



ETDP-SETA IMPACT OF COVID-19 STUDY

BUILDING A RESILIENT SKILLS ECOSYSTEM: SITUATIONAL ANALYSIS REPORT ON THE FORWARD PATH OF EDUCATION AND TRAINING IN LIGHT OF THE PANDEMIC AND 4IR/5IR SHIFTS IN THE ETD SECTOR

HIGHER EDUCATION SUBSECTOR

February 2024

Submitted to ETPD-SETA by:
The Human Sciences Research Council (HSRC)
Equitable Education & Economies (EEE)




Table of Contents

| | | |
|----------|---|------------------------------|
| 1 | Introduction and context | 1 |
| 2 | mapping the subsectoral context | 2 |
| 3 | pre-covid status quo | 11 |
| 3.1 | The state of the subsector pre covid..... | 11 |
| 3.2 | The state of education and training provision | 14 |
| 4 | post covid status quo | 17 |
| 4.1 | The state of the subsector post covid | 17 |
| 4.2 | Emerging trends..... | Error! Bookmark not defined. |
| 4.3 | Coping and Adaptation Strategies within COVID-19 | 20 |
| 5 | Allocation and prioritisation of resources in the sector | 31 |
| 6 | information gaps | 36 |
| 7 | conclusions and implications for skills development | 37 |
| 8 | recommendations | 40 |

APPROVAL OF THE RESEARCH REPORT:

FINAL REPORT ON BUILDING A RESILIENT SKILLS ECOSYSTEM:
SITUATIONAL ANALYSIS REPORT ON THE FORWARD PATH OF EDUCATION AND TRAINING
IN LIGHT OF THE PANDEMIC AND 4IR/5IR SHIFTS IN THE ETD SECTOR

HIGHER EDUCATION SUBSECTOR

| APPROVED BY ETD P SETA RESEARCH AND SKILLS PLANNING UNIT OFFICIAL: | |
|--|---|
| APPROVED BY: | MR THOKOZANI MLAMBO |
| DESIGNATION: | SENIOR RESEARCH SPECIALIST |
| SIGNATURE: |  |
| DATE: | 25 MARCH 2024 |
| COMMENTS: | APPROVED |

| Abbreviation | Description |
|--------------|---|
| 4IR | Fourth Industrial Revolution |
| 5IR | Fifth Industrial Revolution |
| COIL | Collaborative online international learning - COIL |
| COO | Chief Operating Officer |
| DBE | Department of Basic Education |
| DHET | Department of Higher Education and Training |
| ETD | Education, Training and Development |
| ETDP SETA | Education, Training and Development Practices Sector Education and Training Authority |
| HEI | Higher Education Institutions |
| HSRC | Human Sciences Research Council |
| ICT | Information and Communications Technology |
| OECD | Organisation for Economic Co-operation and Development . |
| PSET | Post-School Education and Training |
| PwD | Persons with disabilities |
| SETA | Sector Education and Training Authority |

1 INTRODUCTION AND CONTEXT

Higher education plays an integral role in equipping graduates for employment and driving socioeconomic growth by supplying human capital and innovation (Abiwu & Martins, 2022; Dyason et al., 2019; Fisher & Scott, 2011). Given high demand for skilled labor in South Africa coupled with low tertiary education attainment locally (7% of 25–64-year-olds in 2020), skills planning and alignment of offerings to labor market needs is imperative (Khuluvhe et al., 2022; OECD, 2022). However, concerns persist regarding the relevance of qualifications, fields of study chosen by students, and graduate preparedness (Department of Higher Education and Training [DHET], 2022; Mncayi & Dunga, 2016; Ohei & Brink, 2016).

The Coronavirus (COVID-19) pandemic has had an unprecedented impact on the national economy, revealing digital divides and necessitating remote emergency teaching solutions without adequate lead times or resources (Aruleba et al., 2022; Landa et al., 2021). In recent years, the world has witnessed a rapid transformation in various sectors due to the emergence of the Fourth Industrial Revolution (4IR). This revolution, characterized by the integration of digital technologies into every aspect of our lives, has brought forth both challenges and opportunities. Nowhere is this more evident than in the field of higher education, where the impact of 4IR and the ongoing Covid-19 pandemic has created a seismic shift in the way learning and teaching are conducted.

The ETDP SETA, mandated with promoting and facilitating skills development with the aim of improving the skills profile of the workforce in the education, training, and development sector, now faces the arduous task of planning for and implementing policy that will position the sector well to respond to the implications of COVID-19. However, planning, policymaking, and implementation require a clear assessment of the impact of COVID-19 on its 14 constituencies or sub-sectors of which **Higher Education** is one. Obtaining robust intelligence on the state of skills supply, demand, and shortages within the sector is at the heart of this endeavour. Additionally, reflecting on the emerging skills and related challenges is necessary to inform the planning and implementation of appropriate interventions, as well as general funding decisions and allocation of resources from the SETA to support its various sub-sectors.

The fundamental concern facing the ETDP-SETA is the impact of the COVID-19 outbreak and the transition to 4IR on the education and training requirements of the sector. This requires engagement within the context of the Fourth Industrial Revolution (4IR) and its impact on skills development training needs and interventions. With the dual challenges of the 4IR and the COVID-19 pandemic, the education and training sectors are undoubtedly facing unprecedented upheavals. The 4IR, characterised by breakthroughs in fields like AI, robotics, and the Internet of Things, demands new skill sets and learning paradigms. Understanding this impact is pivotal for future planning and ensuring the relevancy of education, training and skills development.

Therefore, the main objective of this project is: To build a resilient skills ecosystem defining the forward path for the education and training (ETD) arising from the pandemic and 4IR/5IR shifts.

Towards this end, this paper focuses on available research on what is known about the status of **skills development and labour market** information recovery arising from COVID-19 and changes because of 4IR/5IR. It seeks understand the impact of these changes on the Higher Education Institutions ability to equip graduates for employability now and in the future.

2 MAPPING THE SUBSECTORAL CONTEXT

2.1 Introduction

This section maps the sub sectoral context of higher education institutions in South Africa, with a specific focus on their response to the impact of Covid-19 and their efforts to adapt to the demands of the 4IR. By delving into the unique characteristics, strengths, and challenges faced by these institutions, we aim to gain valuable insights that will inform policy decisions, strategic planning, and resource allocation.

Mapping the sub sectoral context involves a comprehensive analysis of various factors, including but not limited to:

- An overview of the ***different types of higher education institutions*** in South Africa, including universities, technical and vocational education and training (TVET) colleges, and private institutions. This analysis examines their size, location, ownership, and historical background to gain a holistic understanding of the diverse landscape within which these institutions operate.
- ***Academic programmes and disciplines***: Here we briefly explore the range of academic programmes and disciplines offered by higher education institutions in South Africa and the distribution of these programmes across different disciplines. Through this we aim to identify areas of strength and potential gaps that need to be addressed to align with the demands of the 4IR.
- ***Infrastructure and resources***: An assessment of infrastructure and resources available to higher education institutions, including physical facilities, technological capabilities, research laboratories, libraries, and funding sources. This is crucial for assessing the institutions' preparedness to navigate the challenges brought forth by the Covid-19 pandemic and the transition to 4IR.
- ***Student demographics and enrolment patterns***: This section analyses the characteristics of the student population, including demographics, enrolment patterns, and access to higher education. By examining factors such as gender distribution, racial representation, and geographic disparities, we can identify potential barriers and inequalities that need to be addressed to ensure equitable access to quality education.

Through this mapping the sub sectoral context of higher education institutions in South Africa, we aim to provide a comprehensive understanding of the unique challenges and opportunities these institutions face. This knowledge will serve as a foundation for developing evidence-based strategies and interventions to ensure that South Africa's higher education sector remains responsive, inclusive, and resilient in the face of the evolving 4IR landscape and the ongoing impact of the Covid-19 pandemic.

2.2 Profile of the South African Higher Education Sector

The higher education sector plays a pivotal role in national development, mandated with producing skilled graduates, generating new knowledge, and promoting equity and social justice (Department of Higher Education and Training [DHET], 2022). The National Development Plan (NDP) outlines three broad functions of the higher education sector (Department of Higher Education and Training (DHET), 2022):

1. Educate and equip individuals with high-level skills to meet employment demands of the country.
2. Produce new knowledge as well as evaluate and identify new applications for existing knowledge.
3. Provide opportunities for social mobility while strengthening equity, social justice, and democracy to challenge the continuing injustices because of apartheid.

2.2.1 Policy and Legislation

The White Paper articulates the vision and policy framework guiding the transformation and reconstruction of higher education (Department of Education, 1997). The Higher Education Act 101 of 1997 provides the legal framework for a unified and nationally planned system. Its regulations establish the Council for Higher Education and confer powers to the Minister of Higher Education to steer the higher education sector.

The National Plan for Higher Education aims to promote equity of access and outcomes as well as sustainability and efficiency of the higher education sector to meet national development needs (Ministry of Education, 2001). It puts forward key objectives around developing graduates with skills and competencies aligned to social and economic demands.

2.2.2 Governance and Oversight

Higher education institutions (HEIs) operate under the oversight of the Department of Higher Education and Training (DHET). The DHET is advised by permanent committees including the Council on Higher Education (CHE) and the South African Qualifications Authority (SAQA) (DHET, 2022).

The DHET is advised by two statutory bodies - the Council on Higher Education (CHE) and the South African Qualifications Authority (SAQA) (DHET, 2022). The CHE is responsible for quality assurance and has a permanent Higher Education Quality Committee (HEQC) that conducts institutional audits. SAQA oversees the National Qualifications Framework, registers standards and qualifications, and ensures coordination between education sectors.

2.2.3 Profile of Stakeholders in the Higher Education Sector

Here is an overview of key stakeholders in South Africa's higher education sector, their profiles, roles, and significance:

Government: The Department of Higher Education and Training (DHET) is the lead stakeholder responsible for administering higher education, developing policy frameworks, disbursing public funds to institutions, and monitoring the system (DHET, 2022). The DHET facilitates access, promotes quality, and aligns programmes with

South Africa's skills needs.

Public Higher Education Institutions: South Africa has 26 public universities. Public HEIs equip graduates for employability, drive research and innovation, provide opportunities for socioeconomic mobility, and supply human capital needs (Abiwu & Martins, 2022; DHET, 2022). They face rising enrolments amidst resource constraints.

Private Higher Education Institutions: There are 132 registered private higher education institutions concentrating programme offerings in market-oriented fields like business studies, commerce, and management (DHET, 2022). Private institutions expand system capacity but require regulation to uphold quality standards.

Students: Students are primary beneficiaries, gaining skills, knowledge and credentials for employability and livelihoods. South Africa has over 1.3 million higher education students, predominantly African and female (DHET, 2022). Student also provide revenue through fees. Organized student groups like the South African Union of Students (SAUS) advocate for student rights and interests.

Staff: Academics and personnel responsible for teaching, research, administration and support services are crucial stakeholders. Adequate staffing, equitable gender/race representation and appropriate skills/qualifications across functions is necessitated (DHET, 2022).

Employers: The private sector provides graduate placements and absorbs skills produced by higher education into the labor market. Close employer partnerships can strengthen curriculum relevance and work readiness. Industry linkages remain limited and require expansion (Abiwu & Martins, 2022; Essop, 2021).

2.2.4 Types of HE Institutions

There are three types of recognized HEIs – public HEIs, registered private HEIs, and foreign HEIs operating in South Africa (DHET, 2022). As of 2020, there were 26 public universities, 132 registered private institutions concentrated around large cities, and 10 foreign higher education institutions (DHET, 2022) (Table 1).

Table 1: Overview of Higher Education Institutions with enrolment statistics

| | HEIs | | |
|-----------------------------|-----------|---------|-----------|
| | Public | Private | Total |
| Number of institutions | 26 | 132 | 158 |
| Number of enrolled students | 1 094 808 | 219 031 | 1 313 839 |

Source: Department of Higher Education and Training (2022).

The public HEI system distinguishes between traditional universities, universities of technology, and comprehensive institutions offering both university and vocational programs.

Traditional Universities: There are 11 traditional universities in South Africa that focus on theoretically oriented

academic and professional programs across a range of disciplines (DHET, 2022). Examples include the University of Cape Town and Rhodes University. Traditional universities emphasize scientific research and aim to promote advancement of knowledge production.

Universities of Technology: South Africa has 6 universities of technology (formerly "Technikons") providing career-focused education programs grounded in the natural sciences, engineering, and technology fields (DHET, 2022). They have a strong orientation towards industry linkages and applied research connected to economic sectors. Universities of technology include Cape Peninsula University of Technology and Tshwane University of Technology.

Comprehensive Universities: There are 9 comprehensive universities in South Africa, such as the University of Johannesburg and Nelson Mandela Metropolitan University, offering both traditional academic and vocational programs (DHET, 2022). They provide general formative degrees as well as occupationally directed qualifications and technology degrees up through the doctoral level. The programmatic mix supports skills production aligned to labor market needs.

The differentiation allows the 26 public universities to play complementary roles expanding system capacity and responding to diverse economic and social priorities. Maintaining sectoral coordination remains an ongoing pursuit (DHET, 2022).

2.2.5 Public Sector HEI Profile

Public HEIs service most students, with 1 094 808 enrolled in 2020 compared to 219 031 in private institutions (DHET, 2022) (Table 2)

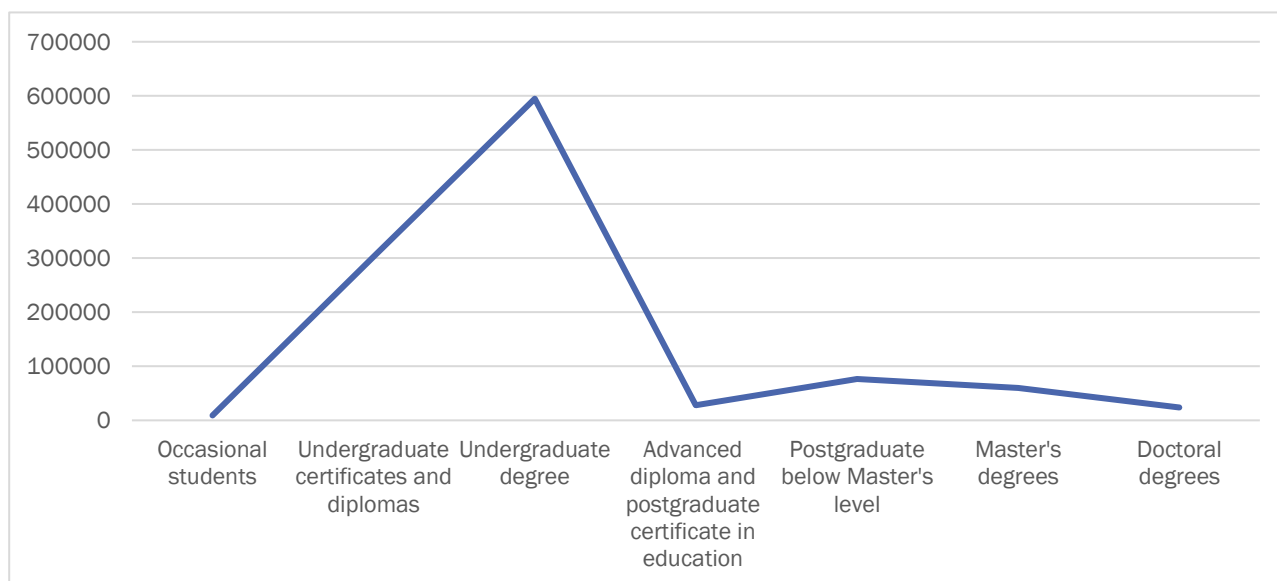
Table 2: Students Enrolled in Public HEIs, by Attendance Mode, Population Group and Gender, 2020.

| Population group | Contact | | | Distance | | Total | | | |
|------------------|----------------|----------------|-----------|----------------|----------------|----------------|----------------|-----------|------------------|
| | Female | Male | No info. | Female | Male | Female | Male | No info. | Total |
| African | 289 555 | 234 089 | 32 | 237 137 | 101 500 | 526 692 | 335 589 | 32 | 862 313 |
| Coloured | 25 613 | 16 449 | 10 | 14 095 | 5 756 | 39 708 | 22 205 | 10 | 61 923 |
| Indian/Asia | 14 031 | 11 512 | 3 | 10 825 | 4 891 | 24 856 | 16 403 | 3 | 41 262 |
| White | 44 490 | 37 347 | 34 | 24 012 | 12 622 | 68 502 | 49 969 | 34 | 118 505 |
| No info. | 4 953 | 4 310 | 12 | 918 | 612 | 5 871 | 4 922 | 12 | 10 805 |
| Total | 378 642 | 303 707 | 91 | 286 987 | 125 381 | 665 629 | 429 088 | 91 | 1 094 808 |

Source: DHET (2022)

Figure 1 illustrates that just over half of the total number of students were enrolled for undergraduate degrees in 2020 (594 731; 54%). Regarding the younger age groups, most students were enrolled for undergraduate certificates, diplomas or degrees. However, the older age groups, specifically students older than 50 years were more likely to be enrolled in a postgraduate degree.

Figure 1: Enrolment in Public HEIs, by Qualification Category, 2020.



Source: Department of Higher Education and Training (2022).

Public HEI Graduation Rates

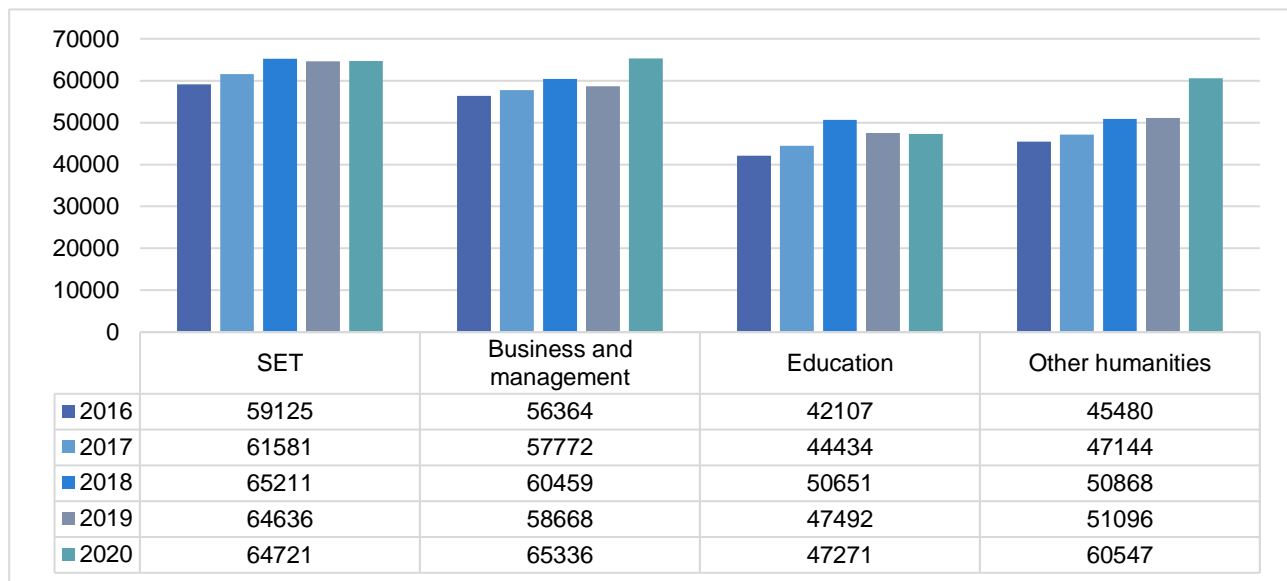
Regarding the number of graduates from public HEIs, there has been a steady increase with 237 882 graduates in 2020. Significant majority of graduates were from the SET and business and management fields of study (Figure 2). While a focus on the business and management fields of study this may be expected to boost the economy and create jobs, research has noted that this is not necessarily the case as many entrepreneurs become sole traders and have limited potential to create employment. There was also a steady increase in the number of graduates from humanities.

The number of graduates from public HEIs grew steadily between 2016-2020, concentrated in business/management fields (see Figure 2) (DHET, 2022). However, research indicates lengthy unemployment spells for certain majors namely human resources, industrial psychology, labour relations management, public administration, public management, and politics experienced longer times of unemployment.

On the other hand, graduates who majored in accounting, mathematics, education, and health, had the shortest

average waiting times before employment (Mncayi & Dunga, 2016). The small increase in graduates from the science, engineering, and technology (SET) field of study, is doubly worrisome as these fields are important for economic development (DHET, 2022; Khuluvhe et al, 2022). There is thus a mismatch between the fields of study students are choosing to pursue in higher education and the skills needs of the labour market.

Figure 2: Number of graduates from public HEIs, by major field of study, 2016-2020.



Source: DHET, 2022

Meanwhile science, engineering and technology (SET) graduation rates, crucial for innovation and development, decreased slightly (DHET, 2022). Studies affirm SET and ICT graduates often lack applied competencies employers require (Ohei & Brink, 2016; Schofield & Dwolatzky, 2022).

Using a case-study approach, Ohei and Brink (2016) note that there is low employability of ICT graduates for various reasons, including lack of work experience, lack of soft and hard skills, and inability of graduates to apply what they have learnt during their higher education studies. This aligns with the statements of Smith et al (2021) above and shows that all fields would benefit from augmenting work-integrated and vocational learning is advised to enhance absorptive capacity (Ohei & Brink, 2019; Smith et al, 2021). Furthermore, the *2022 JCSE-IITPSA ICT Skills Survey Twelfth Edition* shows that, while the pandemic has boosted the ICT industry and digital transformation, over 50% of employers are recruiting from overseas rather than locally. In addition, professional experience was by far the most highly ranked attribute of potential recruits followed by graduate degrees (Schofield & Dwolatzky, 2022). This suggests that local graduates are not perceived as having sufficient knowledge and skills. To improve the higher education system and its delivery, it must be ensured that higher education staff have the necessary skillsets.

While enrolments and graduations have increased overall, issues persist around skills mismatches, gender imbalances, and boosting PhDs. Curriculum reforms prioritizing labor market relevance and applied competencies developed through work-integrated modalities can optimize higher education’s development impacts.

Public HE Sector Student Profile

In 2020, 61% of students in public HEIs were female and 79% were African (DHET, 2022) (see Table 2). Only 1% reported having a disability, primarily sight disabilities (21%) or physical disabilities (20%) (see Table 3) (DHET, 2022). Postgraduate enrolments are concentrated in older age groups while younger cohorts are enrolled in undergraduate diplomas or degrees (see Figure 1) (DHET, 2022).

Students with disabilities are an important demographic in achievement of equity targets. The total number of students who reported having a disability was 11 617 in 2020, which was 1% of the total enrolment in public HEIs. As seen in

Table 3, the primary disability reported was a sight disability (2 467; 21%) followed by a physical disability (2 283; 20%).

Table 3: Number of students in public HEIs, by disability and gender, 2020.

| Disability | Female | Male | No information | Total |
|--------------------------|--------------|--------------|----------------|---------------|
| Communication | 58 | 131 | 0 | 189 |
| Emotional | 555 | 341 | 2 | 898 |
| Hearing | 1 166 | 869 | 0 | 2 035 |
| Intellectual | 582 | 725 | 2 | 1 309 |
| Multiple | 40 | 40 | 0 | 80 |
| Physical | 1 270 | 1 011 | 2 | 2 283 |
| Sight | 1 350 | 1 116 | 1 | 2 467 |
| Disabled but unspecified | 1 377 | 976 | 3 | 2 356 |
| Total | 6 398 | 5 209 | 10 | 11 617 |

Source: Department of Higher Education and Training (2022).

Public HEI Staff Profile

Turning to staffing, Table 4 provides the number of permanent staff in public HEIs and shows a total of 64 551 personnel spread across instruction and research (20 309; 31%), administrative (32 644; 51%), and services

(11 598; 18%). Over 50% of permanent staff were African (38 086; 59%), followed by White staff (14 753; 23%). Gender disparities were evident in public HEIs with more female staff confined in administrative work in comparison to male staff who were spread across instruction, research and services (DHET, 2022).

Given the total student population of 1 094 808 students enrolled in public higher education and a total staff of 11 598, the average staff-to-student ratio is 1:94 (DHET, 2022). Although this seems reasonably high, the data is skewed by the inclusion of online students.

Table 4: Number of permanent staff in public HEIs, by population group, personnel category, and gender, 2020.

| Population group | Instruction and research | | | Administrative | | | Services | | |
|------------------|--------------------------|---------------|---------------|----------------|---------------|---------------|--------------|--------------|--------------|
| | Female | Male | Total | Female | Male | Total | Female | Male | Total |
| African | 3 688 | 5 089 | 8 777 | 10 147 | 8 731 | 18 878 | 5 458 | 4 973 | 10 431 |
| Coloured | 815 | 683 | 1 498 | 3 330 | 1 889 | 5 219 | 554 | 475 | 1 029 |
| Indian/Asian | 912 | 725 | 1 637 | 1 085 | 697 | 1 782 | 12 | 47 | 59 |
| White | 4 319 | 3 676 | 7 995 | 4 622 | 2 060 | 6 682 | 29 | 47 | 76 |
| Unknown | 95 | 307 | 402 | 34 | 49 | 83 | 3 | 0 | 3 |
| Total | 9 829 | 10 480 | 20 309 | 19 218 | 13 426 | 32 644 | 6 056 | 5 542 | 11 98 |

Source: Department of Higher Education and Training (2022)

Evidence indicates a concerning but unsurprising asymmetry where female staff are concentrated into administrative roles compared to male staff's wider distribution across instruction, research and service functions (see Table 4) (DHET, 2022). The proportion of PhD qualified university staff requires expansion to strengthen research and teaching capabilities (NPC, 2012).

2.2.6. Private HEI Profile

All private institutions must be registered with DHET to offer higher education in South Africa as per three pieces of legislation: the Higher Education Act, 1997 (Act No. 101 of 1997, as amended); the Public Notice (Government Gazette No. 19389, dated 30 October 1988); and the Regulations for the Registration of Private Higher Education Institutions (Government Gazette No. 39880, dated 31 March 2016). There are 132 registered private HEIs as of 2020.

In 2020, there were 219 031 students enrolled in private HEIs with 131 149 female students, 86 721 male students, and 1 161 unspecified students (DHET, 2022). As shown in Table 5, the vast majority of private HEIs students were enrolled for programmes in the field of business, commerce and management studies (120 145; 54.9%), followed by education, training and development (27 848; 12.7%) and physical, mathematical, computer

and life sciences (20 296; 9.3%). Similar concerns to those regarding the fields of graduates from public HEIs are relevant here.

Table 5: Number of students in private HEIs, by NQF field, 2020.

| NQF field | 2020 | Percentage | Number of private HEIs offering |
|---|---------|------------|---------------------------------|
| Agriculture and nature conservation | 295 | 0.1% | 4 |
| Culture and arts | 14 331 | 6.5% | 36 |
| Business, commerce, and management studies | 120 145 | 54.9% | 49 |
| Communication studies and language | 6 232 | 2.8% | 17 |
| Education, training, and development | 27 848 | 12.7% | 18 |
| Manufacturing, engineering, and technology | 586 | 0.3% | 4 |
| Human and social studies | 12 286 | 5.6% | 39 |
| Law, military science, and security | 10 410 | 4.8% | 6 |
| Health sciences and social services | 2 610 | 1.2% | 19 |
| Physical, mathematical, computer, and life sciences | 20 296 | 9.3% | 19 |
| Services | 3 690 | 1.7% | 16 |

| | | | |
|------------------------------------|----------------|-------------|------------|
| Physical planning and construction | 302 | 0.1% | 2 |
| Total | 219 031 | 100% | 229 |

Source: Department of Higher Education and Training (2022)

There was limited information on staff at private HEIs. There were approximately equal numbers of academic or research staff who were employed full-time and part-time. This was different for service and support staff where the majority were employed full-time.

Table 6: Number of staff in private HEIs, by employment period and personnel category, 2020.

| Employment period | Academic/Research | Service staff | Support staff | Total |
|-------------------|-------------------|---------------|---------------|---------------|
| Full-time | 4 017 | 1 218 | 4 864 | 10 099 |
| Part-time | 4 275 | 129 | 815 | 5 219 |
| Total | 8 292 | 1 347 | 5 679 | 15 318 |

Department of Higher Education and Training (2022).

3. PRE-COVID STATUS QUO

Higher education influences labour supply through individuals' attainment of qualifications that inform prospective employers of employee's abilities. A highly skilled labour force supports economic growth as this workforce is more productive and efficient (Khuluvhe et al, 2022). There is thus a high return on skilled labour, in line with evidence showing that those with higher education have the lowest unemployment rates (Fisher & Scott, 2011; Khuluvhe et al, 2022).

3.1. The State of the Subsector Pre-Covid

Prior to the pandemic, South Africa already faced economic stagnation and declining GDP growth rates averaging below 2% (Kantor, 2019). This exacerbated historically high structural unemployment disproportionately affecting youth and unskilled labor (Akanbi, 2021). Over 30% of the labor force remained jobless while over 50% of youth were unemployed (Kantor, 2019).

These economic constraints compounded poverty and inequality challenges with 55% living below the upper bound poverty line (Akanbi, 2021). Poor and working-class students faced rising higher education costs and

inadequate student aid limiting college access and success (Wangenge-Ouma, 2021). In 2017, less than 20% of 18-24 years olds were enrolled in higher education versus global average above 30%, reflecting inequitable access and outcomes (McKune, 2019).

Notwithstanding some diversification, the student and staff profiles at many elites historically white institutions remained untransformed with underrepresentation of blacks and women in the academy (Bozalek & Boughey, 2012). Curricula also focused disproportionately on Western paradigms failing to meet social needs (Heleta, 2016).

These interconnected economic, poverty and inequality challenges fueled social instability and campus protests like #FeesMustFall campaigning for free, quality, decolonized education alongside labor, housing and land rights (Langa et al., 2017). The higher education crisis thus symptomized wider societal fissures.

Low Tertiary Attainment

Despite enrollment increases, South Africa's tertiary attainment lags comparator countries. Only 7% of 25–64-year-olds completed some form of higher education in 2020, far below the G20 average of 17% for this demographic cohort (Khuluvhe et al., 2022; Organisation for Economic Co-operation and Development [OECD], 2022). More younger adults pursue qualifications but at 15% attainment for 25–34-year-olds, still trails the G20 average of 40% in this age bracket (OECD, 2022). The skills pipeline output remains inadequate, and signals need to improve quality and completion.

Field of Study Mismatches

Trends further show a steady rise in humanities graduates, now outnumbering critical science and technology fields (DHET, 2022). However, humanities qualifications often face higher unemployment levels and lengthier transitions into employment (Mncayi & Dunga, 2016). This signals mismatches between skills supplied versus economic demand drivers. Rebalancing enrolments and strategic incentives can help align graduate outputs with areas of labor market skills shortfalls (Essop, 2021).

3.2. Higher Education Affordances

South Africa has seen dramatic expansion in higher education enrollment over the past two decades, increasing by 33.6% from 983,703 students in 2010 to 1,313,839 by 2020 (Department of Higher Education and Training [DHET], 2022). This reflects major system growth and surging demand. However, capacity constraints impact admission rates and equitable access (Council on Higher Education, 2020).

Many higher education institutions (HEIs) developed business continuity and emergency preparedness plans after the 2015/2016 #FeesMustFall protests enabling a baseline level of online learning readiness (du Plessis et al., 2022). Investments in ICTs and learning platforms expanded remote education access and modalities, improved

student preparedness through greater exposure, and reduced delivery costs if effectively leveraged (Bajinath, 2018; Motala & Menon, 2020). Individual faculty also increasingly self-upgraded their technological capabilities anticipating 4IR/5IR transformations and to enable pedagogical innovation (Ndevu, 2023).

3.3. Higher Education Institution Challenges Pre-Covid

Prior to COVID-19, persisting concerns regarding the relevance of qualifications and chosen fields of study signaled misalignments with labor market needs and inadequate graduate preparedness for employability (Department of Higher Education and Training [DHET], 2022; Mncayi & Dunga, 2016; Ohei & Brink, 2016). Trends showed rising graduates in often oversubscribed humanities and business fields facing higher unemployment rather than priority areas like science, technology, engineering, and mathematics (STEM) where skills shortages persisted (DHET, 2022).

At the root of the challenge facing the Higher Education sector is that the basic education pipeline inadequately equipped school leavers with the advanced cognitive capabilities required for tertiary education (Bajinath, 2018; Council on Higher Education, 2020). Rapid ICT expansions outstripped many institutions' digital infrastructure, human resource capabilities and instructional capacities to optimally harness technologies for teaching and learning (Council on Higher Education, 2020). Continuing inefficiencies in critical student funding schemes like the National Student Financial Aid Scheme (NSFAS) and government grants administration undermined access for financially needy learners (Langa et al., 2017). Low student success and throughput rates compounded funding wastages and skill yield shortfalls. In 2017 only 32% of contact students at universities completed their 3-year degree in that timeframe and just over half within 5 years (McKune, 2019). Overall efficiencies remained concerning.

Low Graduation Rates

Student performance data indicates deep challenges related to quality and efficiency. The overall graduation rate from 2015-2017 for the undergraduate 3-year degree was 20%, meaning just 1 in 5 students completed their qualification in the allotted time (Higher Education Management Information System [Hemis], 2017). At postgraduate level, only 13.5% graduated within 5 years (Hemis, 2017). Beyond benchmarks, low throughput squanders resources and denies graduates to the economy.

Despite enrollment increases, South Africa's tertiary attainment lags comparator countries. Only 7% of 25–64-year-olds completed some form of higher education in 2020, far below the G20 average of 17% for this demographic cohort (Khuluvhe et al., 2022; Organisation for Economic Co-operation and Development [OECD], 2022). More younger adults pursue qualifications but at 15% attainment for 25–34-year-olds, still trails the G20 average of 40% in this age bracket (OECD, 2022). The skills pipeline output remains inadequate, and signals need to improve quality and completion.

Mismatched Graduate Outputs

Linkages between educational offerings and applied competencies demanded by employers remained weak (Abiwu & Martins, 2022; Ohei & Brink, 2016). Even graduates from vocational fields like ICT often lacked critical technical and soft skills (Schofield & Dwolatzky, 2022). Experts widely advised augmenting work-integrated,

vocational, and technical training to enhance absorptive capacity (Smith et al., 2021).

While the 4IR intensified imperatives to expand remote learning modalities, inadequate technology access and digital literacy especially in rural areas constrained adoption (Mncube et al., 2019). Teacher capacity for learner-centered pedagogies suited to online environments also required strengthening (Motala & Menon, 2020). Uneven basic infrastructure and connectivity compounded by socioeconomic inequalities inhibited equitable remote learning expansion pre-COVID (Reddy et al., 2020).

Trends further show a steady rise in humanities graduates, now outnumbering critical science and technology fields (DHET, 2022). To address this challenge, the DHET developed a list of approximately 370 occupations considered in high-demand and covers the following broad categories: managers, professionals, technicians and associate professionals, clerical support workers, service and sales workers, skilled agricultural workers, and plant and machine operators and assemblers. This list of occupations was primarily developed to support enrolment planning at HEIs as well as macro-planning at a national level (DHET, 2019). Furthermore, the list can provide guidance to South African youth to make informed decisions regarding their subject choices for Grade 10 onwards as well as programmes of study in higher education (DHET, 2019). Finally, this list of occupations assisted the National Skills Fund (NSF), Sector Education and Training Authorities (SETAs) and other organisations that provide bursaries and scholarships to allocate resources towards students who aim to enter occupations that are in high demand (DHET, 2019).

Quality Shortcomings

Experts assess the quality of education offered as lower than comparator countries with more productive economies and advanced innovation systems (Council on Higher Education, 2020; Organisation for Economic Co-operation and Development, 2019). Approximately half of what 1st year students learn becomes outdated by final year, signaling curriculum relevance issues (Smit & Serfontein, 2020). pedagogical limitations compound dropout risks.

Additional concerns like limited PhD qualified faculty, racial/gender imbalances among staff, and surging enrolments amidst systemic underfunding also impacted quality, efficiency and transformation pre-COVID-19 (NPC, 2012; Wangenge-Ouma, 2021). In summary, the pre-pandemic higher education landscape reflected mismatch and unevenness across qualifications and competencies produced, labor market relevance, remote learning readiness, and resources versus enrollment pressures.

3.4. The State of Education and Training Provision

3.4.1. Skills Shortages and Surpluses

Taking a broad perspective of the labour market, DHET (2022) performed an analysis of skills shortages across 21 industries, such as education, training, and development practices, banking, agriculture, etc. This analysis showed that 13 of these industries were experiencing skills shortages. These shortages were most pronounced in the education, training, and development practices followed by financial and insurance activities. The other eight industries were experiencing surplus skills with the biggest in the construction industry followed by culture, arts,

tourism, hospitality, and sports (DHET, 2022). These results illustrate that industries experiencing shortages tend to attract high-skilled workers whereas surpluses are found in industries that typically attract low-skilled workers (DHET, 2022).

Skills were also mapped to occupations using O*NET (a tool for career exploration and job analysis) and classified into six skills categories: complex problem-solving skills, technical skills, systems skills, social skills, basic skills and resource management skills (DHET, 2022). South Africa showed skills shortages across all six categories, indicating far greater shortages than two comparative middle-income countries, Peru and Turkey. Other than technical skills in Turkey, all categories were in surplus in both countries. Within these six skills groups, 35 individual skills are measured. Further calculations of skills shortages for South Africa by the OECD using O*NET showed that of the 35 individual skills measured, 27 are in short supply while the rest were in surplus. The individual skills shortages were most severe for reading comprehension, writing, speaking, and active listening (DHET, 2022). Again, a common thread with the afore-stated skills is that they are basic skills. Thus, a dearth of such skills is disturbing for South Africa, as mastering such skills is generally a requirement for the acquisition of more specialised skills (DHET, 2022).

More specifically to the higher education sector, the ETDP SETA has identified 13 high caliber skills gaps that overlap in numerous respects across all the major occupational group hierarchies within the ETD sector. These skills gaps comprise 1) adaptive teaching skills; 2) communication skills; 3) customer care skills; 4) digital teaching and learning skills; 5) emotional intelligence skills; 6) computer skills; 7) first aid skills; 8) ICT skills; 9) legislative compliance skills; 10) management and leadership skills; 11) research skills; 12) social/ interpersonal skills; and (13) academic writing skills (ETDP SETA, 2022). These are similar to those identified by the World Economic Forum (2020). Furthermore, high impact technology-related and non-cognitive soft skills are projected to grow exponentially soon (ETDP SETA, 2022; DHET, 2022).

The mandate of higher education institutions is to contribute to the development of their respective societies. Teaching and learning strategies must therefore create well-educated, socially conscious graduates who are equipped with the knowledge, skills, and competencies for success in a rapidly changing and globalised world (Motala & Menon, 2020). One means to do so, is for universities to improve the qualifications of their higher education academic staff. Namely, increasing the percentage of PhD qualified staff in the higher education sector from the current 34% to over 75% by 2030. To this end, Higher Education South Africa (HESA) has developed a detailed proposal to develop the next generation of academics, and this should be implemented. In addition, teaching ability by university lecturers need to be further developed (NPC, 2012). Following the Covid-19 pandemic, a key training area that universities should provide to their staff is knowledge and capability of using blended learning.

Table 7 below lists skills gaps also identified for the higher education sector across various occupations:

Table 7: List of skills gaps identified by the ETDP SETA.

| Major group | OFO codes and occupations | Skills gaps |
|-------------|---------------------------|--|
| Managers | Research and development | Qualitative data analysis; Advanced Excel; |

| | | |
|---|---------------------------------|--|
| | manager | Mentoring and coaching; Research management; Academic writing for publication purposes; Advanced statistical analysis for report writing purposes |
| Professionals | University lecturer | Research supervision; Project management skills; Professional writing skills; Emotional intelligence; Digital teaching; Management and leadership skills; Moderation skills; Research skills |
| | Librarian | Advanced MS Office; Digital curation; Electronic records management; Teaching and learning for LIS |
| | Student support service officer | POPIA compliance; facilitation; effective communication skills; Customer care |
| Technicians and associate professionals | Personal assistant | Customer care; MS Office; Office management; POPIA; Writing professional report; Social skills; Proper communication skills; Administration |
| | Recruitment officer | HR management and analytics; MS Excel; Office administration skills; Occupational health and safety |
| Clerical support workers | General clerk | Advanced Excel; Office administration; Skill-up NQF; Social skills; Transversal skills (BAS, LOGIS, PERSAL) |
| | Accounts clerk | Social skills; Communication skills; MS Office; Interpersonal skills; Computer literacy |

ETDP SETA (2022).

3.4.2. Current Sectoral Occupational Demand

The ETDP SETA has identified two occupations considered Hard-to-Fill-Vacancies within higher education namely university lecturers as well as research and development managers (ETDP SETA, 2020). These roles require highly specialized qualifications and experience which contributes to recruitment and retention challenges (ETDP SETA, 2020).

Beyond these specified vacancies, national labor market analyses point to wider shortages in managerial, professional and technical occupations that lecturers and university leadership would fall into (DHET, 2022). The ETDP SETA skills plan also highlights needs for professionals with specialized capabilities in areas like data analysis, advanced IT/software skills, writing for academic publications, research skills, project management, and others

(ETDP SETA, 2022).

3.4.3. Future Sectoral Occupational Demand

Overall, the skills need of a country are evolutionary in nature as the economy undergoes structural changes. To understand the skills requirements of businesses, HEIs need to cooperate and form collaborative partnerships with businesses, who are at the forefront of experiencing changes in their industry (DHET, 2022). The impetus for greater collaboration will guarantee that students acquire the skills that are pertinent to the modern labour market, and markedly enhancing the likelihoods of landing a job matching the skills acquired.

Looking forward, ETDP SETA notes exponential growth in demand for technology-related hard and soft skills aligned to the Fourth Industrial Revolution across higher education occupations (ETDP SETA, 2022). Adaptability to virtual environments has further risen in criticality (Abiwu & Martins, 2022).

4. POST COVID STATUS QUO

This objective seeks to gain a comprehensive understanding of where the ETD sectors currently stand in terms of skills development amidst and post the pandemic. It acknowledges that the pandemic may have both directly and indirectly affected the way skills are imparted and acquired.

Here you can elaborate on slide 30

- What is the state of education and training provision as in 2022 (skill supply and demand)? Has there been any changes in skills development priorities since 2020?
- Extent of skills and occupational shortages,
- Hard to fill vacancies
- reskilling, upskilling, adaptation, workforce sustainability?
- What are key factors affecting skills supply and demand?

4.1. The State of the HE Subsector Post Covid

The ripple effect of the pandemic has led to numerous changes in organisational and educational structures including staffing, teaching methodologies, or curricular content.

Hard to Fill Vacancies

According to ETDP SETA Sub-sector Skills Plan lecturers, professors and associate professors were in great need (ETDP SETA, 2022). Other vacancies identified included:

- Data Management Manager
- Statistician
- Education/Training Advisor
- Organisation and Methods Analyst
- Software Developers

- Multi-media Specialists
- Systems Administrator
- Network Analyst
- ICT Communications Assistant
- Computer Network Technicians

Covid 19 and 4IR also forced the implementation of online learning options without adequate planning and infact increased workloads (Table 8).

Table 8: Role of Technology in response to Covid 19 and 4IR

| Tools used (Mhlanga & Moloji, 2020) | Description | Platform |
|--|--|--------------------------------|
| Mobile platforms and applications (Vodacom, Cell C, MTN) | Learners access learning materials from educational and informational websites | Online desktop/ laptop/ mobile |
| Internet (websites) YouTube (most universities) | Learning on their own at home | Online desktop/ laptop/ mobile |
| Microsoft Teams | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop/ laptop/ mobile |
| Skype | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop/ laptop/mobile |
| WhatsApp | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop/ laptop/ mobile |
| Zoom | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop |

Source: Aruleba, et al, 2022, Mncube et al 2021, Ndevu, 2023

Pedagogical Approaches to teaching and learning arising from Covid 19 and 4IR.

A study by Moodley (2021) at a South African university of technology highlights several concerning issues regarding the student experience with emergency remote online learning during COVID-19:

Alienation and Lack of Support: Students reported feeling isolated and deprived of personalized guidance and interaction with lecturers in the online space (Moodley, 2021). The abrupt shift online severed a valued human connection and support system for learning.

Declining Motivation: Learners increasingly suffered from motivational issues and "online learning fatigue" studying independently without peer communities to provide motivation and emotional assistance according to the study (Moodley, 2021).

Learning Management System Issues: Students expressed frustration with learning management platforms used simply to upload content rather than leverage affordances for engaged teaching and class community building.

Loss of Social Learning: The loss of collaborative, peer-supported learning environments contributed to more severe learning and psychological challenges for some including trauma and fear according to student feedback (Moodley, 2021).

Practical Learning Disruptions: The rapid digitization also disrupted opportunities for applied practical learning experiences essential to certain technical programs.

The study spotlighted gaps in pedagogical support, social connections, motivation and practical engagements - all vital to meaningful, holistic learning. As remote and online delivery prevails post-COVID, these human factors require urgent redressal through instructor supports and purposeful virtual community building.

Emerging Trends

The COVID-19 pandemic accelerated several technology-influenced trends that are likely to endure as permanent shifts within higher education as outlined below.

Mainstreaming of Online Modalities: Blended, hybrid and fully online teaching and learning models have been widely adopted and are expected to remain entrenched post-pandemic facilitating expanded access (Essop, 2021). However, equalizing digital capabilities across institutions and student groups remains vital.

Commoditization Risks: Some caution the emergency digitization amplified tendencies to view education as mere "content delivery" rather than a transformational process premised on human relationships (Brabazon, 2022). Coupled with budget constraints, there are risks of academics becoming atomized and disempowered, programs focusing myopically on convenient content transmission rather than learning efficacy and integrity.

Growth of MOOCs and Microcredentials: Mass open online courses (MOOCs) and alternative credentialing platforms grew substantially during recent disruptions to traditional campus-based models. These more

affordable programs reached wider audiences although variable quality and recognition issues persist around such qualifications (Leibowitz, 2022).

Constructivist, Connectivist Pedagogies Displaced: In the rushed shift online, established practices like connectivist teaching helping tie novel information to existing mental models, and constructivist co-creation of knowledge were often displaced by passive, instructivist broadcasting of pre-recorded content rather than meaningful two-way interactions (Moodley, 2022; Siemens, 2005).

In summary, while COVID-induced contingencies illuminated opportunities for flexibility and access leveraging technologies, maintaining foundational tenets of impactful learning including social affiliation, scaffolding development and context-sensitive application remains imperative (Motala & Menon, 2020).

4.2. Coping and Adaptation Strategies within COVID 19

Post-pandemic recovery is a concern for every sector, and ETD is no exception. Understanding the various strategies and interventions organisations have implemented is important as it assists with long term planning and building resilience against future disruptions.

The Covid-19 pandemic greatly disrupted higher education systems across the globe, including South Africa, as campus closures were implemented to enforce social distancing measures (du Plessis, Van Niekerk, Rosenkranz & Preiser, 2022). Many HEIs were required to identify and implement strategies to continue service provision including emergency remote learning and teaching, working from home arrangements, alternative means of providing support to both students and staff, and the reallocation of budgets to address the emerging needs (du Plessis et al, 2022). Although these short-term measures were able, in some ways to salvage the academic year, to survive beyond Covid-19 and meet the challenges of the fourth industrial revolution (4IR), it is necessary to implement long-term strategic plans. This section describes the short-term coping and adaptation strategies within higher education during Covid-19 while also providing long-term recommendations for the future.

4.2.1. LEADERSHIP

To cope and adapt during the pandemic, certain leadership traits were exhibited by leaders in South African universities, namely, responsibility, previous leadership experience, and adaptability (Lawton-Misra & Pretorius, 2021). According to Misra and Pretorius (2021) responsibility was seen as a facilitator of effective leadership, while previous leadership experience was viewed as an operational engine for tackling the Covid-19 crisis, and adaptability, with an emphasis in adaptable mindset, seen as essential in tackling different administrative, teaching, research, and communication situations.

4.2.2. EMERGENCY REMOTE LEARNING

In response to Covid-19, the rapid shift to remote teaching and learning had several pedagogical implications. This included ways in which to reduce distance between the aim and the reality of online teaching and learning as well

as capitalising on aspects of synchronous and asynchronous modes of delivery (Table 9) to benefit students. Teaching approaches had to be adapted and varied, developing smaller units of module content, utilising discussion forums, and introducing mini assessments. A key challenge, however, is that differences exist across faculties and that disciplines cannot receive a one-size-fits-all solution. For example, some have practicals, work-integrated learning, or laboratory work that require innovative solutions such as online simulations or videoed practicals. In this case, student-centred curriculum delivery modes were appropriate.

Table 9: Tools used for synchronous and asynchronous delivery in tertiary education.

| Tools used | Description | Platform |
|---|--|--------------------------------|
| Mobile platforms and applications (Vodacom, Cell C, MTN) | Learners access learning materials from educational and informational websites | Online desktop/ laptop/ mobile |
| Internet (websites) YouTube (most universities) | Learning on their own at home | Online desktop/ laptop/ mobile |
| Microsoft Teams | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop/ laptop/ mobile |
| Skype | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop/ laptop/ mobile |
| WhatsApp | Used mainly by staff and learners in tertiary institutions to hold discussions | Online desktop/ laptop/ mobile |
| Zoom | Used mainly by staff and learners | Online desktop |

| | | |
|--|--|--|
| | in tertiary institutions to hold discussions | |
|--|--|--|

Mhlanga & Moloj, (2020).

Student-centred curriculum delivery modes proved to be useful to facilitate dialogue. University lecturers had to mix old-style teaching techniques with small group teaching, flipped classroom techniques, gamification, and quizzes (Ashwin & McVittyl, 2015). Accordingly, Joshi (2021) noted that a future clinical microbiology course is expected to be blended in format, combining online platforms for guest lectures, gamification, online quizzes and face-to-face didactic and practical sessions to enhance microbiology learning. Given the dictates of the 4IR/5IR epochs, this will require continuous adjustment and testing of different approaches to fathom the ones that are suitable across cohorts (Joshi, 2021).

Finally, assessments were also altered to place a higher emphasis on continuous formative assessment. In their research delving into 'Covid-19 And Psychological Assessment Teaching Practices...', Munnik, Smith, Tucke and Human (2021) noted that lecturers proposed aligning competency training and assessment with revised work and altered teaching environments.

When moving forward, it is critical to consider emergency remote teaching as separate from a well-considered transition to online learning. The latter allows the time and resources to do so as well as consideration of the preparedness of both faculty and students (Motala & Menon, 2020).

4.2.3. SUPPORTING PERSONS WITH DISABILITIES

Persons with disabilities (PwDs) were disproportionately impacted during Covid-19, including within higher education as their support services were disrupted. For example, PwDs were unable to effectively participate in online learning as they did not have access to specialised equipment nor the Disability Services Units (DSU) staff who otherwise convert materials to the format required by the student. A key factor here is the compartmentalisation of PwDs where they engage with DSU rather than their lecturers, the latter thus having little awareness of the needs of these students once teaching shifted online (Ntombela, 2022). In moving forward, Ntombela (2022) advocates that Universal Design for Learning (UDL) is adopted within higher education where content is presented in multiple and flexible means, thus including PwDs within mainstream classrooms and capacitating them to assess their learning needs, monitor their progress, and sustain their learning journeys. Adopting UDL would make higher education more inclusive, not only for PwDs but for all students who may struggle with the current elements of course design, teaching, or assessment (Dalton, Lyner-Cleophas, Ferguson & McKenzie, 2019; Ntombela, 2022). A requirement of this would be staff development that focuses on 1) how to adapt and clarify curriculum goals and make teaching more accessible, 2) how to remove barriers to learning and enable all students to meet their learning goals, and 3) how to support all students, how to advocate for PwDs or marginalised students, and what and when to escalate (Dalton et al, 2019; Ntombela, 2022).

4.2.4. PROFESSIONAL DEVELOPMENT

For HEIs to move forward or to achieve sustainable competitive advantage following the aftermath of Covid-19, they will require skilled, capable, and talented staff complements. Talent development with HEIs is thus crucial and is defined as: *“An organisational activity aimed at maintaining and enhancing employees’ careers, skills and knowledge to align them with the organisational strategic goals”* (Abiwu & Martins, 2022, p. 3).

Talent development strategies such as training and development as well as career development, are therefore seen as mechanisms through which sustainability of South African universities can be enhanced. Abiwu and Martins (2022) evaluated the use of talent development strategies to improve the sustainability of South African universities during the Covid-19 pandemic. Recruited from three universities in KwaZulu-Natal, Gauteng, and the Western Cape, two hundred and sixty-five (265) academic respondents educated to either Masters (26%) or Doctorate (74%) level, completed an online structured questionnaire. The results showed a significant positive association between training and development and competitive advantage during the Covid-19 pandemic. There was furthermore a significant positive association between career development and sustainability of South African universities during the pandemic (Abiwu & Martins, 2022). The study thus supports further efforts by universities towards training and development and career development of their staff to promote sustainability in the face of challenges such as Covid-19. Kibirige (2022) makes a similar argument where Short Learning Programmes (SLP) are promoted as a means of supporting individuals in the labour market, including higher education staff. SLPs are defined as short courses and skills programs that can be formal or informal. They can equip individuals with the knowledge and skills they need to face new challenges in the workplace environment, such as those related to Covid-19, the 4IR, and globalisation. In this, a lifelong learning approach is supported. The author argues that effective and inclusive use of SLPs would narrow inequalities such as the digital divide and safeguard against unemployment by making individuals more versatile and empowered to meet market demands (Kibirige, 2022). Higher education staff could thus benefit from SLPs as the higher education landscape shifts and adapts to the changes following Covid-19. To do so, required skills need to be identified. For example, the systematic review by Maisiri, Darwish & Van Dyk (2019) identified the essential skills for the 4IR in the engineering profession with results noting the following broad categories, each with their own subskills:

- Technical skills
- Programming skills
- Digital skills
- Thinking skills
- Social skills
- Personal skills

Identification of skills regarding various professions would inform not only SLPs and other staff development approaches, but also higher education curricula (Maisiri et al, 2019).

4.2.5. PSYCHOSOCIAL SUPPORT

The Covid-19 pandemic and the 4IR altered the university environment which usually provided prospects for offering closely knit social interconnectedness (with feedback, feed forward communication loops), a criterion for

the universal need to belong to a community (World Health Organisation (WHO), 2022; Johns Hopkins Bloomberg School of Public Health & United Nations International Emergency Children’s Fund (UNICEF), 2022; Olawale, Mutongoza, Adu & Omodan, 2021). Ensuring access to comprehensive services in school, including those related to mental health and psychosocial support (MHPSS) is critical for supporting student learning and attendance and safeguard academic success in tempestuous physical and psychological environments (Govender, Reddy & Bhagwan, 2021; Sneyd, Mathoulin, O’Sullivan, So, Roberts, Paul & Balkisson, 2020). Research suggests, for instance, that mental health programmes at schools are associated with improved learning outcomes (Simjee, Mncwabe, Sindhrajh, Khan, Seedat, Xulu & Rampersad, 2021). This is also true for higher education staff, particularly females.

In a study by Newlin & Anthony (2022) on ‘Resilience of Female Academics in Rural South African Higher Education amid the Covid-19 Pandemic’ strategies to addressing challenges that women in academia faced, workload, involved employers in higher education coming up with a workload policy. Faced with a myriad of challenges, female academicians tapped within themselves to build resilience (Newlin & Anthony, 2022). Psychosocial support as well as assisting lecturers in using new technologies during their teaching is important. Mpungose (2021) notes that lecturers from a South African university struggled with Zoom digital fatigue, promoting student autonomy, and enhancing emotional connectedness (Mpungose, 2021).

4.3. Education Practices, Curriculum, and Pedagogy Implications

Bearing in mind the need for transformation of the higher education system, DHET is currently undertaking five programmes aimed to improve staff complements at HEIs. These are described in

Table 10 below.

Table 10: Development Programmes by DHET to Improve Higher Education in South Africa.

| Development programme | Aim(s) | Anticipated and/or realised outcome(s) |
|--|--|--|
| New Generation of Academics Programme (nGAP) | To recruit highly capable scholars as new academics against carefully designed and balanced equity considerations and disciplinary areas of greatest need into permanent posts at universities and support them through an intensive development programme | Implemented since 2015, a total of 373 posts have been allocated to universities |
| Nurturing Emerging Scholars | To actively direct strong emerging | A viable talent pool from which |

| | | |
|---|--|--|
| Programme (NESP) | scholars (postgraduates) towards a career in academia through making structured, attractive prospects and opportunities visible and available to them | future academics can be recruited |
| University Staff Doctoral Programme (USDP) | To support existing permanent academics at universities to achieve doctoral qualifications within four years or less | An increased number of academics with doctoral qualifications who can also provide supervision |
| Future Professors Programme (FPP) | To implement a coherent, structured, adequately supported two-year programme to target talented individuals at universities and support them toward being eligible for professorship | Create synergies that benefit fellows upon entering the professoriate as well as cascade to the next generation of South African academics |
| Higher Education Leadership and Management Programme (HELM) | To identify and respond to the leadership and management development needs in the university system and develop future academic and administrative leaders | Outcomes will combine to strengthen university leadership, management, and performance |

Source: Department of Higher Education and Training (nd)

The impact of the pandemic and the 4IR/5IR furthermore has pedagogical implications. In moving forward, teaching and learning in higher education will also need to consider several factors, such as investment in technology, provision of various resources to support content delivery, and the type of graduate being produced (Motala & Menon, 2020). It is recommended that these deliberations depart from a social justice framework that considers the different backgrounds from which students enter higher education as well as the differing curricula needs of disciplines (Motala & Menon, 2020). It will furthermore be necessary to work closely with pedagogical contingency planners (PCPs) to ensure that revised designs guard against future adversities through policies, processes, and procedures, and that the skills, education, and training required to support institutions are developed (Nyoni, 2022).

At the policy level, the Covid-19 impact and implications for the academic project in HEIs are epitomized in five policy pillars as expatiated below.

4.3.1. SALIENT ROLE OF THE ACADEMY

Despite its disruptions, the digital pandemic has underscored the salient role of the university in addressing

societal issues through scientific research and the generation of new knowledge to provide scientific guidance and expertise to enable governments to make informed choices in identifying public policies (Essop, 2021). This is attested to by the two-thirds of institutions surveyed by the International Association of Universities (IAU) who acquiesced to the fact that their senior management and faculty had been approached by their respective governments regarding Covid-19 related issues and challenges (Essop, 2021). However, at the same time, it peripheralised other relevant disciplines of the academy such as the humanities and social sciences. For instance, the constitution of the Ministerial Advisory Committee (MAC) in South Africa left a lot to be desired as it ignored the social, economic and cultural context of society as it was composed of mainly natural scientists, public health specialists and clinicians but no scholars from the humanities and social sciences (Essop, 2021). The heightened role of science and technology in the fight against Covid-19, and the rapid development of vaccines, gave an impetus for redirection of research funding to the broad field of science, engineering and technology at the expense of the humanities and social sciences (Essop, 2021).

4.3.2. CURRICULUM RELEVANCE

The significance of the curriculum in higher education has been debated on two fronts. Students are increasingly pursuing shorter and vocational courses, for example coding bootcamps, which are said to be relatively inexpensive, and their relevance to industry offer a faster and customised seamless entry point into the labour market (Essop, 2021; Inner City Education Foundation (ICEF) Monitor, 2019; Razavi, 2020). Universities, arguably, are not well-prepared to create and respond to rapidly changing knowledge and skills needs (Essop, 2021). Smit and Serfontein (2020) opined that approximately 50% of the knowledge acquired by first-year undergraduates in a four-year technical degree will be obsolete by the time they graduate. They further argue that courses/modules that are not pertinent to the needs of the labour market and loss-making should not be tolerated in the system.

4.3.3. COLLABORATION

The pandemic has highlighted the need to reconsider and rethink the traditional competitive approach to research and teaching. Inter-institutional collaboration in teaching and research should be encouraged (Essop, 2021). It would need governments and funding agencies to offer funding and other incentives to support inter-institutional collaboration and partnerships both within and between countries (Salmi & D’Addio, 2020). This form of collaboration should also create links between universities and employers and employer organisations in curriculum development.

4.3.4. TECHNOLOGY AND THE PRIVATISATION OF HIGHER EDUCATION

There is an emerging view that the pandemic provides an opportunity to disrupt the apparent broken model of campus-based, contact higher education which is characterised by increasing costs, limited return on investment, inefficiencies and inequalities and an archaic curriculum that is not relevant to the rapidly changing labour market demands in the context of the rise of the 4IR/5IR. A gallant proponent of this perspective is Scott Galloway, Professor of Marketing at New York University’s Stern School of Business (2020) who argues that university degrees are “prohibitively expensive and unnecessary” and should not be “fettersed” but replaced by short

certificated vocational programmes which are a “gangster way of preparing a person of any age for a career” in “hot fields” such as computer programming and product management (Essop, 2021).

At the operational policy level, at the onset of the Covid-19 pandemic, the 4IR and its sequel the 5IR, a digital pedagogy has been unfolding in earnest, characterised in ten foundational taxonomies of an unfolding digitalised curricular and digital pedagogy in HEIs and traverse education and training practices, assessment and instructional methodologies in HEIs. The sections that follow are devoted to explicating these taxonomies as they were operationalised in the field in HEIs in South Africa.

4.3.5. DIGITAL LITERACY PRACTICES (DLP)

Digital literacy communities comprise closed and open networks that stress teaching and learning enthralled in authentic networks (human or digital) central to modern pedagogy where individuals in this space are closely knit for a learning setting acquiring a specialized form of knowledge. Digital literacies practices make use of distance learning, blended learning, mobile learning and online learning as strategies in times of crisis especially in resource-stricken milieus, to help learners achieve learning outcomes. Mdiniso, Shangase, Nkwanyana, Cele and Mkhasibe (2022) observed that lecturers and students in Historically Black Universities (HBUs) experienced several difficulties in navigating to digital teaching and learning because of a dearth of resources, data and skills in using teaching and learning technologies. An aligned recourse was for lecturers to receive technology-related professional development to ensure seamless amalgamation and enhanced digital pedagogical practices. Coupled with lack of the digital skills was the issue of lectures’ mindsets towards the use of digital platforms to navigate the pandemic and the 4IR epoch (Phejane, 2022; Jere, 2020).

4.3.6. COLLABORATIVE LEARNING AND TEACHING

The collaborative theory is premised on the notion of peer-to-peer education that cultivates deeper thinking in the classroom. It elevates group learning as an antidote to assist students to enhance their higher-level thinking, oral communication, and self-management and leadership skills. The originator of this theory is Lev Vygotsky’s with his concept of zone of proximal development (ZPD). The main tenet of the theory is identifying what a learner can do ‘unscaffolded’ and what a student can do with scaffolding (Vygotsky, L.S., 1978).

Within the rubrics of the collaborative theory, extant literature contends that, amid the Covid19 epidemic, HEIs should encapsulate surrogates to learning and teaching such as the utilisation of open distance learning (ODL). They contended that the adoption of ODL will facilitate technology inclusion for students living with disabilities through collaborative online international learning - COIL (de Klerk & Palmer, 2022). The digital platforms to implement COIL comprise the following, amongst others: Skype, Zoom, Blackboard, One drive, Google drive, MS Teams and Moodle. COIL projects can take place in face-to-face, fully online, or hybrid (partly face-to-face, partly online) courses. Projects can involve complementary content (IKUDU, 2020). As a digital pedagogical tool, COIL is suitable (1) for students, to help improve their 21st Century skills such as digitisation skills and boost employability skills (i.e. communication, language, cultural, leadership and time management skills); (2) for academics to empower them to encourage students and to get them involved and engaged; and (3) for institutions, to facilitate inclusive internationalisation, enable intercultural learning, help develop new collaborations and partnerships and

improve the institutional image (IKUDU, 2020). Collaboration in teaching and learning is further characterised in communities of practice, which refers to a group of individuals bound by common interest which is enhanced as group members support and interact with one another (Naidoo, 2020).

4.3.7. SELF-DIRECTED LEARNING (SDL): STUDENT VOICE PERSPECTIVE

Sometimes dubbed learning by oneself, self-directed learning is a context where people, particularly learners, take sole responsibility of organising, monitoring and evaluating their learning practices (Merriam, Caffarella, & Baumgartner, 2007). More importantly, learners take control and proactively get involved in the learning process (Boyer & Usinger, 2015; Grover, 2015).

The choice for SDL strongly hinges on the type of learner, the type of learning facilitator, and the learning environment. It is also emphasised that if SDL was not promoted in classrooms before the Covid-19 pandemic, learners could have experienced challenges during the lockdown that possibly affected their education (Blignaut, & Du Toit-Brits, 2022). In other words, a learning environment devoid of SDL may promote traditional education and surface or rote learning, among others (Blignaut, & Du Toit-Brits, 2022).

In this pedagogic domain the emphasis is on learning kits and settings. Students create and partake in super-imposed physical and digital learning settings for continued and lived experiences. Thus, knowledge is used, curated, and stored in these settings, making them 'podiums' for inquiry and springs of collaboration and creativity.

4.3.8. DIGITAL INFRASTRUCTURE

The advent of the 4IR and the 5IR demands that we invent and innovate a prototype of infrastructure for teaching and learning to deliver the skills for doing work and gain attributes to live in society. There are two types of this digital infrastructure namely: hardware and software. Within the pedagogic practice of higher education, the infrastructure can be broken into two based on the Siamese twins of education function (teaching and learning) and digital infrastructure and digital learning making the infrastructure physical and aero-digital. To authenticate the veracity of the preceding valuations in the era of the 4IR/5IR, literature has advocated for the adequate delivery of effective online audio-visual sessions with abundant Aero-digital space to allow for student-lecturer's interactions and low-tech online sessions and content deliveries (Omodan, Tsotetsi, & Ige, 2021).

To buttress the impetus for the provision of digital infrastructure for mobile and online teaching, Chisadza, Clance, Mthembu, Nicols & Yitbarek (2021) contented that enhancing digital infrastructure and decreasing the price of internet access were the salient ingredients for ameliorating the effects of the Covid-19 pandemic on education achievements. Concentrating on HBUs in South Africa, Mdiniso et al (2022), have argued that progress in ICT infrastructure amongst HBUs in the aftermath of Covid-19 persist and should be addressed during the shift to more online teaching and learning.

Accordingly, academic staff from HBUs should go through some form of technology-related professional development and training to ensure successful integration and improved pedagogical practices (Evans & Popova, 2016). Additionally, improvements in ICT infrastructure among HBUs post-Covid-19 remain critical and should be considered in the transition to online teaching and learning (Mdiniso et al, 2022). Collaborative learning and

teaching and digital infrastructure are intertwined in that to collaborate in teaching and learning, one needs mobile and online podiums (refer to Collaborative Learning and Teaching on COIL).

4.3.9. DIGITAL INCLUSIVITY AND STUDENT DIVERSITY

Whereas digitising education has been lauded as a boon in improving teaching and learning in South African HEIs, concerns relate to digital or technological exclusivity that has been exposed by Covid-19. The segments not adequately served by technology in teaching and learning include learners and learning facilitators with disabilities and students from low socioeconomic status and historically black universities (Dube, 2020; Van Wyk, Mooney, Duma & Faloye, 2020).

Furthermore, student diversity challenges have not been attended to adequately (Mhlanga & Ramoroka, 2021) for example, student learning preferences such as multimodal learning (kinaesthetic modality) (Pillay & Govender, 2022). Accordingly, Pillay and Govender (2022) also observed that ‘voice-over PowerPoint presentations and Microsoft Team sessions with transitioning images, and audio files, supported the visual and aural learning through asynchronous engagement’. A kinaesthetic learner is a learner who needs to be continuously and actively engaged in his/her learning. This type of learner is not amenable to traditional learning environs, as a tactile learner s/he uses movement, testing, trial and error to retain and remember information.

Focusing on pre-service learning facilitators with disabilities in their study, de Klerk, Palmer, and Alexander (2021) concluded that HEIs institutions encapsulate a pedagogy of inclusivity to attain transformative equity for pre-service educators with disabilities and provide an inclusive response framework to enable full participation, learning and foster collegiate within HEIs (see also UNESCO-UIS, UNICEF, The World bank & OECD, 2022). This inclusive and collegial response should address issues of stigma and social exclusion to usher in a sense of belonging within HEIs (de Klerk et al, 2021).

A case about kinaesthetic modality is its promise to provide a multichannel learning and teaching framework post-Covid-19 and in the era of the 4IR/5IR. In post-Covid-19 and beyond particularly in the 5IR epoch, it is about humanity, inclusivity, collaboration; thus, adopting a kinaesthetic modality is embracing diversity and personalisation (which also epitomises customisation) in teaching and learning.

4.3.10. WELLNESS AND AWARENESS OF MENTAL HEALTH: PSYCHOSOCIOECONOMIC SCAFFOLDING

Mental well-being is engrained for students/learners and teachers/lecturers in HEIs environments. Thus, in the social and economic aftermath of the Covid-19 pandemic, unprecedented income inequality, joblessness, high crime and violence levels, the mental health path of students, learning facilitators and lecturers were aggravated (Sneyd et al, 2020). According to Sneyd et al (2020) a focus on wellness, awareness of mental health issues and multimodal support was going to lead to a reduction in trainee distress. Hence, they asserted that it was the flexing of requirements that was important and further opining that in anaesthesia departments, support was more important than grades and job designations (Sneyd et al, 2020). To ameliorate mental health dysfunctions, concerned institutions should offer proactive remedial services to enhance the quality of life of affected students

and academics (Simjee et al, 2021). Further, evidence from literature shows that mental health is an overarching problem and that psychosocial wellness programming for all the ETD sectors including rural institutions, should be provided together with the government and the private sector to assist funding such an initiative (Pillay & Kramers-Olen, 2022; Govender et al, 2021).

4.3.11. CURRICULAR REFORM

Digital Curriculum

Three broad leitmotifs ensuing from the literature reviewed epitomises a digital curriculum, namely: curriculum for learning facilitators or lecturers; curriculum for learners/students and curriculum delivery modes at the onset of Covid-19 and the 4IR/5IR epochs and beyond. With the onset of Covid-19, to salvage teaching and learning, the terms emergence and adaptation were trending. Thus, a salient tenet of the 4IR/5IR in the 21st-century is rapidity and perennial change. Urgency and adaptability interface with teaching as well as assessment and curriculum.

The pandemic and concomitant digital epochs of the 4IR/5IR have demanded that learning facilitators or lectures at HEIs become learners all to acquire specialised knowledge tailor-made to perform specific work (skills for doing work). Lecturer or learning facilitators' curriculum requires an escalation of lecturer training in the use of digital infrastructure for teaching and learning to enable them to embrace it in their teaching practice (Ndebele & Mbodila, 2022). The digital skills acquired will help them deliver curricula such as study material and other resources, make use of online platforms and media in accessible formats, to a diverse student population untrammelled (Chisadza et al, 2021).

Digital Curriculum Delivery Modes

Whereas prior to the pandemic 'high dose' tutoring (in small group or one-to-one) were shown to enhance learning outcomes, latest evidence reveals the capacity of online (Gortazar, Hupkau & Roldan, 2022) and remote (SMS messages) tutoring internationally (Angrist, N., Bergman, P., Brewster, C., & Matsheng, M. 2020). Further, to deliver the digital curriculum in HEIs (mainly urban), a gamut of digital podiums was used to enable teaching and learning, such as Zoom, Moodle, WhatsApp, Facebook, Skype, Email, D6 and Zoom video conferencing technology (ZVCT), Google Apps, YouTube licensing and Office 365 licensing/ MS Teams (Khoza, 2021; Moloi & Mhlanga, 2021).

For a digital curriculum in clinical microbiology during the Covid-19 the delivery modes must be student-centred as opposed to teacher-centred and should be imbued with engagement. To facilitate engagement, university lecturers employed a mix old-style teaching technique with small group teaching, flipped classroom techniques, gamification and quizzes (Ashwin & McVittyl, 2015). Accordingly, Joshi (2021), a future clinical microbiology course is expected to be blended in format, combining online platforms for guest lectures, gamification, online quizzes and face-to-face didactic and practical sessions to enhance microbiology learning. Given the dictates of the 4IR/5IR epochs, this will require continuous adjustment and testing of different approaches to fathom the one that is suitable across cohorts (Joshi, 2021).

Structured Digitised Pedagogy

A plethora of evidence is substantiating that structured pedagogy programmes lead to enhanced learning outcomes in learning institutions (World Bank, 2018; Snilstveit et al, 2017). Structured pedagogy programmes comprise supporting learning facilitators with facilitators' guides, structured lesson plans, student materials and facilitators training (World Bank, 2018; Snilstveit et al, 2017). Online teaching and learning ushered in the use of various high-, medium- and low-technology remote modes of communication. Accordingly, many countries implemented professional development for teachers on the effective use of technologies during the learning years 2020/2021 and 2021/2022 (Evans & Popova, 2016). For continuous professional development and evolving teaching and learning that meet learners' needs, analytics and personalisation should epitomise the education pedagogy. This places the role of data at the centre of teaching and learning. Analytics can (theoretically) be used to forecast and personalise varying dimensions of teaching and learning, such as pace, complexity, content, and many others. Artificial Intelligence (AI) is set to revolutionise this practice in education.

In the final analysis, in the 4IR/5IR domains, there needs to be an embracing caring pedagogy aligned to the principles of learner-centeredness, constructivism, and heuristic–eclectic embedded humanity of ubuntu (*umuntu ngumuntu ngabantu: you are who you are because of other people*) and resonate with those identified elsewhere in literature (USA and Europe). Nevertheless, the identified taxonomies should be seen as social practices open to scrutiny, contestation, deconstruction and reconstruction as we continually architect our worldviews.

4.3.12. EDUCATION AS A SOCIOECONOMIC AND POLITICAL TRANSACTION

The education system is presided over by the polity (the state DHET for PSET which includes HEIs) who enacts laws to govern the system, be it the budgets, administration etc. The National Treasury determines the allocation of budgets for the HEIs in South Africa. Thus, politics in tandem with the economy affects education directly or indirectly and therefore a trickle-down effect has an impact on skills formation. This is called political economy.

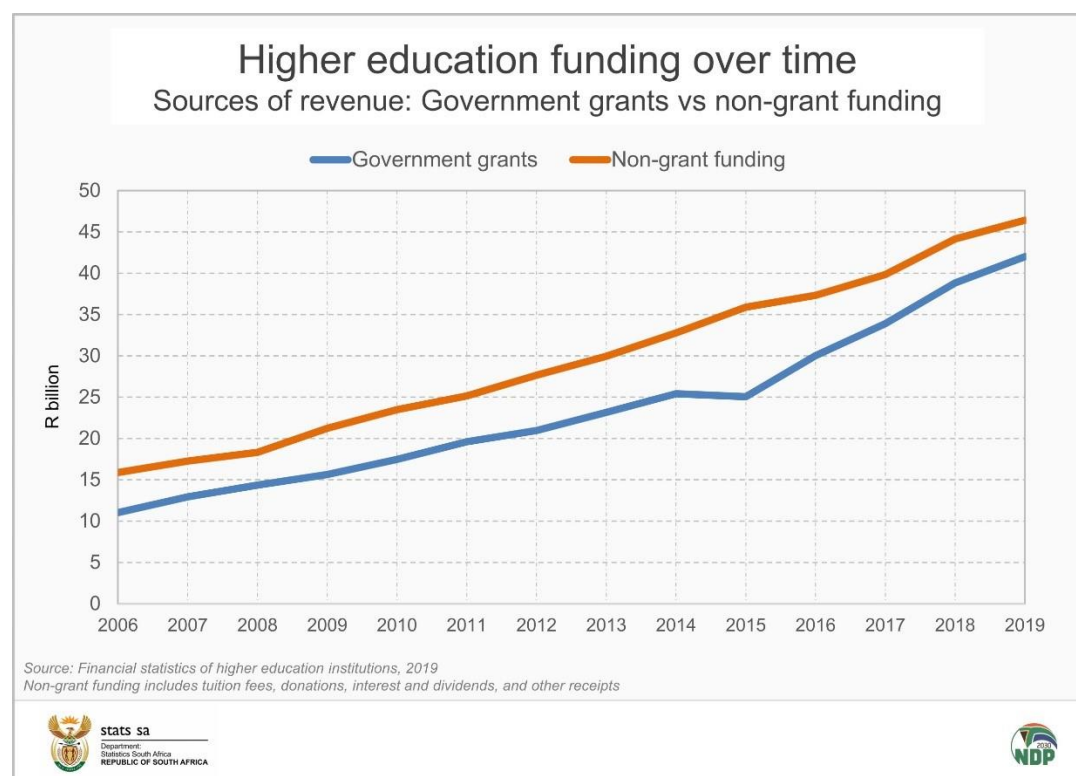
Accordingly, policy concepts of supply and demand of skills are political and economic buttressing Seymour Papert's observation that "generally in life, knowledge is acquired to be used. But school learning more often fits Freire's apt metaphor: knowledge is treated like money, to be put away in a bank for the future." (Papert, 1993, p28). According to Stephanie and Carmel (2020) skills supply and demand ideations misjudge 'how the ability of education to prepare for work is shaped by the ways in which work is organised'. They argue for a shift from market-based regulatory models towards models focused on building institutional capacity (Stephanie & Carmel, 2020; Ocholla, 2021).

Like Papert (1993), Koopman and Koopman (2021) viewed knowledge in HEIs as undergirded by the dictates of free market mantra of neoliberalism wherein knowledge is perceived as a utilitarian value. Arguing from the perspective of indigenous knowledge, they contend this utilitarian approach has deprived the inclusion of indigenous knowledge in the curriculum (Koopman & Koopman, 2021). Moreover, their expose on the neoliberal treatise pertaining to the digitised curriculum underscores how the polity ostracised the voices and efforts of indigenous healers in the fight against the Covid-19 pandemic. Owing to the preceding developments, it can be inferred that the polity holds so much power to impose its neoliberal programme on the university with the deleterious effect of thwarting or shutting out indigenous knowledge (Koopman & Koopman, 2021) from education.

5. ALLOCATION AND PRIORITISATION OF RESOURCES IN THE SECTOR

Financial stability is crucial for the sustainability of any sector. It is acknowledged that the economic strain imposed by the pandemic has had significant implications for the sector. Figure 3 from Statistics South Africa illustrates the amount of revenue provided to South Africa's 26 universities across the 2006 to 2019 period. Government provides revenue in the form of grants from DHET while non-grant funding is revenue generated or received from tuition fees, donations, interest, and dividends. This chart shows that HEIs generate or receive slightly more revenue from non-grant funding (R46 billion in 2019) than government grants (R42 billion in 2019) (Statistics South Africa (StatsSA), 2020).

Figure 3: Higher Education Funding over Time.



Statistics South Africa (2020).

Expenditure for the PSET sector increased at an average annual rate of 5% over the medium term. On 23 February 2023, the Finance Minister, Mr. Enoch Godongwana, delivered the 2023 Budget Speech that included the monetary figure to be spent for the DHET over the upcoming three years for higher education, TVETs, CET, and SETAs. According to the National Treasury, over the Medium-Term Expenditure Framework (MTEF), DHETs expenditure is expected to reach:

- R135.6 billion in the 2023/24 financial year
- R148.3 billion in the 2024/25 financial year
- R153.9 billion in the 2025/26 financial year

Of these amounts, it is expected that approximately R50 billion in the 2023/24 financial year will be allocated to the National Student Financial Aid Scheme (NSFAS) which provides bursaries to university students. The second largest allocation is to universities' subsidies, at approximately R44.4 billion (Siebritz, 2023).

If higher education transitions to blended teaching and learning, resourcing in terms of technology is imperative. Prior to the pandemic, the higher education system had been urged to adopt online technologies as a response to the 4IR (Mncube, Olawale & Hendricks, 2019). The Covid-19 pandemic, however, forced the immediate implementation of online learning options without adequate planning (Aruleba, Jere & Matarirano, 2022; Mncube et al, 2021). As a result, rather than providing continued learning and teaching for all students, there was a lack of equitable access as many students did not have the necessary support, devices, or infrastructure (Aruleba et al, 2022; Landa et al, 2021; Mncube et al, 2021).

Students from underdeveloped, remote, and rural areas struggled with access to online learning (Aruleba et al, 2022; Mncube et al, 2021), experiencing challenges such as late provision of data and laptops as well as digital/information technology literacy difficulties that ranged from inability to access the internet to difficulty in navigating the online learning space (Landa, Zhou & Marongwe, 2021).

The Covid-19 pandemic thus highlighted a sub-inequality within the South African education landscape, namely digital inequality or the 'digital divide' (Reddy, Soudien & Winnaar, 2020). The digital divide in South Africa is a manifestation of poverty, marginalisation, and inequality and is centered on two issues. Firstly, the poorer a community, the less exposure the members of that community have to digital technology opportunities. This is linked to a general shortage of infrastructures as well as their high cost. Secondly, poorer communities have limited access to digital/information technology literacy training, resulting in low levels of these skills and a lack of understanding of the utility of these skills (Aruleba et al, 2022).

Metropolitan households were well off technologically with superior connectivity from home compared to their rural counterparts (12 percentage points gap) (StatsSA, 2022). Nevertheless, in 2020 rural South African households made gargantuan inroads by acquiring internet connectivity through smartphones culminating in reduced access gaps (44,6% in 2019 compared to 56,8% in 2020) (StatsSA, 2022). Thus, internet connectivity increased by 12.2% for rural households. Despite these positive gains, chances were that rural households had lower odds than their counterparts in urban households to access internet connectivity from home when comparing 2019 to 2020 (StatsSA, 2022; Paidamoyo, Patrick, Mavis, & Kemist, 2021). Online teaching and learning in South Africa and similar contexts re-incarnated structural issues of 'race,' class, gender and geography, and must be accompanied by rigorous support structures for students who are vulnerable in these contexts (Fouche, & Andrews, 2022; Omidire, & Aluko, 2022). The introduction of support, devices, and infrastructure is thus crucial in overcoming the digital divide.

The financial sustainability of higher education institutions in developing countries, which was unpredictable pre-Covid-19, has been dealt a death knell by the pandemic and linked economic downturn (Essop, 2021). In South Africa, this has put strain on the main income streams of universities - state subsidies; tuition fees; third-stream income from contract research; consulting services; short courses; and philanthropic donations (de Villiers, 2020b; Koornhof, 2020). This is heightened in the historically disadvantaged institutions (HDIs), which rely solely on state subsidies and tuition fees. To worsen the situation, the state subsidy has gradually declined while access has

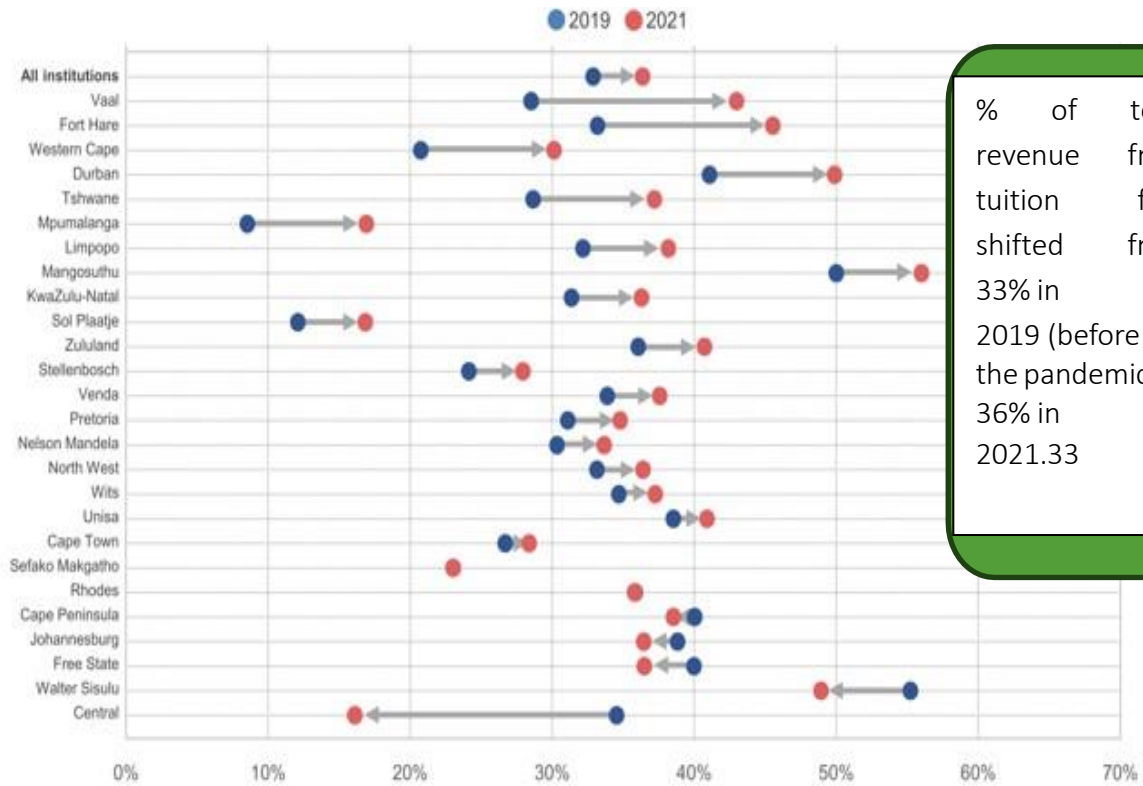
increased.

The COVID-19 pandemic and associated economic impacts resulted in budget cuts across many sectors, including higher education in South Africa (Department of Higher Education and Training, 2020; National Treasury, 2020). The 2020/21 infrastructure allocation for universities was reduced by R500 million, while the block grant supporting institutional operations was cut by R382.59 million or 1.07% (DHET, 2020; National Treasury, 2020). The national Department of Science and Innovation (DSI) also faced a 16% budget reduction affecting postgraduate scholarships and research funding (Mahlaka, 2020).

These cuts negatively impacted progress towards much needed development programs. The DSI had to reduce planned postgraduate bursaries from 9,300 to 6,000 and doctoral grants from 3,100 to 2,000 (Mahlaka, 2020). Budget shortfalls further threatened existing initiatives like the University Capacity Development Grant (UCDG) which supports staff and curriculum development, and student support services (Wangenge-Ouma, 2021). While some continued grant assistance helped historically disadvantaged institutions provide staff training and postgraduate writing mentors, the extent of research chairs and centres of excellence halt remains unclear (DHET, 2020).

The pandemic response fiscal policies significantly reduced higher education and research funding levels through cuts in infrastructure, operational and targeted development program budgets. These shortfalls inhibited progress on addressing backlogs, inequalities and staffing issues in a sector already characterized by underfunding and student resource shortages pre-COVID (Bozzoli, 2021; Wangenge-Ouma, 2021). Increased investments into digital capabilities offer potential to offset some material access barriers (Mahlaka, 2020). However, adequate public financing remains vital for ensuring instructional quality, strong developmental programs and an empowered next generation driving societal transformation.

Figure 4: Tuition Fees as a percentage of revenue for all HEIs 2019/-2021



% of total revenue from tuition fees shifted from 33% in 2019 (before the pandemic) to 36% in 2021.33

source: Financial statistics of higher education, 2021



6. INFORMATION GAPS

Higher education personnel, particularly at the leadership echelons, have been reluctant to talk about the three salient issues raised below. This reluctance has been based on the misplaced trust on lecturers' resourcefulness that they will deliver educational outcomes based on their qualification credentials. Traditional lecturers or academics are hired based on their raw credentials devoid of emphasis on ethical conduct and an emphasis on structured pedagogy. With the advent of Covid-19 and the 4IR, research reviewed have shown an impetus for these to be engaged and applied. Teaching and learning beyond Covid-19 and during the 4IR and 5IR epochs will be more need-based and will require certain ethical consideration that stress humanity, inclusivity, collaboration, embracing diversity and personalisation (which also epitomises customisation) in teaching and learning. Several uncertainties remain regarding higher education's pandemic-induced shifts that warrant further examination.

6.1. ROLE OF LEADERSHIP IN TIMES OF CRISIS

While some writers touched on the issue of leadership, it is very limited. Key informants to address the gaps will include the following:

- Academics/lecturers in HEIs
- Management of HEIs
- Teaching and Learning practitioners in the ETD sector
- Selected students in student formations within HEIs
- Relevant international academic community
- Industry stakeholders
- Relevant International organisations e.g., UNESCO, IMF, World Bank, OECD
- Other relevant think tanks on the raised issues.

6.2. PROFESSIONALISATION OF LECTURERS

Professionalisation of lectures has received little attention. The literature reviewed point to a massive need regarding skills and competencies of personnel and skills formation. This professionalisation programme can be modelled against the Stellenbosch doctoral supervision programme at their Doctoral Academy and input from different stakeholders.

6.3. STRUCTURED DIGITAL PEDAGOGY

Within education and training practices, the foundational taxonomies of an evolving digitalised curricular and digital pedagogy can only be obtained in structured pedagogy and customised teaching. The impetus for pedagogical interventions with adaptive instruction methods is their promise to boost learner outcomes, learner progress and advance the much-needed skills formation.

6.4. Effectiveness of Institutional Collaborations

The outcomes achieved from DHET's efforts to spur cooperation between well-resourced and poorly-resourced institutions requires evaluation given continued resource disparities exposed by emergency remote learning transitions (Bozalek & Ng'ambi, 2022). Assessing how curricular, staffing and infrastructure collaborations expanded disadvantaged institutions' capabilities can inform ongoing support.

6.5. Implications of Mainstreamed MOOC Models

The large-scale expansion of mass open online courses (MOOCs) and alternative credentialing platforms during COVID requires analyzing tradeoffs around broadened access or deepening inequalities, as well as drop-out risks if self-directed online learning models prove inadequate for student success (Leibowitz, 2022; Essop, 2021).

6.6. Equity Issues in Online Pivot

The rush to emergency remote learning surfaced pressing questions around accommodating student diversity including home language proficiency, disability barriers and psychosocial circumstances impeding engagement that remain unresolved (Essop, 2021; Phakeng, 2022). Understanding specific inclusion gaps is vital.

6.7. Curricular Responsiveness Gaps

The growing obsolescence of skills and knowledge taught highlighted by experts underscores lagging curricular responsiveness to changing occupational realities facing graduates (Fanyana, 2022; Smit & Serfontein, 2020). Rethinking how programs interface with dynamic labor markets and leverage work-integrated learning is crucial.

In summary, COVID-19 created an imperfect natural experiment in digitally-mediated education at scale, generating critical lessons regarding balancing access, quality, inclusion and relevance imperatives (Czerniewicz et al., 2022). Further research on the complex equity and outcome tradeoffs can illuminate more constructive paths

7. CONCLUSIONS AND RECOMMENDATIONS FOR SKILLS DEVELOPMENT

7.1. Conclusions

Both Covid-19 and the 4IR/5IR caused immense disruptions and transformations of the higher education system. However, higher education is seemingly struggling to adapt to the new demands, leaving graduates in a precarious position where they are not adequately prepared to enter the labour market nor create employment.

This study revealed that higher education institutions recorded diminishing returns on SET outcomes (declining

numbers of SET graduates) and expanding number of humanities and business and management graduates, a phenomenon that is negative for the South African economy and the labour market, particularly for skills formation. Hard-to-fill vacancies and skills gaps reveal the shortage of learning facilitators with specialisation in high-demand critical cognitive skills such as mathematics, sciences, special education, and languages. These skills are correlational with management and technology-based occupations with severe deficits in individual skills in reading comprehension, active listening, speaking and writing.

Evidence presented in this study suggests that skills formation is a complex phenomenon which cannot just be simplistically subjected to the parochial whims of the mechanistic market-oriented analyses of supply and demand. As this study shows, skills formation is affected by a whole gamut of other issues such as education and training practices, curriculum, pedagogy, financial investment, coping and adaptation strategies and any disruption such as Covid-19 and technological shifts.

With the coming of the digital pandemic (Covid-19), marketisation of the higher education landscape became entrenched. This entrenchment is manifested in the increased market forces affecting the HE landscapes as well as more neoliberal forces influencing academic freedom. The neo liberalisation of higher education has been going on for more than two decades now, however, this has intensified with the advent of Covid-19 and the 4IR/5IR epochs. The neoliberal thought perceives education as a pursuit of individuals keen to invest in skills and credentials that will develop their value in the labour market (Brabazon, 2022). In this purview tertiary education is seen as ‘an instrumental mode of job training’ (Brabazon, 2022).

Further, education is merely “content delivery” (Brabazon, 2022) or material transmission. Simultaneously, academics are encouraged to remove the transformative pedagogical work that has long underpinned their profession and to simply administer a course or deliver course material. The assumption is that educating involves merely delivering information to students, which can be done just as easily online as it can be in person (Brabazon, 2022).

Within the neoliberal mantra, increasing atomisation of academics becomes central and internalised. This results in faculties or colleges increasingly seeing themselves as competitors rather than collaborators. To authenticate this, in universities’ reaction to Covid-19, academics have failed to consult faculty or faculty associations, bypassed academic governance structures, prioritised profit concerns over the safety and pedagogical concerns of faculty or the workload, equity, and academic freedom provisions of collective agreements (Brabazon, 2022).

Gradually, students are perceived by HEIs as customers engaged in a transactional relationship manifesting in increased tuition fees (Brabazon, 2022). Equally, research and faculty are expendable. With research, the public sphere is relentlessly reduced, and the role of the university in the public sphere is devalued. The principle that enquiry and debate are public goods is degraded, undergirded by the notion that a society’s self-knowledge and self-criticism are salient for democracy, societal improvement, and the pursuit of the good life (Brabazon, 2022). Expert opinion is devalued, and research is only useful when it translates into profits for the private sector, making universities conduits to channel public funds into private research and development (Brabazon, 2022). The entrenchment of marketisation in higher education is increasing contractual work of academics. There has been an increase in the number of academics employed on contract to deliver courses to students. Thus, a disturbing trend that institutionalises exploitation of contract staff.

Another panoptic trend across the globe manifesting in the wake of the digital pandemic, has been the general growth in mass, open and online courses (MOOC) aimed at the entire PSET system, including universities, technical and vocational education and training (TVET) colleges and community education and training (CET) colleges, as well as skills providers. However, South Africa has not opened the system to as many private providers as possible. In 2017 the DHET adopted an 'open learning' strategy to enhance access to education and training opportunities for all and to construct quality learning environments which take account of learners' context and use the most appropriate and cost-effective methods and technologies.

The shift to online and distance learning and teaching during Covid-19 have historically disadvantaged universities reeling to cope. What further compounded access to digital or technological infrastructure is the nature of the South African society which is characterised by entrenched dichotomies and dialectics of the haves and the have-nots (Makumbe, 2020). That being the case, there was a noticeable urban-rural divide (close to 19 percentage points) that existed among South African households who accessed the Internet using phones (StatsSA, 2022). Thus, metropolitan households are well off technologically with superior connectivity from home compared to their rural counterparts (12 percentage points gap) (StatsSA, 2022). Nevertheless, in 2020 rural South African households made gargantuan inroads by acquiring internet connectivity through smartphones culminating in reduced access gaps (44,6% in 2019 compared to 56,8% in 2020) (StatsSA, 2022). Thus, internet connectivity increased by 12.2% for rural households. Despite these positive gains, chances were that rural households had lower odds than their counterparts in urban households to access internet connectivity from home when comparing 2019 to 2020 (StatsSA, 2022; Paidamoyo et al, 2021; Whitelaw, Mamas, Topol & Spall, 2020).

One of the classical examples of a live digital gap involves lecturers and students in historical black universities (HBUs) encountering problems in accustoming to remote teaching and learning due to a dearth of resources and acute lack of access to data and skills in using teaching and learning technologies (Mdiniso et al, 2022; Mkhize, & Davids, 2021). A transition from traditional to virtual methods of learning brought to the fore several challenges, specifically in resource repressed milieus in less developed countries (Nyambuya, Nyamaruze, Dube, & Shumba, 2021), and in South Africa the technological transition mostly impacted students who came from low socioeconomic status homes (Paidamoyo et al, 2021).

Online teaching and learning in South Africa and similar contexts re-incarnated structural issues of 'race,' class, gender and geography, and must be accompanied by rigorous support structures for students who are vulnerable in these contexts (Fouche, & Andrews, 2022; Omidire, & Aluko, 2022). According to Azionya and Nhedzi (2021) the digital mass media in the digital divide suffuses socio-economic interconnection between university students and management. Thus, online education did not help the access for university learning during the pandemic for students studying at historically disadvantaged universities. Thus, network coverage, gadget type, time, socio-economic status and digital aptitude negatively affected synchronised lecture engagement and turnout hence an impact on skills formation (Azionya, & Nhedzi, 2021).

With growth in ICT and the 4IR, more ICT-related courses have been developed, most of which are a direct response to skills needs and closer collaboration with industry. Kibirige (2022) makes a similar argument where Short Learning Programmes (SLP) are promoted as a means of supporting individuals in the labour market, including higher education staff.

7.2. Recommendations

Here are recommendations for the ETDP SETA to consider based on the preceding analysis:

- Support capacity building initiatives to facilitate smooth transitions to blended learning models, including training educators and students on virtual tools and modalities.
- Advocate government investments into connectivity infrastructure, devices, and accessibility tools to mitigate inequities in rural/disadvantaged areas.
- Foster industry collaborations and work-integrated learning to strengthen curriculum alignment with labor market needs. The impetus for greater collaboration will ensure that students acquired the skills that are pertinent to the modern labour market, enhancing the likelihood of landing a job.
- Promote international skills exchanges allowing strategic hiring of niche foreign experts able to build domestic capabilities. Most economies (emerging and developed economies) are bringing in skills from expatriates to address rapid skills shortages while South Africa is rather closing its doors to an immigrant skilled work force.
- Encourage higher education institutions to diversify funding sources and demonstrate return on investments for continued public funding.
- Support further research quantifying pandemic disruptions and remote learning implications to inform rehabilitation efforts.
- Develop professionalization structures mandating continuous upskilling of educators on technological tools and virtual pedagogies.
- Mainstream informal micro-credentialing through short course skills updating aligned to emerging occupations.
- Incentivize inter-institutional teaching collaborations pooling expertise across better resourced universities.
- Secure public-private partnerships to resource infrastructure upgrades enabling blended learning.
- Prioritize student psychosocial support services and mental health interventions as part of holistic wellness.

Additional potential recommendations:

- Establish early warning data systems tracking labor market signals to align offerings with skills needs.
- Support rollout of modularized courses facilitating credit transfers and coordination.

- Pilot Income Share Agreement models expanding access alongside shared risk.

- The PSET system (HEIs) should enact relevant policies to address psychosocial wellbeing and mental health dysfunctions/disorders. These policy interventions should address the following:
 - Put emphasis on transitional periods,
 - Provide educator well-being programmes, and
 - Support peripheralised practitioners and learners living with disabilities as they are more susceptible to mental health disorders.

8. REFERENCES

Here is the list of references with duplicates removed and ordered alphabetically:

- Abiwu, L., & Martins, I. (2022). Talent development as a source of sustainable competitive advantage for higher education institutions during the COVID-19 pandemic. *SA Journal of Human Resource Management*, 20(10).
- Akanbi, O. A. (2021). Inequality in South Africa: A multidimensional analysis. *Development Southern Africa*, 38(2), 167-186. <https://doi.org/10.1080/0376835X.2020.1756804>
- Angrist, N., Bergman, P., Brewster, C., & Matsheng, M. (2020). Stemming learning loss during the pandemic: A rapid randomized trial of a low-tech intervention in Botswana. *CSAE Working Paper Series 2020-13*, Centre for the Study of African Economies, University of Oxford.
- Baijnath, N. (2018). Graduate employability challenges in the changing dynamics of the economy and the world of work. *Development Southern Africa*, 35(3), 297-309. <https://doi.org/10.1080/0376835X.2018.1452711>
- Bozalek, V., & Boughey, C. (2012). (Mis)framing higher education in South Africa. *Social Policy & Administration*, 46(6), 688-703. <https://doi.org/10.1111/j.1467-9515.2012.00863.x>
- Bozalek, V., & Ng'ambi, D. (2022). Transitioning to emergency remote teaching during the COVID-19 pandemic: academics' experiences using an online learning framework. *Assessment & Evaluation in Higher Education*, 1-18. <https://doi.org/10.1080/02602938.2022.2043570>
- Bozzoli, B. (2021). The financial fragility of South African universities in the age of Covid. *Politikon*, 48(1), 136-153. <https://doi.org/10.1080/02589346.2021.1911590>
- Brabazon, T. (2022). Emergency remote learning and conspicuous conservation. *Postdigital Science and Education*. <https://doi.org/10.1007/s42438-022-00339-7>
- Chisadza, C., Clance, M., Mthembu, T., Nicols & Yitbarek. (2021). Online and face-to-face learning: Evidence from students' performance during the Covid-19 pandemic. *African Development Review*, 33(S1). <https://doi.org/10.1111/1467-8268.12520>
- Council on Higher Education. (2020). *VitalStats Public Higher Education 2018*. CHE: Pretoria.
- Czerniewicz, L...[et al] (2022). A wake-up call: Equity, inequality and Covid-19 emergency remote teaching and learning. *Postdigital Science and Education*, 4, 1194–1233. <https://doi.org/10.1007/s42438-021-00242-3>
- Department of Education. (1997). *Education White Paper 3: A programme for higher education transformation*. *Government Gazette*, 386(18207). <https://www.gov.za/documents/education-white-paper-3-programme-transformation-higher-education-0>
- Department of Higher Education and Training. (n.d.). *Development programmes*. Unpublished document.
- Department of Higher Education and Training. (2020). *Minister Blade Nzimande: Coronavirus COVID-19 readiness for reopening of universities and TVET colleges*. <https://www.gov.za/speeches/minister-blade-nzimande-coronavirus-covid-19-readiness-reopening-universities-and-tvet-7-jun-2020-0000>

Department of Higher Education and Training. (2022). Skills supply and demand in South Africa: Labour market intelligence research programme. Pretoria: DHET.

du Plessis, E., van Niekerk, D., Rosenkranz, B., & Preiser, W. (2022). After the COVID-19 state of disaster in South Africa. *Nature Human Behaviour*, 6, 901. <https://doi.org/10.1038/s41562-022-01409-4>

Essop, A. (2021). COVID-19: The “new normal” and the future of higher education. <https://www.uj.ac.za/wp-content/uploads/2021/09/covid-19-and-the-future-of-higher-education.pdf>

ETDP SETA. (2020). ETDP SETA Sector Skills Plan 2020-2025. Johannesburg: ETDP SETA.

ETDP SETA. (2022). ETDP SETA Annual Performance Plan 2022/2023. Johannesburg: ETDP SETA.

Evans, D. K., & Popova, A. (2016). What really works to improve learning in developing countries? An analysis of divergent findings in systematic reviews. *The World Bank Research Observer*, 31(2), 242–270. <https://doi.org/10.1093/wbro/lkw004>

Fanyana, M. (2022). The employability of TVET college graduates in South Africa. *Educational Research for Social Change*, 11(1), 78-90. <https://doi.org/10.17159/2221-4070/2022/v11i1a6>

Heleta, S. (2016). Decolonisation of higher education: Dismantling epistemic violence and Eurocentrism in South Africa. *Transformation in Higher Education*, 1(1), 1-8. <https://doi.org/10.4102/the.v1i1.9>

Higher Education Management Information System. (2017). 2017 Status of the Higher Education System report. Pretoria: DHET.

Kantor, B. (2019, August 13). Unemployment and poverty challenges of the South African economy. Brand South Africa. <https://www.brandsouthafrica.com/investments-immigration/business/economy/development/unemployment-and-poverty>

Khuluvhe, M., Bhorat, H., Oosthuizen, M., Stanwix, B. & Mvula, A. (2022). Skills supply and demand in South Africa. Labour Market Intelligence Partnership, Development Policy Research Unit, University of Cape Town.

Koopman, O., & Koopman, K.J. (2021). The impact of the neoliberal technological epoch and Covid-19 on the decolonization of the university curriculum. *South African Journal of Higher Education*, 35(1), 127-142.

Langa, M., Ndelu, S., Edwin, Y., & Vilakazi, M. (2017). \#Hashtag: An analysis of the \#FeesMustFall Movement at South African universities. Johannesburg: Centre for the Study of Violence and Reconciliation.

Leibowitz, B. (2022). Theorising micro-credentials in a digitalising higher education environment. *Journal of Education*, 86, 33-49.

Mahlaka, R. (2020, July 22). Universities look to science and technology to lead Covid-19 recovery. *Business Maverick*. <https://www.dailymaverick.co.za/article/2020-07-22-universities-look-to-science-and-technology-to-lead-covid-19-recovery/>

McKune, C. (2019, January 17). FACTSHEET: Understanding student protests in South Africa. *Africa Check*. <https://africacheck.org/factsheets/factsheet-understanding-student-protests-south-africa/>

- Ministry of Education. (2001). National Plan for Higher Education. <https://www.dhet.gov.za/Planning%20and%20Reporting/National%20Plan%20for%20Higher%20Education.pdf>
- Mncayi, P., & Dunga, S. H. (2016). Career choice and unemployment length. *Industry and Higher Education*, 30(6), 413-423. <https://doi.org/10.1177/0950422216670500>
- Moodley, D. (2022). Emergency remote teaching and students' experience of connectivism and constructive alignment. *Postdigital Science and Education*. <https://doi.org/10.1007/s42438-022-00360-4>
- Moodley, P. (2021). An analysis of the student learning experience in emergency remote teaching at a university of technology. *Postdigital Science and Education*, 3, 890–898. <https://doi.org/10.1007/s42438-021-00243-2>
- Motala, S., & Menon, K. (2020). In search of the 'new normal': Reflections on teaching and learning during Covid-19 in a South African university. *Southern African Review of Education with Education with Production*, 26(1), 80–99.
- Motala, S., & Menon, K. (2020). In search of the 'new normal': Reflections on teaching and learning during Covid-19 in a South African university. *Southern African Review of Education with Education with Production*, 26(1), 80–99.
- Mncube, V. S., Mutongoza, B. H., & Olawale, B. E. (2021). Managing higher education institutions in the context of Covid-19 stringency: Experiences of stakeholders at a rural South African university. *Perspectives in Education*, 39(1). <https://doi.org/10.18820/2519593x/pie.v39.i1.24>
- National Planning Commission. (2012). National Development Plan 2030. Our future - Make it work. <https://www.gov.za/documents/national-development-plan-2030-our-future-make-it-work>
- National Treasury. (2020). Estimates of national expenditure. <http://www.treasury.gov.za/documents/national%20budget/2020/ene/FullENE.pdf>
- Ndevu, Z. J. (2023). Digital literacy practices in advancing Fourth Industrial Revolution discourse in a South African rural university. *International Journal of Higher Education*, 12(1), 52-62. <https://doi.org/10.5430/ijhe.v12n1p52>
- Ohei, K. N., & Brink, R. (2016). Investigating the prevailing issues surrounding ICT graduate employability in South Africa: A case study of a South African university. *The Independent Journal of Teaching and Learning*, 14(2).
- Organisation for Economic Co-operation and Development (OECD). (2022). Education at a glance 2022: OECD indicators. Paris: OECD Publishing. <https://doi.org/10.1787/3197152b-en>
- Organisation for Economic Co-operation and Development. (2019). Development co-operation report 2019 South Africa: COVID-19 pandemic raises the urgency of structural reforms. <https://www.oecd.org/southafrica/south-africa-covid-19-pandemic-raises-the-urgency-of-structural-reforms.htm>
- Papert S. (1993). *The children's machine: rethinking school in the age of the computer*. New York: BasicBooks.

Phakeng, M. (2022). Breaking barriers: Towards shaping the world we want through science. *South African Journal of Science*, 118(3/4). <http://dx.doi.org/10.17159/sajs.2022/13143>

Reddy, V., Soudien, C., & Winnaar, L. (2020). The Impact of COVID-19 on a Fragile Education System. Retrieved from https://cisp.cachefly.net/assets/articles/attachments/86795_covid-19_a-fragile-ecosystem.pdf

Salmi, J., & D'Addio, A. (2020). Policies for achieving inclusion in higher education. *Policy Reviews in Higher Education*, 5(1), 1-26. <https://doi.org/10.1080/23322969.2020.1835529>

Schofield, A., & Dwolatzky, B. (2022). 2022 JCSE-IITPSA ICT Skills Survey Twelfth Edition. Joburg Centre for Software Engineering (JCSE) and IITPSA.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*. http://www.itdl.org/journal/jan_05/article01.htm

Smit, V.A., & Serfontein, C. (2020, August 31). Traditional universities must adapt or die. *Mail & Guardian*. <https://mg.co.za/education/2020-08-31-traditional-universities-must-adapt-or-die/>

Smith, M., Volschenk, J., & Aziakpono, M. (2021). Millions of young South Africans are without jobs: What are the answers? *The Conversation Africa*. <https://theconversation.com/millions-of-young-south-africans-are-without-jobs-what-are-the-answers-162701>

Snilstveit, B., Gallagher, E., Phillips, D., Vojtkova, M., Eyers, J., Skaldiou, D., Stevenson, J., Bhavsar, A., & Davies, P. (2017). Interventions for improving learning outcomes and access to education in low- and middle-income countries: a systematic review. *Campbell Systematic Reviews*, 13(1), 1--82. <https://doi.org/10.1002/cl2.176>

Tjønneland, E. N. (2017). Cooperation in higher education and student mobility between South Africa and the Nordic countries: Obstacles and opportunities. *Journal of Student Affairs in Africa*, 5(2), v-x. <https://doi.org/10.24085/jsaa.v5i2.2704>

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press

Wangenge-Ouma, G. (2021). Financialisation of South African universities. *Higher Education*, 81, 35–51. <https://doi.org/10.1007/s10734-020-00571-y>

World Bank. (2018). *World Development Report 2018: Learning to realize education's promise*. Washington, DC: World Bank. doi:10.1596/978-1-4648-1096-1. License: Creative Commons Attribution CC BY 3.0 IGO.