In the last few years, numerous initiatives have been put in place to prioritise support to students and help them to achieve their desired awards. Specialist teams and support networks work to engage with students to ensure that they

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[65] UWS had 1,076 students with advanced standing out of a total of 3,999 in Scotland for 2014/15. Scottish Funding Council. 2017. Universities: Progress and Ambitions
Summary of progress 2015-16. Accessed at
http://www.sfc.ac.uk/web/FILES/Funding_Outcome_Agreements_2016-17/University_Outcome_Agreements_Summary_2015-16.pdf, on 09 August 2021.

[66] Students in Scotland receive a degree on completion of three years at university. To obtain an Honours classification, students must complete a fourth year, unlike in England where after three years students can earn an Honours classification based on their learning results. For more information on the Scottish Credit and Qualifications Framework, please see Dr Helena Lim's paper, 'The changing landscape of learning and teaching in UK higher education in the last 25 years: The story so far' (Paper 13 in this Bulletin).

have the tools needed to complete their degrees. The percentage of Scottish-domiciled full-time first-year undergraduate UWS students returning to study in year two increased from 85.6% in 2013/14 to 87.4% in 2015/16. In 2014/15, the national average was 90.5%.[67]

While the retention rate at UWS continues to improve, the university recognises the need to make further progress. This progress is shown in the major steps taken in 2016 to improve support for students, by bringing together several support departments, including the Registry, and those for Admissions and Recruitment, the Library, Student Services and Sport. These departments were brought together into 'Student Life' under a newly created Director post. The core focus is to deliver a seamless, efficient and effective student support system across UWS campuses. Other student progression initiatives are outlined below.

- The **My Journey** initiative was introduced to allow students actively to support their own learning engagement. The self-evaluation tool that was launched in Term 1 of 2016/17 also facilitated the early identification of students who needed some intervention to support their academic progress.
- **A Personal Tutor Toolkit** was developed at UWS to provide support for personal tutors, and includes a training programme, a seminar series, a support crib sheet, and suggested agendas for meetings throughout the academic year.
- UWS is planning to pilot **exit and 'keeping in touch' interviews** for those students considering withdrawing from the university, or those who have already withdrawn, to help to identify why students leave.
- A further project involves setting up a **pre-entry Moodle** site to give students a better understanding of their programmes before they start formal studies, as well as an understanding of their own learning styles.
- UWS is working to develop a **timetable**, which includes both contact time and independent study time. This timetable would be for the first term or first year of study and will aim to help to integrate students into the academic culture of the university. This initiative promises to be extremely helpful for first-generation students.

[67] Scottish Funding Council. 2017. Universities: Progress and Ambitions
Summary of progress 2015-16. Accessed at
http://www.sfc.ac.uk/web/FILES/Funding_Outcome_Agreements_2016-17/University_Outcome_Agreements_Summary_2015-16.pdf, on 09 August 2021

- Student Life recently reviewed the university's **Student Pregnancy and Maternity Policy** and consulted with stakeholders and committees on the provision of support for student parents. The policy was updated to provide all student parents with clear information on the support they would receive at UWS. According to Bairn Necessities, in a report commissioned by the National Union of Students Scotland, UWS has the largest proportion (22%) of students who are parents in Scotland (University of the West of Scotland, 2017b).

The Student Development Department works to give support and guidance to all students throughout every step of their learning experience. This department is continually working to improve all the student services provided, which include the services through five professional teams, namely, those for Counselling, Disability, International Student Support, Funding and Advice, and the Multi-faith team.

As part of the wider student support offered to students, UWS launched **The Hub** in September 2016 as a 'one-stop-shop' to enrich the student experience. The Hub provides a space for students and includes self-help resources, a service desk and both learning and social spaces, including The Hub Café and pop-up spaces for events and campaigns. The Hub is the central information point for students at the university, bringing together a range of student-facing facilities. For example, the Disability Service offers 'lecture capture' (where lectures are recorded, usually in the form of the slide show plus audio), and assistive software is provided on all campus personal computers (PCs) with packages for mind-mapping, a read-aloud function, and enhanced spelling and grammar checking.

Students can access a Counselling Service at every Scottish campus, and choose between a wellbeing appointment, counselling appointment or drop-in session. The Hub offers financial advice to students on statutory student support, such as student loans, grants, or bursaries, in addition to advice on a range of Discretionary and Childcare Funds. Recognising the importance of providing support to students outside of term time, UWS offers pastoral and academic support over the summer months and across other student vacation periods. This type of support is a key part of the university's delivery to ensure that students are supported at all stages of their UWS journeys and assists students in finishing their courses and collecting their degrees. At UWS, the focus is placed on creating a supportive and safe environment for all students at every step and stage of their academic journeys.

The Hub's support network operates alongside the Students' Union and UWS academic schools to add to the academic and personal successes of all students. Student Services at UWS partner with the UWS academic schools to integrate the delivery of personal development skills directly into programmes and deliver joint events with the Students' Union. Every decision is informed by student feedback and data, with committed teams working to increase student engagement and raise awareness of all of the support and services available.

Student support is also offered through key events in the academic calendar. For instance, Student Services and the Students' Union partnered to deliver National Student Money Week across all five campuses, highlighting the theme 'Waste Not, Want Not'. The week of events aimed to engage students and raise awareness of the support available to them. The event included inputs from local Credit Unions, offered training from Love Food Hate Waste, and discussed topics such as shopping more wisely, storing food to make it last longer, using leftovers, cooking on a budget, and preparing lunches.

The university also promotes wellbeing through many events such as the University Mental Health Day, which is marked by universities across the UK. UWS took part for the first time in 2017 (University of the West of Scotland, 2017a). The Disability Service, Counselling Team and the Students' Union worked in partnership across the university and with external partners to deliver events at all five UK campuses. The theme of this year's event was 'Activity', with events designed to engage students on the relationships between mental and physical wellbeing. Over 300 students engaged with the activities and 150 'relaxation packs' were given out. Some of the activities are described below.

- The Student Services Teams provided advice and information about services on offer, such as Silver Cloud, an online Cognitive Behavioural Therapy (CBT)-based self-help toolkit which offers 30+ online behavioural health programmes to address a wide range of issues, from anxiety to depression and many more.
- The Students' Union and university sports teams showcased the opportunities available to all, encouraging participation in team activities, and provided sports water bottles for students.
- Gardening and cycling were also promoted as positive steps to mental and physical wellbeing, with the UWS Sustainability Hub offering gardening and cycle maintenance workshops.

- Student nurses offered health checks e.g. blood pressure.
- Occupational Therapists offered relaxation and Pilates-type sessions.

Students engaged positively with the external agencies, Breathing Space and See Me Scotland, which provided information and advice.

INSTITUTIONAL SUPPORT AT UWS: SUPPORT FOR CARE LEAVERS

A care leaver is any adult who spent time in care as a child (i.e. under the age of 18). Such care could be in foster care, residential care (mainly children's homes), or other arrangements outside the immediate or extended family. UWS continues to develop and implement care leaver support and has increased the number of care leaver enrolments, as reflected in Figure 3. There has been a steady increase in applications, offers and enrolments since 2008.

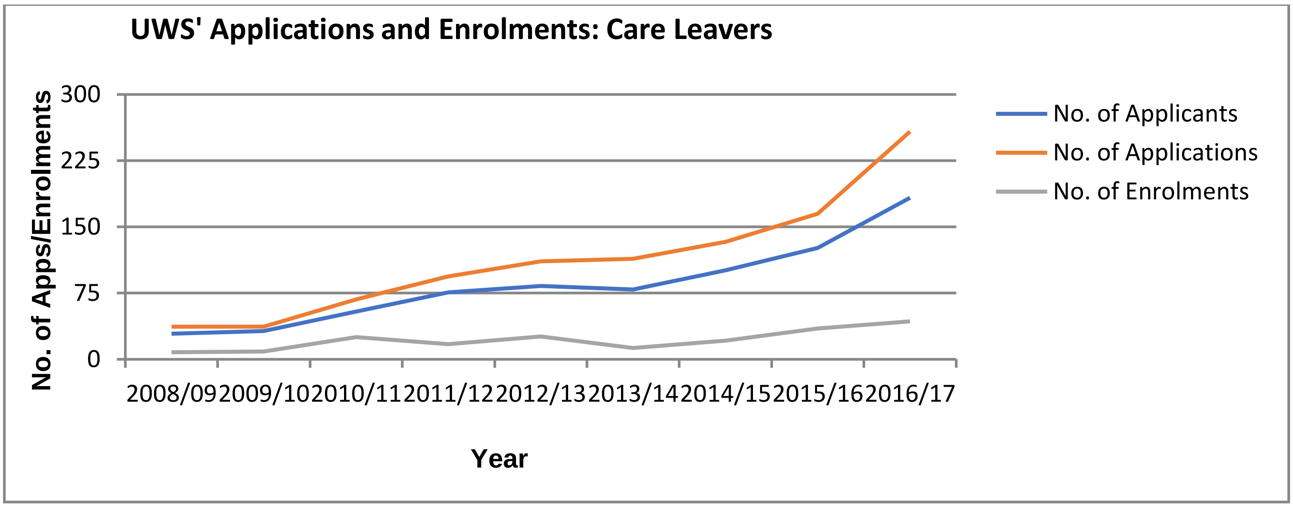

Figure 3: UWS Care Leavers Data

UWS has a comprehensive package of support in place for care leavers from pre-entry until two years after graduation. UWS continues to work closely in partnership with the Centre for Excellence for Looked-After Children in Scotland (CELCIS) and other universities and colleges through the West of Scotland Care Leavers Forum. The Forum came together with colleagues from the East Forum in June 2016 for a seminar and continues to meet at least once a year. The two fora work together to continue to strive towards a common national framework, to share good practice, and to address the barriers to learning that care leavers encounter in Scotland.

UWS supports care leavers from the early stages of their academic journeys by identifying and contacting these care leavers at the application stage to discuss what transition support they need. UWS has established procedures with local schools, Activity 16+ Coordinators, relevant colleagues within local authorities and the Scottish Throughcare and Aftercare Forum, to provide support. This support works to ensure that pupils who are considering going to university can receive information and guidance to make informed choices regarding their education. A meeting between groups of pupils and their teacher or a Throughcare Support Worker is encouraged to ascertain the level of pre-entry support needed, and to provide opportunities for pupils to meet with the Senior Widening Participation Development Officer and any other relevant colleagues from services within the university. This type of support allows pupils to transition successfully into UWS from school, college or the community. UWS and teacher contact with the Senior Widening Participation Development Officer is ongoing throughout pupils' studies, to ensure that support is provided quickly if there are any indications that pupils are having problems. The Senior Widening Participation Development Officer works in partnership internally with colleagues from the UWS Funding and Advice Team, Disability Support Services, Accommodation, Counselling Services, Careers Service, Education Guidance Advisors, and Student Enhancement Developers. Furthermore, academic staff at UWS take on the role of the committed 'Corporate Parent' and continue to work with local authorities to help to create and contribute to their action plans to support Care Leavers.

MODERN APPROACH TO WORK-BASED LEARNING

UWS has created a Graduate Level Apprenticeship programme to help widen access to higher education as well as to bridge the skills gap. The university was awarded over £2 Million in funding by Skills Development Scotland (SDS) to design and deliver a programme on Software Development and Engineering, focusing on Design and Manufacturing. UWS developed five Graduate Apprenticeships for September 2020. These included:

- BSc (Hons) IT: Software Development;
- BEng (Hons) Engineering Design & Manufacture;
- BEng (Hons) Civil Engineering;
- BA (Hons) Business Management; and
- BA Early Learning & Childcare.

These graduate-level apprenticeships were created to respond to changing markets and the growing desire for workplace learning. The programmes focus on areas where skills gaps have been identified and give apprentices the chance to work with leading employers while studying for a degree. All those involved get the opportunity to combine both academic learning with practical learning in the workplace. This benefits all of the workplaces involved as it allows organisations to invest in their staff, develop their workforces and support staff in developing industry-specific skills. This programme has enabled the university to create an industry focus and help businesses to attract and retain talent while creating a wider range of opportunities for learners. These apprenticeships have been developed in partnership with employers and professional bodies to create stronger links between education and industry.

CONCLUSIONS

UWS uses a student-centred approach along with modern pedagogy to create a supportive, innovative and unique learning environment. The university has a strong focus on community engagement, widening access to higher education, and supporting students to ensure student retention, while offering unique learning experiences from on the job graduate apprenticeships, to allowing seamless college progression.

In recent months, the physical campuses had to be closed due to the Coronavirus (Covid-19) pandemic, with colleagues having to work remotely. Recognising that some students may be more vulnerable during this time, due to Covid-19-related difficulties such as the lack of personal or private study space, reduced social contact, and having to move back into difficult family circumstances, the university has worked to increase its support to students. Examples include delivering food parcels, increasing communication and continuing to offer wellbeing support. Staff, while working from home, have continued to offer counselling sessions, online fitness and health resources, library support, financial guidance, and advice, to all students. Discretionary Funds were set up from March 2020 to support students impacted by Covid-19. Data up until June 2020, show that approximately 350 students had been awarded just over £360,000. Support was provided until the end of the academic year (July). Further funds were set aside to cover August and September 2020, with the aim being to provide meaningful levels of support to students in the summer period when they did not receive student funding and when employment opportunities were impacted by Covid-19.

The use of technology on and off-campus at UWS has created a technology-driven learning experience allowing for the development of digital intelligence. The intention is to create graduates equipped to work in the 21st century and be prepared for the fourth industrial revolution.

Since the outbreak of the pandemic, UWS, like universities across the world, rapidly had to move its teaching online. The university procured an external digital technology partner, Aula, in July 2020 to help to transfer all Year 1 modules into a new, comprehensive and technology-enabled learning system. This is much more than just a digital repository. It is an interactive learning platform that can be used in a flipped classroom form, offering learning vignettes and reviews of learning, or be an accompaniment to face-to-face delivery. The new academic year, starting in September 2020 brought new challenges. Colleagues across UWS worked extremely hard to plan for a Covid-19-safe learning and campus experience. At the time of writing, the university was working with government, funders, health professionals and others to ensure that UWS is compliant with national guidance. Planning ensured that UWS provided a welcoming and safe learning and working environment. Putting a detailed approach in place was a complex process. A small selection of the type of interventions required is highlighted below.

- Timetable adjustments and scheduling to ensure limited numbers of students on campus at any given time.
- Introducing processes to limit the number of colleagues on campus at any given time.
- Adjustments to learning spaces to ensure that social distancing guidelines could be followed.
- Adjusting working areas to limit the concentration of colleagues in certain workspaces.

In the short-term, the online model of learning that has been adopted since the closure of the university's physical campuses will continue in a new hybrid form, combining online delivery with face-to-face teaching. This means all students are able physically to access campus as well as online delivery when campuses are open, and this access is in line with the Scottish government's four-phase plan for recovery from the pandemic lockdown.

Whether the university's courses are delivered fully online, or as a combination of online courses and face-to-face activities, students will continue to receive the highest quality teaching and education from UWS. Fundamentally, UWS wants to ensure that higher education is an option for all, and that this opportunity is based on ability and not background or circumstances. Pandemic or otherwise, this civic university is *here for good*, creating change through students, in the community and the economy.

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CLOSING REFLECTIONS

Lessons from the Papers in this Volume

Mr Tshepho Mokwele

OFFERINGS IN THE BULLETIN

In the **introduction to this volume**, Chetty began by acknowledging the harsh realities of the Covid-19 pandemic and its impact across the globe. The ‘new normal’ has, however, catalysed the advancement and use of technology and the Fourth Industrial Revolution (4IR), the impact of which is (and will continue to be) felt across sectors including education, training, development and work. The author highlights the South African Qualifications Authority’s (SAQA) policy imperatives and legislative mandate further to develop and implement the National Qualifications Framework (NQF), leading the NQF community, and embracing the 4IR to this end. This section provides the context for the SAQA Bulletin, drawing on recent research and events on the 4IR in the education and training sector in South Africa. The author provides, as a point of departure, a discussion around conceptualisations of 4IR, noting a common global understanding that it (4IR) represents more than just digitisation, which dates back to the Third Industrial Revolution, and includes innovation based on the fusion of the physical, digital and biological spheres. The author then outlines the South African context and initiatives undertaken in the public and private sectors in the country, in response to the disruptive 4IR. She draws a picture of the 4IR in the context of the education and training sector, particularly in relation to development, accreditation, delivery, recognition, and quality assurance of skills and competences. Bringing the topic closer to home, the author highlights how SAQA is embracing the 4IR to deliver its mandate and provide services to the public, engage in events, and conduct research to explore the implications of the 4IR on, and chart the future for, the NQF and its context as a whole.

In **Paper 1,** Bingham and Porter look into the preparedness of the Master of Architecture (M.Arch) graduates for the 4IR. In particular, the paper explores the relevance of the current M.Arch curriculum, and whether it equips graduates with the necessary skills for the digital future. The authors gathered perspectives from 17 M.Arch graduates from four higher education institutions (HEIs) in South Africa, on whether their tertiary education had provided them with solid foundations for work in the field of architecture. The paper begins by providing an overview of the architectural profession in South Africa and the qualifications and professional registration required to practice as an architect. In relation to Continuing

Professional Development (CPD), Bingham and Porter note that Artificial Intelligence (AI) will drive the design industry in future - advanced programmes such as CAD are already used in the profession. There is a need for fundamental change in the course content of the architecture curriculum to take advantage of the offerings of technology. The authors describe how particular Critical Cross-Field Outcomes (CCFOs) are necessary for graduate architects in the 4IR world. The authors further propose the development and implementation of a 4IR-informed architectural pedagogy. Some key critical skills identified for architects in the 4IR world include creativity, problem-solving, communication, teamwork, social aptitude, entrepreneurial ability, and financial literacy. HEIs play a central role in imparting these skills and offering multidisciplinary learning opportunities in the 4IR context. The authors acknowledge the debate around technology 'replacing' humans, and emphasise the importance of CPD requirements for the different categories of professional architectural practitioners. According to Bingham and Porter, the study participants highlighted the lack of guidance in their curriculum on topics of new building technologies such as nanotechnology, smart cities, and virtual worlds, and that as a result, they were not fully prepared for the 4IR. They had learned CAD and presentation skills in the workspace and were not provided with knowledge on running architectural practices in the education space.

From a higher education perspective, Punchoo, Bhoora and Wolvaardt explore, in **Paper 2**, the intersection between 4IR and Health Professions Education (HPE) in the context of the University of Pretoria (UP). The authors examine the use of 4IR-informed hybrid and flipped classroom teaching approaches in a pilot unit (endocrinology) in Chemical Pathology for postgraduate students at UP. The authors provided an overview of the pedagogic principles framing the teaching and assessment model used in the study unit; describe the design elements of the model; and discuss the experiences and challenges in delivering a teaching unit that uses a hybrid flipped teaching model. The delivery through the hybrid flipped classroom consisted of online pre-class teaching using 'e-lecture' and 'e-tivities' through Learning Management System (LMS) platforms such as Backboard™. This work was followed by an in-class contact session, and post-class engagement (a discussion forum). The authors address the interlinked elements of formative and summative assessment, and teacher experience. The paper explores the roles and experiences of teachers; the involvement of multidisciplinary voices was found to be key for the design and delivery of the online course material. The use of technology, the authors suggest, needs careful consideration to ensure the fitness for purpose of the relevant learning outcomes and blueprinted assessments based on pedagogic evidence. The ‘backward lesson plan’ (flipped classroom) was critical to the selection and alignment of online teaching and assessment technologies.

Singh and Singh explore, in **Paper 3**, the role of AI in student recruitment and selection in HEIs. They examine, in particular, the use of AI, and how and whether authenticity and integrity can be maintained in such student recruitment processes. The authors ask if AI would be a responsible solution for university selection and recruitment processes. To what extent can technology account for context? The debate around the use of AI and machine learning algorithms that represent diversity and democratisation is not new. The authors emphasise that legal and ethical considerations should be integrated into the adoption of 4IR strategies and technologies. The paper explores the question of access to HEIs through recruitment and selection processes that utilise AI with authenticity and integrity, and optimise the NQF agenda of learning access and progression, redress for past injustices, quality and transparency. The authors note the integration of AI and machine learning in institutional admission management plans in many HEIs in the United States (US). The use of algorithms in these recruitment and selection processes, however, poses risks. In the US, for example, the recruitment and selection processes via AI favoured prospective college students from specific geographic areas, and the use of historical and current data for predictive models (to determine which students are ‘likely to succeed’) showed bias. As noted by the authors, these processes can ‘produce student archetypes’ and ‘compromise the diversity and democratisation of access to higher education’. The design and implementation of any AI/machine learning system in HEIs must therefore integrate legal and ethical principles. To promote accountability, transparency, privacy and impartiality, institutional frameworks are needed to guide the approaches, implementation, and application of AI in the recruitment and selection of students in higher education.

In **Paper 4**, Zawada explores the nature and process of institutional audits for South African HEIs in the age of the 4IR, from the perspective of the Council on Higher Education (CHE). Quality Assurance is a key element in the context of the NQF in South Africa. The NQF Act No. 67 of 2008 mandates the CHE with its Higher Education Quality Council (HEQC) to quality assure higher education. Quality Assurance by the CHE comprises HEI Self-Evaluations, Institutional Audits, Programme Reviews and the accreditation of learning programmes offered in specific HEIs. In her paper, Zawada speaks to the methodology, standards and guidelines for Institutional Audits. First, the development of the Quality Assurance/ Institutional Audits Framework involves wide stakeholder consultation and engagement in the sector. Secondly, this Framework draws on the foundations of fitness for purpose, value for money and the transformation of higher education[68]. Thirdly, HEIs are responsible for their Quality Assurance (self-evaluation and self-reflection) within the Framework. Fourthly, the self-evaluation reports and portfolios of evidence of each HEI undergo peer-evaluation as part of the Institutional Audits. Lastly, the HEQC's evaluation of the final Institutional Audit Report and outcomes are made known with (re)commendations to be implemented by the specific HEI. In terms of the 4IR, the author suggests that South African HEIs should continue to leverage technologies to improve access, equity, quality, success, efficiency and responsiveness of education and training, as recommended by the 2019 Department of Higher Education and Training (DHET) Colloquium on 4IR in the Post-School Education and Training (PSET) sector. The 4IR, the author notes, already played a critical role in the 2020 Institutional Audits. It did so in two ways: (a) there was substantive incorporation of 4IR into the Standards and Guidelines for Institutional Audits, and (b) there was operational incorporation of 4IR into the methodology and logistics of conducting the Institutional Audits. Importantly, the author emphasises that 4IR is not an end but a means to an end – the end being quality and inclusive education. The 4IR was not the only consideration in developing the 2020 Institutional Audits Framework. Benchmarking the Standards and Guidelines continentally (against African Standards and Guidelines [ASG]) and globally (against European Standards and Guidelines [ESG]) was carefully considered for good practice.

In **Paper 5**, Botha, Newberry, Steyn, Robinson and de Villiers explore how to improve quality programme review in the context of an academic department (namely, Informatics) at the University of Pretoria (UP). This approach, the authors write, is aimed at elevating the programme review cycle to the implementation of a culture of a full programme assessment cycle, incorporating a Learning Management System (LMS) using Blackboard Learn Goals Tool (BbGT). Focusing on the Informatics module of the BCom Degree in Informatics,

[68] Transformation in this context refers to socio-political transformation and redressing the imbalances persisting in democratic South Africa. Prior to the establishment of democracy in 1994, *apartheid* South Africa was an unjust, race-based society.

accredited with the Accreditation Board for Engineering and Technology (ABET),[69] the department has over the years established a programme review process, which was elevated into a programme assessment aided by technology. Annual programme reviews, the authors note, are a cumbersome process, as lecturers always have to align their module outcomes to accreditor's (ABET) required outcomes and institutions' graduate attributes. Some of the challenges found regarding programme review and assessment include working in silos, lack of resources, and the tendency to view these processes as tick-box exercises. The department, therefore, established a Programme Alignment, Implementation and Reporting (PAIR) framework. The PAIR framework and BbGT aim to change thinking and the 'silo-mentality'. BbGT aids in the mapping and alignment of learning outcomes to the module assessments and student activities of every department in the university, as well as to the institutional graduate attributes and accreditation criteria. The success of the model draws on support departments and key stakeholders to assist in the development and execution of the PAIR framework. The authors link the feasibility of PAIR and BbGT to the amount and quality of the guidance provided, the presence of an implementation strategy, teamwork, a centralised approach, an institutional strategy, implementer buy-in, and the review of curricula and learning. Among other things, a Comprehensive Programme Assessment Praxis (CPAP) guided the PAIR processes to elevate these to the institutional level, by outlining the necessary steps for the design of programmes, including the development of individual modules in the delivery phase. The authors also note that with Covid-19, the Informatics department was able to implement CPAP and *clickUp* swiftly. An Assessment Technology Adoption Framework (ATAF) can enhance reporting on students' performance regarding learning outcomes. With that in mind, the drivers of success are academic processes (80%) and the integration of technology (20%).

In **Paper 6**, Loots and Butcher explore the potential and challenges of aligning Post-School Education and Training ((PSET) and the NQF in South Africa in the context of the 4IR. The authors begin by reviewing international experiences of aligning and optimising education and training in the face of the technological revolution, before bringing the South African context to the fore. They acknowledge the disruptive nature of 4IR and note that, in other countries, the alignment of education and training (including non-formal learning and quality assurance) is critical for the changing workforce needs. Loots and Butcher argue that

[69] ABET is a non-governmental organisation that accredits post-secondary education programs in applied and natural science, computing, engineering and engineering technology mainly in the United States (US) and also internationally.

workforce skills development is key in an ever-changing world. Individualised learning, workplace training, and public-private partnerships, they note, are avenues that can bring about agility and a demand-driven skills environment for upskilling and reskilling. The authors flag the importance of investment in quality Technical and Vocational Education and Training (TVET) systems, and in reskilling and upskilling, including CPD, as exemplified in Kazakhstan, Finland and Singapore. They refer to 'flexible accreditation systems' and the 'micro-credentialing' of informal and non-formal learning, and identify some good practices of such recognition systems in France, Hungary and Scotland. For regional and international benchmarking, the authors compare qualification frameworks and encourage countries to prioritise digital skills development. Having explored international experiences, Loots and Butcher turn to the South African context and moves towards a more 'flexible and inclusive' education and training system. In South Africa, collaboration and strengthening the relationships within and between parts of the NQF community are important for enabling flexible learning opportunities, the recognition of informal and non-formal learning, and responsiveness to the new skills demands accelerated by the digital revolution. The authors contend that the NQF with its three articulated Sub-Frameworks should take into consideration the changing nature of education and training as the NQF Improvement Plan is implemented, with full staff capacity building in the NQF space. They note that the success of a renewed vision of education and training aligned with the demands of the 4IR, is contingent on parallel strategies to address, for example, the digital divide.

In **Paper 7**, Urquhart and Surianarain explore what the South African PSET system needs to be responsive to the 4IR disruptions in the context of opportunities for the youth. The authors note the risks of 4IR in creating a minority of youth 'insiders' and a majority youth 'outsiders'. Post-school skilling needs to be demand-led; skilling outcomes must be achievable; accreditation turnaround times must be quicker; there is a need to include more open-access learning; and agile funding is imperative. The authors mention some existing initiatives such as the Presidential Commission on 4IR; the Public-Private Growth Initiative; and the Ministry of Communication (MoC) and the Media, Information and Communication Technologies Sector Education and Training Authority's (MICTSETA) commitment to creating one million 4IR-related jobs (or job opportunities) by 2030. The zone of opportunities identified for youth in the digital space includes data analysis and data mining; software development; and network and information security. However, there are challenges regarding the realisation of the digital dividend, which render the impact of the 4IR uneven that include the skills demand-supply misalignment or mismatch; the high costs associated with digital/IT qualifications; and the lack of access to digital infrastructure. For this reason, the authors suggest an 'agile skilling system' with demand-led skilling that involves leading customised initiatives, finding zones of opportunity, creating collaborations and partnerships; timely credentialing including 'micro-credentialing' to keep up with the pace of technological/4IR advancements; achievable learning and skills outcomes; increased access to open learning to bridge the gap between digital insiders and outsiders; and agile funding models.

Moldenhauer, Londt, Beyer and Melton consider, in **Paper 8**, what entrepreneurship in the future South African workforce could look like, and what is happening in emerging markets in this regard. Specifically, the paper explores markets that have emerged and promise to have a considerable impact in the future and where digital and technological advances are central. The authors note that, understanding the history of entrepreneurship as a holistic concept that existed in prior industrial revolutions is helpful for the contemporary study of entrepreneurship in the context of the 4IR. Entrepreneurship dates back to the 'First Industrial Revolution' that was predicated on the textile industry and the evolution of machinery and new techniques developed to exploit the gains. These developments led to subsequent revolutions. The authors juxtapose entrepreneurship across the First Industrial Revolution and the Fourth Industrial Revolution. They argue that little has changed regarding who benefits from these revolutions, namely, innovators, investors, and shareholders as opposed to the public in general. The authors identify potential profitable 4IR markets for entrepreneurs, such as those for: electronics, the Internet of Things (IoT), AI, Big Data, machine learning, cloud computing and digital platforms. The authors maintain that the levels of entrepreneurial activity in South Africa are low, while unemployment is high. The important role of Sector Education and Training Authorities (SETAs) in the provision of knowledge and skills for entrepreneurs is acknowledged (the authors mention the National Certificate in New Venture Creation as an example). The Wholesale and Retail Sector Education Authority (W&RSETA) provides skills development for individuals to develop their entrepreneurial ventures. Tourism and hospitality provide further examples of avenues for entrepreneurship supported by digital technology. Systemic challenges and impediments to these activities include the lack of a stable electricity supply, social ills such as crime, xenophobia and others; low levels of computer/digital literacy; lack of investment in digital infrastructure; attitudes towards technology; and slow integration of technology into teaching and learning.

In **Paper 9**, Adigun, Wurz, and Antonites bring the profession of archaeology into the spotlight, investigating its relationship with the 4IR. They reflect on the role of the Association of Southern African Professional Archaeologists (ASAPA) in stimulating public interest and enhancing access to archaeological education and training, including the context of the 4IR. They reflect on the journey of archaeologists towards professionalisation, the membership categories offered, and the objectives of the association. Archaeologists, they note, are the least likely of all professionals to be ‘replaced’ by robots but ought to navigate the technological landscape. This endeavour is supported by the association’s transformative agenda and its community engagement activities to enhance archaeological education. Digital technology, the authors emphasise, is not new or uncharted territory for archaeologists – who utilised early technologies since the late 1950s and started using modern and advanced technologies in the mid-2000s. For example, there is now an integration of technologies such as Geographical Information Systems (GIS), Computer-Aided Design (CAD), and three-dimensional (3D) (re)constructions of cultural heritage conservation sites. There is also increasing use of drone technology to survey inaccessible prospective sites and the use of minimally destructive sampling methods in analytics in archaeological practice. The 4IR has also brought innovative virtual reality and re-enactment simulations to explore the past. The authors argue that literature on the methods, theories and teaching pedagogies of archaeology lack critical reflection on what the profession could look like in the context of the 4IR and, importantly, the types of skills that are required. Based on a review of the literature, ASAPA acknowledges the types of digital skills that its members need to nurture better to position the profession for the 4IR. The point of departure for this work is to create awareness, through workshops and webinars, around the types of digital technologies needed for the profession. Important to note is that ASAPA champions the Recognition of Prior Learning (RPL) and is committed to developing new skills and fostering lifelong learning amongst its members.

Van den Heever, Hattingh, Singaram, Arnesen and Maree appraise, in **Paper 10**, the challenges presented by the 4IR and the Covid-19 pandemic, for the TVET sector in South Africa. The authors present what the Association for Skills Development South Africa (ASDSA) is doing to tackle these challenges. ASDSA, a non-statutory professional body/

association represents Skills Development Practitioners (SDPs) in the learning and development field. Amongst other things, the association uses its SDPs to assist small, under-resourced enterprises to submit their employee Workplace Skills Plans (WSPs) and Annual Training Report (ATRs) to the SETAs, as this process is considered cumbersome and expensive. A related challenge the authors flagged is the lack of understanding among students and employees, of the NQF and its systems and they detailed, as an example, an account of an ASDSA member's journey. One of the solutions to the challenges noted is the utilisations of partnerships or collaborative initiatives. A partnership between the Local Government SETA (LGSETA) and ASDSA focuses for example, on supporting 155 municipal SDPs to achieve professional designation status. According to the authors, municipalities need to enhance service delivery through continuous adaptation to change, including embracing technology. The main change drivers that influence different economic sectors include technology, economy, legislation, politics, and competition. In the 'occupation-directed' training space, the authors argue that the Organising Framework for Occupations (OFO) may not be an appropriate tool for planning skills priorities in the age of the 4IR, as it does not cater for the new types of jobs that are less structured, less permanent and continuously changing in this context. Turning to work placement as being integral to achieving a qualification, the authors note that many students from poor and under-resourced backgrounds do not find the work placements needed to complete their qualifications. Among other things, the authors point to the need for SDPs to embrace the 4IR and suggest that the needs of small enterprises; the Workplace Skills Plans (WSPs), the OFO and other aspects be reviewed. Also, work placements need to be considered for people in areas far from the city centres.

Barac, Plant, and Olivier examine, in **Paper 11**, the profession of chartered accountancy and the preparation of Chartered Accountants (CAs) to work in the 4IR context in South Africa. The study on which this paper is based used qualitative research methods in the form of semi-structured interviews to investigate the digital skills relevant for CAs in the age of 4IR. The authors ask pertinently, 'what are the digital skills that CAs need to remain fit for purpose in an Industry 4.0 world?' In exploring this question, they conducted 44 interviews that focused on the changes they considered essential for CAs' future skill sets. In their review of the literature, the authors establish that accountancy professional bodies support the need for competency among their professionals and have refined their competency frameworks to underline digital skills (such as Big Data, Blockchain, *etcetera*). The study found, amongst other aspects, that CAs are already immersing themselves in the automation enabled by machine learning, and that they will need to adapt to other technologies affecting their work: cloud computing, robotics, AI, Bitcoin, and cryptocurrencies. CAs work with bulk financial data and can work as data scientists within businesses. The authors argue that the profession will be enhanced, rather than replaced, by technology. The findings of this study corroborate the existing body of knowledge that focuses on the skills needed by accountants in the 4IR world. The research contributed to the development of a revised curriculum for the South African Institute for Chartered Accountants (SAICA), and will inform the academic and training programmes with which it is associated.

Moodley examines, in **Paper 12**, the disruptive nature of 4IR as an element of the 'VUCA' (volatile, uncertain, complex, and ambiguous) world. It is against this backdrop that she details the purpose and objectives of a collaborative 'Sandbox Schools Initiative' led by the National Education Collaboration Trust (NECT), which seeks to equip young people with a broad range of 'competences for a changing world'. The Sandbox initiative, which is underway at the time of this publication, comprises the development of such competences in eleven primary schools in South Africa. The 4IR has the potential to exacerbate current South African social ills such as poverty, inequality and unemployment. For this reason, Moodley writes, the focus in schools and elsewhere should be on the transformative nature of education. Developing broader competences through 'deepening learning' enables learners to transfer their knowledge and skills across situations and contexts. Through a Design-Based Research (DBR) model, the Sandbox Initiative trials methods to developing competences and in so doing complements the Department of Basic Education (DBE's) 'Three-Stream Model'[70]; Robotics and Coding curriculum; Schools of Specialisation; and entrepreneurship development. The initiative focuses on how classroom practices and learning environments contribute to the development of competences, and the need to strengthen teacher agency towards this end. The author advocates flexible assessment practices; while the schooling system currently places summative assessment at a higher premium, since formative assessment is associated with deep, conceptual learning, it should be prioritised. The Covid-19 pandemic and 4IR events underline the VUCA world, making the adaptability and agility of systems across society even more critical than is

[70] The DBE's Three-Stream Model comprises three streams at Further Education and Training (FET) level – the last three years of schooling in South Africa. These streams comprise and enable further learning in trades and occupations, vocational and academic directions respectively.

usually the case. Therefore, the success and replication/scaling-up of the Sandbox Schools Initiative is the point of departure to responding to these challenges at the basic schooling level.

From an international perspective, Lim explores, in **Paper 13**, the changing policy landscape in teaching and learning in higher education in the United Kingdom (UK), with specific reference to England, Scotland, Wales, and Northern Ireland, in the last 25 years. Lim notes that there has been a significant transformation in higher education across the four nations, with an emphasis on learners. Policy drivers and initiatives that support and enhance teaching and learning include the professionalisation of teaching, technology-enhanced learning, teaching quality, and allowing 'the student voice'. Qualifications and credit frameworks provide a useful reference point for, and consistency in the recording and recognition of, qualifications offered in the UK. Lim outlines some significant developments and initiatives in the UK's learning and teaching space with successive public policy reviews to transform the system through the lens of the 'Dearing' Report (1997)[71]. The author includes the example of the Teaching Quality Enhancement Fund (TQEF) that supports the development of learning and teaching across three levels: sectoral, institutional and individual. The TQEF was used to set up the Institute of Learning and Teaching in Higher Education (ILTHE) – a professional body for all who teach and support learning in the higher education context. Other initiatives include the Teaching and Learning Research Programme (TLRP) that funds 14 projects that address challenges in learning and teaching. The Learning and Teaching Subject Network (LTSN) aims to provide subject-level support for innovation in teaching through 24 Subject Centres based in 21 higher education institutions (HEIs) across all four UK nations. It also includes a generic centre co-located with the ILTHE in York. The National Teaching Fellowship Scheme (NTFS) was established to recognise and reward academic staff who demonstrate excellence in learning and teaching. The Teaching Quality Enhancement Committee (TQEC), established by the Higher Education Funding Council of England (HEFCE), Universities UK (UUK) and the Standing Conference of Principals (SCOP) to review the arrangements for supporting the enhancement of learning and teaching, proposed the creation of a single, central body for higher education. The Higher Education Academy (HEA) was then formed through the amalgamation of the ILTHE, the LTSN and the National Coordination Team for TQEF into a

[71] Dearing, R. 1997. Higher Education in the Learning Society. The Report of the National Committee of Inquiry into Higher Education - The Dearing Report. London: HMSO.

single organisation. *Advance HE* aims for a single sector agency for learning and teaching, equality and diversity, and leadership and governance in higher education. The National Student Survey (NSS), an annual survey of final-year undergraduate students' opinions, establishes student views on the quality of their courses. The Joint Information Systems Committee (JISC) set up its e-Learning programme to enable 'the development and effective use of digital technologies to support learning and teaching in universities and colleges. Lim notes that in addition to these initiatives, there is a need to professionalise teaching and the leadership of teaching. Currently, teaching in the higher education context is one of the few professions that do not require a licence to practice. The author notes further that student voices should be at the centre of teaching and learning, and that students need enhanced access to high-quality information about the different courses and institutions available to them, to enable them to make more informed choices. Lim notes that there is general acknowledgement that emerging technologies and the 4IR are likely to have a profound impact on learning and teaching, curriculum and pedagogy, and that the Covid-19 pandemic has accelerated technological advancement and use.

In **Paper 14**, Kennedy examines quality assurance in universities through the lenses of the 4IR, exploring some of the ways in which new 4IR technologies can be used to transform this work to meet the needs of the 21st Century. Quality assurance has been high on the higher education agenda for some time. It includes site visits for course accreditation, institution-wide quality audits, and programme area accreditation. Quality assurance is currently conducted in an environment where industry 4.0 is fundamentally changing employment patterns, work and social patterns. Machines are not only doing the work done by humans but are programmed to think like humans. It is therefore essential to match quality assurance with this new machine-oriented/human interface. The development of quality assurance, according to Kennedy, will take place through four distinct phases - inspection, design, empowerment, and discovery - leading to 'Quality 4.0'. The 'discovery' phase is equated to 'Quality 4.0'. The characteristics of quality assurance in business (the availability of information, connectivity, intelligence processing, new modes of interaction and production) also apply to the education sector. The author notes that although technological processes have been around for some time, they have recently developed almost human characteristics in the form of AI, Big Data, deep learning, machine learning, data science, and other tools, which make information meaningful. The author argues that technology does not replace traditional methods; rather, it betters these. Institutional performance as a whole, rather than the performance of its parts, needs to be the focus of quality assurance. The 4IR (and ‘Quality 4.0’) can enable end-to-end business integration, addressing both internal and external priorities in rapid and real-time information flows. In turn, the seamless flow of information with feedback enabled by end-to-end integration, paves way for evidence-based decision-making. But the future of quality assurance in higher education is dependent on infrastructure to make use of Big Data and Cloud Computing to enhance teaching and learning, student experiences, and the business positioning of universities. The author notes that evidence is central to the quality assurance facilitated by technology across the end-to-end organisation. Professionals will manage the quality assurance processes in ways that lead digital transformation efforts in the space. To transition to a new quality assurance environment, the training, reskilling and upskilling of professionals, as well as funding, will be required. ‘Quality 4.0’ will be central in universities in every respect, with human-machine interaction as a norm.

Mahoney, Hayes, Harris, Durham, and Lim explore, in **Paper 15**, modern pedagogy, student retention, and the widening of access to higher education in the context of the University of the West of Scotland (UWS) in the UK. The authors detail the UWS’s commitment and student-centred approach to teaching, learning, and research that aims to equip their students with, amongst others, the digital literacy needed to prepare for, and manage their lives in, the context of the 4IR. The outbreak of Covid-19 has hastened the revolution, which has seen new developments including online learning platforms, a modern approach to work-based learning, a graduate apprentice scheme and hybrid learning and teaching, at UWS. In this paper, the authors describe how UWS has provided higher education to individuals in some of Scotland’s most deprived areas and delivered on its commitment to education provision. This whole approach is framed by the university’s 2025 strategy that, amongst others, seeks to shape its global, innovative and student-centred approach to teaching and learning. The strategy outlines the university’s commitment to widening student access, student population growth/retention, internationalisation, research excellence, and a technology-enabled curriculum. The authors underline UWS’s investment in the modernisation of learning spaces. To this end, UWS has developed the ‘*I am UWS’* skills and attributes framework in response to, and as part of, the 4IR. UWS also provides institutional support for caregivers. The authors touch on the technology-related work-based learning provided by UWS. For example, UWS has introduced a programme on Software Development and Engineering, focusing on design and manufacturing, and provides apprenticeships in response to the changing nature of markets and areas with skills gaps. Overall, this paper presents a student-centred approach and modern pedagogy aimed at creating a supportive, innovative and unique learning environment in the context of the 4IR. This environment is not just a digital repository, but also an interactive learning platform. The article calls for strong community engagement; the widening of access to, and mainlining retention in, higher education; and indicates that the use of technology on and off campus has created/accelerated appropriate technology-driven learning experiences at UWS to these ends.

Looking across the papers in this volume, three broad cross-cutting themes emerge. The first is the **readiness of sectors**, to embrace the 4IR, and the emergence of new ideas and new technologies in these sectors as well as some of the related enablers and challenges. Paper 1 considers the architecture profession; Paper 8, entrepreneurship; Paper 9, the field of archaeology; and Paper 11, preparing Chartered Accountants for this new world.

A second thread comprises more **general reflections of whole NQF systems or aspects of these systems**, in the context of the 4IR, including enablers, challenges, roles and responsibilities. Paper 6 presents a thoughtful analysis of the multiple dimensions to be considered when seeking to align a whole Post-School Education and Training (PSET) system to an NQF in the 4IR context. Papers 4, 7 and 14 consider the implications for quality assurance in an NQF context, and the skills system, respectively. Paper 10 focuses on the role that a professional body and partnerships can play, in addressing the enablers and challenges of the 4IR.

The third cross-cutting theme is the presentation of **actual technological innovations** underway. Paper 3 introduces the idea of AI for transparent, fair, equitable student recruitment and selection. With respect to teaching and learning, Paper 2 presents the ideas of ‘hybrid’ and ‘flipped’ classrooms, and Paper 13, changes in the whole legislative and institutional landscape in higher education across the UK, to embrace learning and teaching in the 4IR context. Paper 15 details multiple innovations in one university, to deepen access, inclusivity, the inclusion of poor and marginalised students, and technological innovation. Paper 6 sketches the ‘School Sandbox Initiative’ to build 4IR competences in basic education. Paper 5 describes a sophisticated tool for university programme review that deepens understanding of quality and consistency across the organisation.

All the papers in this volume affirm (and challenge) the kinds of objectives found in NQFs around the world. In addition, they provide valuable insights into one or more aspects regarding access and inclusivity in education, training, development and work; learning and teaching; entity roles and responsibilities; the relationships and collaboration needed for quality learning-and-work pathways; and possible technologies and innovations in the 4IR context.

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List of Acronyms

3D	Three-Dimensional
4IR	Fourth Industrial Revolution
ABET	Accreditation Board for Engineering and Technology
ACCA	Association of Chartered Certified Accountants
AI	Artificial Intelligence
AICPA	American Institute of Certified Public Accountants
ALMP	Active Labour Market Policy
ALS	Architectural Learning Site
AMS	Assessment Management System
ANZAScA	Architectural Science Association
AP	Assurance Provider
AQF	Australian Qualifications Framework
AR	Augmented Reality
ASAPA	Association of Southern African Professional Archaeologists
ASDSA	Association for Skills Development in South Africa
ASEAN	Association of Southeast Asian Nations
ASGs	African Standards and Guidelines
ASME	Association for the Study of Medical Education
ATR	Annual Training Report
BBBEE	Broad-Based Black Economic Empowerment
BbGT	Blackboard Goals Tool
BGM	Biennial General Meeting
BIM	Building Information Management
BIS	Department for Business, Innovation and Skills
BPESA	Business Process Enabling South Africa
BPS	British Psychological Society
BSc (Hons)	Bachelor of Science (Honours)
BSc	Bachelor of Science
CA	Chartered Accountant
CA	Canberra Accord

CAA	Commonwealth Association of Architects
CAD	Computer-Aided Design
CAPS	Curriculum and Assessment Policy Statement
CBLT	Competency-Based Learning and Teaching
CCFO	Critical Cross-Field Outcomes
CCR	Centre for Curriculum Redesign
CETA	Construction Education and Training Authority
CETL	Centre for Excellence in Teaching and Learning
CGMA	Chartered Global Management Accountant
CHE	Council on Higher Education
CLL	Changing the Learning Landscape
CLP	Competency-based Learning Programme
COVID-19	Coronavirus Disease 2019
CPD	Continuing Professional Development
CPD	Centre for Professional Development
CRM	Cultural Resource Management
DBE	Department of Basic Education
DBR	Design-Based Research
DfE	Department for Education (United Kingdom)
DHET	Department of Higher Education and Training
DLHE	Destinations of Leavers from Higher Education
DPME	Department Planning, Monitoring and Evaluation
DTI	Department of Trade and Industry
E3	Entrepreneurship and Employability Education Initiative
ECU	Equality Challenge Unit
e-Learning	Electronic Learning
EM	Executive and High-Level Management
EPWP	Expanded Public Works Programme
EQF	European Qualifications Framework
ERP	Enterprise Resource Planning
ESGs	European Standards and Guidelines

ETF	European Training Foundation
e-tivities	Electronic activities
EU	European Union
FET	Further Education and Training
FWHEQ	Framework for Higher Education Qualifications
GBS	Global Business Services
GDN	Groningen Declaration Network
GDP	Gross Domestic Product
GET	General Education and Training
GFETQSF	General and Further Education and Training Qualifications Sub-Framework
GIF	Graphics Interchange Format
HE	Higher Education
HEA	Higher Education Academy
HEAR	Higher Education Achievement Report
HEDG	Heads of Educational Development Group
HEFCE	Higher Education Funding Council of England
HEFCW	Higher Education Funding Council of Wales
HEI	Higher Education Institution
HEMIS	Higher Education Management Information System
HEPI	Higher Education Policy Institute
HEQC	Higher Education Quality Committee
HEQIS	Higher Education Quality Information System
HEQSF	Higher Education Qualifications Sub-Framework
HERE-SA	Higher Education Reform Experts South Africa
HKQF	Hong Kong Qualifications Framework
HPE	Health Professions Education
HR	Human Resources
IAESB	International Accounting Education Standards Board
IBL	Inquiry-Based Learning
ICO	Information Commissioner’s Office

ICT	Information and Communication Technology
IDC	Industrial Development Corporation
ILTHE	Institute for Learning and Teaching in Higher Education
IoT	Internet of Things
IPA	Intelligent Process Automation
IRBA	Independent Regulatory Board of Auditors in South Africa
IT	Information Technology
JISC	formerly Joint Information Systems Committee
KIS	Key Information Set
LFHE	Leadership Foundation for Higher Education
LGSETA	Local Government Sector Education and Training Authority
LMS	Learning Management System
LTS	Learning and Teaching Subject Centre
MICTSETA	Media, Information and Communication Technologies Sector Education and Training Authority
MIT	Massachusetts Institute of Technology
MOOC	Massive Open Online Courses
MSc	Master of Science
NDP	National Development Plan
NECT	National Education Collaboration Trust
NEET	Not in Education, Employment or Training
NHLS	National Health Laboratory Services
NLRD	National Learners' Records Database
NPA	National Progression Award
NPC	National Planning Commission
NPO	Non-Profit Organisation
NPPSET	National Plan for Post-School Education and Training
NQF	National Qualifications Framework
NSA	National Skills Authority
NSC	National Senior Certificate
NSFAS	National Student Financial Aid Scheme

NSS	National Student Survey
NTFS	National Teaching Fellowship Scheme
NZQA	New Zealand Qualifications Authority
NZQF	New Zealand Qualifications Framework
OECD	Organisation for Economic Cooperation and Development
OFO	Organising Framework for Occupations
Ofqual	Office of Qualifications and Examinations Regulation
OfS	Office for Students
OQSF	Occupational Qualifications Sub-Framework
PEPUDA	Promotion of Equality and Prevention of Unfair Discrimination Act
PIRLS	Progress in International Reading Literacy Study
PoE	Portfolio of Evidence
POPIA	Protection of Personal Information Act
PPGI	Public-Private Growth Initiative
PPP	Public-Private Partnership
PSET	Post-School Education and Training
QA	Quality Assurance
QAA	Quality Assurance Agency
QC	Quality Council
QCF	Qualifications and Credit Framework
QCTO	Quality Council for Trades and Occupations
RPA	Robotic Process Automation
RPL	Recognition of Prior Learning
SACAP	South African Council for the Architectural Profession
SADA	South Africa in the Digital Age
SADC	Southern African Development Community
SAIA	South African Institute of Architects
SAICA	South African Institute of Chartered Accountants
SALGA	South African Local Government Association
SAQA	South African Qualifications Framework
SCQF	Scottish Credit and Qualifications Framework

SD	Skills Development
SDF	Skills Development Facilitator
SDP	Skills Development Provider/ Practitioner
SDW	Student Development Workshop
SEDA	Staff and Educational Development Association
SER	Self-Evaluation Report
SETA	Sector Education and Training Authority
SFC	Scottish Funding Council
SGB	School Governing Body
SIB	Social Impact Bond
SLP	Structured Learning Programme
SME	Small and Medium-Sized Enterprise
SMME	Small, Medium and Micro Enterprise
SMT	School Management Team
STATS-SA	Statistics South Africa
TALIS	Teaching and Learning International Survey
TE	Technology Experts
TEF	Teaching Excellence Framework
THENSA	Technology Higher Education Network South Africa
TLRP	Teaching and Learning Research Programme
TQEF	Teaching Quality Enhancement Funding
TVET	Technical Vocational Education and Training
TVQF	Technical and Vocational Qualifications Framework
UJ	University of Johannesburg
UKPSF	United Kingdom Professional Standards Framework
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNISA	University of South Africa
UoT	University of Technology
UP	University of Pretoria
USAID	United States Agency for International Development
VR	Virtual Reality

VUCA	Volatile, Uncertain, Complex, Ambiguous
W&RSETA	Wholesale and Retail Sector Education and Training Authority
WAC	World Archaeological Congress
WEF	World Economic Forum
WITS	University of the Witwatersrand
WPPSET	White Paper for Post-School Education and Training
WSP	Workplace Skills Plan
ZooMS	Zooarchaeology Mass Spectrometry

SAQA
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