FRAMING TOMORROW

Education Futures Insights

Mapping Strategic Needs to Strengthen South Africa's Basic Education System

SOCIAL CAPITAL BUILDING FOR EDUCATION IMPROVEMENT
10 Years

NATIONAL EDUCATION COLLABORATION TRUST

KAGISO TRUST

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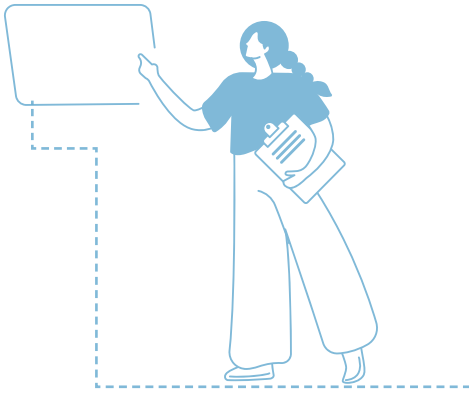
Abbreviations

AIEd	Artificial Intelligence Education
ASER	Age-Specific Enrolment Rate
DBE	Department of Basic Education
CSIR	Council for Scientific and Industrial Research
ECD	Early Childhood Development
FE	Futures Education
GDP	Gross Domestic Product
ITS	Intelligent Tutor Systems
LO	Life Orientation
MCP	Multiple Country Publications
MNCs	Multinational Corporations
MOOCs	Massive Open Online Content
NDP	National Development Plan
NSTF	National Science and Technology Forum
NSC	National Senior Certificate
OECD	Organisation for Economic Co-operation and Development
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PSET	Post School Education and Training
SAIIA	South African Institute of International Affairs (SAIIA)
SCP	Single Country Publications
SDG	Sustainable Development Goals
SLR	Systematic Literature Review
STEM	Science, Technology, Engineering, and Mathematics
STEAME	Science, Technology, Engineering, Mathematics, Art, and Entrepreneurship
ToC	Theory of Change
TVET	Technical Vocational Education and Training
UNESCO	United Nations Educational, Scientific and Cultural Organisation



Concept Notes

21st-Century Skills
A set of competencies, including critical thinking, creativity, collaboration, communication, digital literacy, and social skills, essential for success in today's complex and rapidly changing world.

24/7 Schools
The concept of 24/7 schools envision educational institutions that provide continuous access to learning resources, support, and activities around the clock to accommodate the diverse schedules and needs of learners and their families, particularly in communities where traditional school hours may not align with parents' work schedules or learners' learning rhythms.

Adaptive Learning
An educational method that uses technology to tailor teaching materials and methods to the individual needs and learning styles of each learner.

Artificial Intelligence Education (AIEd)
The use of AI technologies to enhance educational processes, personalise learning experiences, and improve educational outcomes.

Collaboration
The action of working with others to achieve a common goal, often involving shared responsibility and cooperative effort.

Creativity
The use of imagination or original ideas to create something; inventiveness, particularly in problem-solving and innovation.

Critical Thinking
The ability to think clearly and rationally, understanding the logical connection between ideas, and evaluating arguments and evidence systematically.

Digital Ethnography
A qualitative research method that involves studying and analysing online communities, behaviours, and interactions. Researchers use this methodology to understand how people communicate, form relationships, and create culture in digital spaces.

Digital Literacy
The ability to navigate, evaluate, and create information using a range of digital technologies effectively and critically.

Digital Transformation
The integration of digital technology into all areas of business and society, fundamentally changing how organisations operate and deliver value to customers.

Early Childhood Development (ECD)
The comprehensive care and education of children from birth to eight (8) years old, focusing on their cognitive, emotional, social, and physical development.

Education Outsourced
Outsourcing education involves delegating certain educational functions and services to external providers, rather than handling them within the traditional school system. This can include online courses, private tutoring, educational software, and extra-curricular activities. In can be used to leverage specialised expertise, reduce costs, and provide learners with access to a broader range of learning resources.

Education
A systematic process of facilitating learning, acquiring knowledge, skills, values, beliefs, and habits through teaching, training, and research, essential for personal and societal development.

Entrepreneurship Education
Programs and initiatives designed to teach individuals the skills and mindset necessary to create and manage their own businesses or ventures.

Fourth Industrial Revolution (4IR)
The ongoing transformation driven by advanced technologies such as artificial intelligence (AI), robotics, the Internet of Things (IoT), and biotechnology, impacting all aspects of society and the economy.

Futures Literacy
The ability to understand, anticipate, and prepare for potential future scenarios by thinking critically about the implications of current trends and emerging issues.

Futures
An interdisciplinary field that involves exploring and anticipating various possible, probable, and preferable futures to inform decision-making and strategic planning.

Inclusive Education
An educational approach that seeks to address the diverse needs of all learners, ensuring equitable access and participation for everyone, especially those who are marginalised or disadvantaged.

Intelligent Tutor Systems (ITS)
Computer systems that provide personalised instruction or feedback to learners, often using AI to adapt to the needs and responses of each learner.

Learn-as-you-go
Emphasises a flexible and continuous approach to education where learning is integrated into everyday activities and experiences rather than confined to formal classroom settings. This method encourages lifelong learning, adaptability, and practical problem-solving skills, critical for the future of work, by allowing individuals to acquire knowledge and skills as they navigate through different stages of life and work.

Lifelong Learning
The ongoing, voluntary, and self-motivated pursuit of knowledge for personal or professional reasons, emphasising the importance of continuous development and adaptation.

Massive Open Online Courses (MOOCs)
Online courses that are available to anyone with internet access, designed to provide large-scale participation and open access via the web.

Micro-Credentials
Certifications that validate the achievement of specific skills or competencies, often focusing on a narrow field of study, and can be earned more quickly than traditional degrees. These programmes are traditionally completed on digital platforms.

National Development Plan (NDP)
South Africa's strategic framework aimed at eliminating poverty and reducing inequality by 2030 through inclusive economic growth, social cohesion, and sustainable development.

Post School Education and Training (PSET)
Educational programmes and training opportunities available after completing secondary school, including higher education, vocational training, and adult education.

Problem solving
As a skill, it is the process of identifying a challenge, analysing its components, and implementing effective solutions to achieve a desired outcome.

Resilience
The ability to recover quickly from difficulties; toughness, especially in the context of adapting to and overcoming challenges in education and other fields.

Scenario Planning
A strategic planning method used to create and explore multiple future scenarios, helping organisations anticipate and prepare for potential changes and challenges.

Schooling Extended
It is the concept of broadening the traditional educational framework to include a variety of additional services and learning opportunities beyond the standard school hours and existing curriculum. This includes offering extracurricular activities, community services, early childhood education, and parental support programs to create a more integrated and supportive educational environment that caters to the diverse needs of learners, families, and communities.

Strategic Foresight
The practice of predicting and preparing for future challenges and opportunities by systematically exploring possible and probable futures.

Systematic Literature Review (SLR)
A methodical and comprehensive review of existing literature on a specific topic, aiming to summarise and synthesise research findings.
Technical Vocational Education and Training

(TVET)
Education and training programmes that focus on practical skills and knowledge required for specific trades, crafts, and careers in technical fields.

Theory of Change (ToC)
A planning and evaluation framework used to describe how and why a desired change is expected to happen in a particular context.

Section 1

Executive Summary

This report takes a futures perspective to offer renewed insights into the complex landscape of South Africa's basic education sector. By identifying future challenges, but more importantly opportunities, the report aims to enhance risk management and foster proactive strategies, enabling stakeholders to develop relevant policy and make impactful changes.

To achieve this, while aligning with the Ed-Futures unit's mission to enhance and prepare the South African education system for the future, the methodology adopts a comprehensive, systematic approach to gather, analyse, and synthesize relevant data and insights. The report began with a Systematic Quantitative Literature Review adapted to focus on educational futures, technology integration, and scenario planning within the context of South African basic education. A key component of our methodology is the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, ensuring transparency and methodological rigor. The study then applied a systematic literature review, synthesizing findings using meta-analysis from various reliable data sources to enhance the reliability and validity of our conclusions. This approach allowed us to draw nuanced insights from existing knowledge. Finally, the study incorporates a contextual analysis using focus group sessions and structured interviews with key role-players, including government agencies, academia, industry, non-governmental organisations, unions, teachers, and learners, to enrich the insights with first-hand perspectives from diverse stakeholders. This data was triangulated to produce the following conclusions.

Global perspectives and research in futures education

Futures research in education has gained traction globally, guiding stakeholders to anticipate and plan for long-term challenges and opportunities. The World Economic Forum highlights movements toward integrating futures thinking into education systems to prepare learners for rapidly changing job markets and societal needs.

This involves developing adaptable and versatile skill sets, emphasising critical thinking, problem-solving, and digital literacy, reflecting a shift towards more holistic and future-oriented competencies.

- Critical thinking
- Problem-solving
- Digital literacy

South Africa's digital readiness and the Fourth Industrial Revolution (4IR)

South Africa's journey towards embracing the 4IR and enhancing digital readiness is crucial for its success. This is highlighted in whitepapers as well as the National Development Plan (NDP). However, a comprehensive digital policy is needed to address existing inequalities and promote human development. Education is at the heart of this transformation, with a focus on upskilling and investing in human capital, highlighting digital literacy and skills aligned with the demands of the 4IR. This foundational work in education is vital for fostering economic enterprise, active citizenship, social engagement, and innovation.

Impact of the COVID-19 Pandemic on digital readiness

The COVID-19 pandemic underscored the urgency of digital readiness, revealing both strengths and gaps in South Africa's digital landscape. It highlighted the importance of accurate digital data for public planning and the critical role of technology in delivering education in new and novel ways. Several examples were showcased where WhatsApp was used. However, it also exposed the digital divide, particularly in rural areas, townships, and informal settlements. These insights stress the need for robust, inclusive digital policies to bridge these gaps and enhance the overall educational landscape.

Strategic alignment of basic education

Bridging the digital divide and propelling South Africa towards its 4IR goals requires strategic alignment of basic education. Education plays a pivotal role in preparing a digitally savvy workforce capable of thriving in a technologically driven economy. This involves integrating futures into the curriculum to enhance 21st-century skills such as critical thinking, creativity, and digital literacy, ensuring educators are equipped to deliver this content effectively. Strategic foresight in education ensures that South Africa's workforce is not only technically proficient but also adaptable and innovative.

Investing in human capital for the digital era

Investing in human capital for the future requires improving access to quality education, fostering a culture of continuous learning, and creating opportunities for hands-on experience with emerging technologies. Developing future talent is essential for shaping South Africa's trajectory towards becoming a competitive player in the global digital economy. A focus on education, particularly in STEAME (Science, Technology, Engineering, Arts, Mathematics and Entrepreneurship), digital literacy, and aptitudes such as life-long learning, is crucial for nurturing a talent pipeline equipped with the necessary skills and knowledge.

Global drivers of futures research

Several drivers were identified that demonstrate the necessity for futures thinking and integration into basic education, including an aging population, shifting labour force participation, environmental sustainability, rapid urbanization, rising inequality, and technological advancements.

Status quo of futures in education

Futures thinking enables educational institutions to anticipate and navigate complex changes, ensuring resilience and relevance. From higher education institutions to basic education. The report examines these trends, proposing various scenarios for the future of education, such as extending formal education and digital learning environments, and transforming schools into collaborative learning hubs as well as leverage artificial intelligence in systems and in learning.

Strategic anticipation and policy making for education

The report reviews international examples around incorporating futures thinking to better basic education. It was found that several strategies exist that enhance learners' opportunities to thrive in a rapidly changing world. Strategic anticipation in policymaking allows for the creation of resilient education systems that are responsive to future uncertainties, where it was advised that a dedicated team or unit take the lead. Several strategies and associated operational actions are provided to the reader to make this practical.

Status quo of South African education system and socio-economic challenges

Youth unemployment is alarmingly high, particularly among black youth with many arguing that the quality of education for previously disadvantaged persons remains poor. This presents a significant challenge to the education system, which struggles to equip learners with the skills needed for the modern job market. We argue that addressing these disparities through futures thinking is essential to ensure equitable access to quality education and prepare learners for a digitally connected world. The report also underscores the importance of integrating futures thinking into educational planning to enhance the system's ability to adapt to changing circumstances. This aligns with The NDP reflecting a strategic intent to improve basic education and tertiary education participation rates towards enhanced socio-economic conditions in the country.

Futures Tools, methodologies, and frameworks

Futures Tools, methodologies, and frameworks are also provided in this report. These include digital learning platforms, AI-driven personalised learning systems, and virtual reality environments for immersive education. Aligning these tools and frameworks with the DBEs existing competency model can ensure a seamless integration of future-oriented skills.

Government and private sector

Government and private sector collaboration is crucial for addressing infrastructural gaps and enhancing futures literacy. Public-private partnerships, such as the Investec after-school tutoring system, play a vital role in ensuring all learners benefit from advancements in digital education. The Ed-Futures unit is dedicated to delivering research, advisory, and technical expertise to key stakeholders, fostering an environment conducive to innovation and resilience in the education sector and achieving futures potential.

Role of technologies in education

Integrating technology in education, particularly through AI and digital learning platforms, was found to be indispensable for addressing complex problems and enhancing educational opportunities. The report underscores the potential of technologies like mixed reality simulations and personalised learning to reform educational experiences, preparing learners for a digital future and supporting life-long learning. However, challenges such as technological proficiency, resistance to change, and ethical considerations must be managed carefully. To this end the report identifies and reviews key constraints, including resistance to technological change, policy misalignment, and varying teacher competencies.

Theory of Change (ToC) Framework

In pursuit of strengthening South Africa's education system for future demands, this study utilises a forward-looking approach centred around a Theory of Change (ToC). The ToC is a dynamic and iterative analytical process rooted in discussion-based exploration and learning, instrumental in shaping the design, strategy, implementation, evaluation, and impact assessment of futures research. From the ToC, policy & strategic considerations with associated operational recommendations for basic education are provided.

By adhering to these objectives, the NECT and Kagiso Trust aim to inspire actionable steps towards creating a more resilient, innovative, and future-ready education system in South Africa. This will enhance the quality of basic education and the effectiveness of school monitoring and support systems, ensuring all learners are prepared for the challenges and opportunities the future of work presents.

Section 2

Systematic Literature Review (SLR)

The term "futures", often referred to as strategic foresight, is an integral concept as it facilitates creating scenarios, or plausible alternatives to explore future contexts and take necessary actions (Yousefi Hamedani *et al.*, 2023).

As a skill it enriches strategic thinking and informs decisions, particularly under conditions of uncertainty, novelty, and ambiguity. Consequently, it has been applied in several projects. For example, a Norwegian project utilised futures to develop digitalisation in education, revealing immediate relevance during the COVID-19 pandemic (OECD, 2018). It has also been used locally by the South African Institute of International Affairs (SAIIA) to map green hydrogen energy and associated skills at a Technical Vocational Education and Training (TVET) level. Green hydrogen energy is an important emerging industry, identified through futures thinking as crucial for sustainable energy transition, and this shift has significant implications for the workforce, including the need for new skills and training programmes to support the green economy. This aligns with South Africa's energy roadmap, which emphasises the adoption of renewable energy sources and the development of a skilled workforce to meet the country's long-term energy and economic goals.

Futures research then, by challenging current assumptions, offers fresh perspectives on complex issues, such as those in the South African education context (Mkansi and Landman, 2021; Shay, 2017). This forward-looking approach enhances risk management by identifying future challenges and opportunities, enabling proactive strategies and the development of contingency plans. If advisory and key stakeholders could encourage this form of novel thinking, it can help enable innovative thinking for government, educators, and learners alike to stay ahead in changing markets (Mangnus *et al.*, 2021; National Planning Commission, 2020).

Let us consider an example.

Imagine a grade one learner from 2019 who is working hard, amidst economic downturn, geopolitical unrest, in an ever-digitised world to graduate high school as part of the class of 2030. Despite their hard work, this learner will likely enter a changed workplace, encountering roles that do not even exist yet.

Consequently, it is of paramount importance that educators and institutions embrace learning experiences that have links to training, advancing skills for a digital world and competencies applicable for the future of work (Bakhshi et al., 2017; Mbanda and Fourie, 2020; UNESCO, 2021), or "futures".

By fostering such innovative thinking, we can create an educational ecosystem that not only responds to current market dynamics but also proactively prepares the next generation, like the grade one learner of 2019, to thrive in a future filled with unprecedented opportunities and challenges (Bowden, 2021).

To guide stakeholders, futures research in education has seen significant research across the world. This is because it can help anticipate, envision, and plan for long-term challenges and opportunities that lie ahead for educational systems worldwide. The system encompasses basic education, tertiary education (higher education), and life-long learning avenues such as diplomas, micro-credentials, and short courses, to name a few.

Futures as a discipline is an interdisciplinary field, and integrates foresight, scenario planning, and strategic analysis to prepare educational institutions and those that support them for probable, possible, and preferable futures. The use of futures research varies across countries, reflecting differing educational needs, strategic priorities, and levels of investment in forward-looking initiatives (Benavides Rincón and Díaz-Domínguez, 2022; OECD, 2018; Pereira *et al.*, 2018). Developed countries are increasingly integrating futures and 21st-century skills into their systems to prepare learners for the complexities of the future of work (Slaughter, 2012).

This narrative is apparent in **Fig. 1**, as it demonstrates that scientific impact of research in this field is predominantly in developed regions. The grey areas on the map indicate regions with minimal to no research based on the corpus assessed. In contrast, light blue areas denote regions where futures research is a focus, with darker shades of blue highlighting areas with strong research activity. This visual representation helps identify key geographical zones of research intensity. By examining these focus areas and the methodologies employed in these well-researched countries, valuable insights can be garnered for integrating futures education across various nations, including South Africa.

For instance, countries like Finland in the European Union (EU) have been at the forefront of utilising futures research within their educational systems, emphasising a comprehensive skill sets that go beyond traditional academic learning, focusing on critical thinking, creativity, collaboration, and digital literacy (Sahlberg, 2015). These skills, as supported by several others are deemed essential for learners to thrive in our digitised world (Bakhshi *et al.*, 2017). Finland's approach emphasises teacher quality, a learner-centred learning environment, and a curriculum fostering broad competencies. While direct replication may not suit all socio-cultural contexts, these principles offer valuable insights for global educational reforms. Notably, existing research focuses on higher education institutions, highlighting their critical role in advancing futures research and education innovations. This underscores the importance of robust basic education systems, as they provide the foundational skills and knowledge necessary for learners to thrive in higher education.

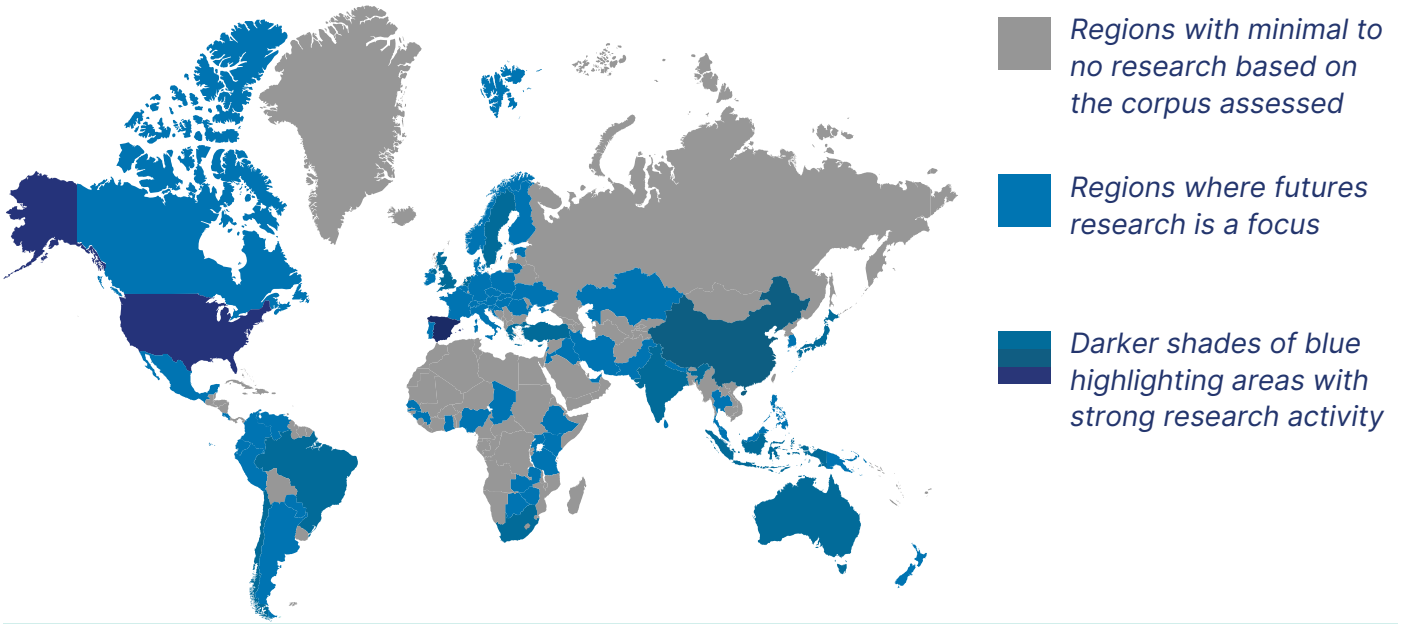


Figure 1: Countries scientific impact spread

Supporting global levels of research is the World Economic Forum (2023) that highlights several movements towards integrating futures thinking into education systems. This involves preparing learners for rapidly changing job markets and societal needs through the development of adaptable and versatile skill sets.

The emphasis is on critical thinking, problem-solving, and digital literacy, reflecting a shift from traditional educational outcomes towards more holistic and future-oriented competencies. The challenge remains to translate policy aspirations into concrete actions that operationalise the intention to promote such skills within the education sector (Murphy *et al.*, 2023).

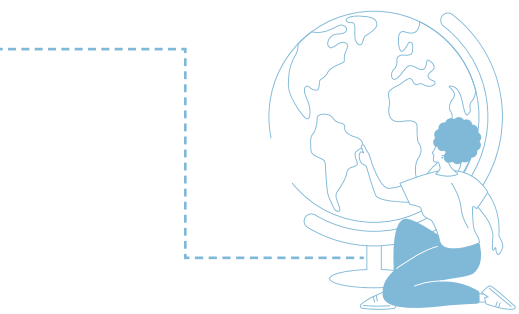
This is supported by Bakhshi *et al.* (2017), in a study entitled "*The Future of Skills: Employment in 2030*". The study offers an integrated analysis of what key global trends that have far-reaching implications for the future of work and skills development. These trends, while distinct, intersect in ways that shape the demands of the labour market, the nature of work, and the skills required for future educational needs from a global perspective.

Demographic Change

An aging population and shifts in labour force participation emphasise the growing need for policies boosting labour productivity and participation. Skills development initiatives will need to focus on lifelong learning to ensure that the aging workforce remains active and productive (OECD, 2018). Additionally, understanding the consumption and work behaviours of the youngest generation, Gen Alpha, who will enter the workforce in the next 4 to 10 years, is crucial for tailoring basic education and training programmes that match future job market needs. As the focus shifts from millennials and soon, Gen Z, to Gen Alpha, the rapid evolution within this environment necessitates a stronger emphasis on futures literacy. This includes accommodating those who choose to enter the workforce directly after school, start their own businesses, or pursue further education (Bakhshi *et al.*, 2017).

Environmental Sustainability

The consensus on climate change and the necessity for green technologies call for a workforce skilled in sustainable practices and innovations. Skills in renewable energy technologies, sustainable agriculture, and green finance will be in high demand (South African National Energy Association, 2023).



Education systems must integrate environmental literacy and sustainability-focused skills into curricula to prepare learners for green jobs and to innovate in sectors directly impacted by climate change (Bugallo-Rodríguez and Vega-Marcote, 2020; Stats SA, 2023). This effort needs to start at the basic education level, as early engagement with South African learners has revealed their understanding of the impact of sewage and clean water on their lives, and their proactive steps to address these issues. Integrating these themes into basic education could foster a generation that is not only aware of environmental challenges but also equipped to develop sustainable solutions.

Rapid Urbanisation

The growing concentration of populations in cities presents both opportunities and challenges. Skills related to urban planning, infrastructure development, and smart city technologies will become increasingly valuable (Martins *et al.*, 2023). Education and training programs should also address the health and social challenges of urban living, equipping individuals with the skills to innovate in knowledge-intensive industries and services that thrive in urban settings (Bakhshi *et al.*, 2017; UNESCO, 2021). To lay the groundwork for these advanced skills, basic education must introduce learners to key concepts. This early exposure will help learners understand the complexities of urban environments and prepare them to contribute to solving the associated challenges. Additionally, integrating lessons on the social and health impacts of urban and rural living into the curriculum can equip young learners with the knowledge to thrive in and improve various settings.

Increasing Inequality

With rising inequality and its impact on social cohesion and economic growth, there is a pressing need for skills that support social mobility and equitable development. Education systems must address the disparities in access to quality education to prevent further inequality, whilst considering ways to develop socially cohesive learners (Stats SA, 2023; The Guardian, 2017). This issue disproportionately affects different age groups, races, and genders, exacerbating existing inequalities and limiting opportunities for marginalised communities. To counteract these negative impacts, basic education could focus on equitable access, ensuring all learners receive quality education regardless of their background. By incorporating curricula that promote social justice, cultural competency, and empathy, schools can empower young learners to challenge and overcome societal inequalities.

Political Uncertainty

Geopolitical and policy uncertainty underscores the importance of skills in negotiation, conflict resolution, and understanding of global dynamics. Professionals equipped with the skills to navigate complex regulatory environments and respond flexibly to geopolitical challenges will be valuable in several sectors (Adamba, 2023). To build this foundation, basic education must begin instilling these critical skills early on. Introducing learners to concepts of global citizenship, cultural awareness, and effective communication can help them develop a nuanced understanding of international issues and the ability to manage conflicts constructively. This early preparation is essential to creating a workforce capable of addressing geopolitical challenges and contributing positively to various critical sectors.

Changing World of Work

The evolving work landscape is being reshaped by advances in technologies such as, but not limited to, artificial intelligence (AI), robotics, and machine learning, signalling a transformative shift in job structures and employment patterns. Repetitive tasks are increasingly automated, altering the nature of workplaces and redefining skill requirements for future professionals (Kruger and Steyn, 2020). With automation threatening traditional roles, new job categories and sectors are emerging, necessitating a re-evaluation of workforce readiness (Qiu *et al.*, 2021). For example, AI, through its capacity to mimic human-like functions such as speech recognition and decision-making, is pivotal in this transformation. It is projected to contribute significantly to global Gross Domestic Product (GDP) growth, with notable productivity enhancements and consumer demand stimulation (Park, 2017). However, the

impact of AI will vary across regions, with developed economies like China and North America seeing substantial gains, while emerging markets in Africa, Latin America, and Asia will experience modest growth (AFRICARENA, 2024; KnowledgeWorks, 2018).

Consequential to technological advancements, complex manual jobs, such as caregiving and personal services, remain resistant to automation due to their reliance on human interaction and social skills. Conversely, routine roles in industries like transportation and administration are rapidly being automated. Professional sectors, including education, law, and medicine, are expected to evolve rather than diminish, integrating new technologies to enhance service delivery (World Economic Forum, 2023b). Transitioning to this new world of work involves navigating challenges like job displacement due to automation, the rise of gig and platform economies, and the need for continuous skill adaptation (Užule *et al.*, 2021). Furthermore, the gig economy (while offering flexibility), also presents challenges of job insecurity and income disparity, underscoring the need for adaptable skillsets and robust social securities (Treasury and Schwab, 2018). The education system has traditionally focused on certain skills and competencies while neglecting others; however, to prepare for the imminent shifts driven by the youngest generation, Gen Alpha, and the rapid evolution of the job market, it is imperative to incorporate a broader range of aptitudes.

Interlinked Skills Development Needs

Across these trends, several cross-cutting skills and competencies emerge as crucial for the future of work and consequently, a need for change in the future of education:

Digital Literacy

As digital technology permeates all aspects of life and work, from green technologies to urban living and beyond, digital literacy becomes fundamental.

Critical Thinking and Problem-Solving

The complexity of global challenges, such as climate change, requires strong problem-solving skills and critical thinking.

Social and Emotional Aptitudes

Demographic shifts, increasing urbanisation, and inequality necessitate strong social and emotional competencies for effective communication, teamwork, and empathy towards diverse populations.

Adaptability and Lifelong Learning

The rapid pace of change across all these trends demands adaptability and a commitment to lifelong learning.

The global drivers and consequential interlinking skills are shown in **Fig. 2**, where the changing world of work necessitates a future education framework.

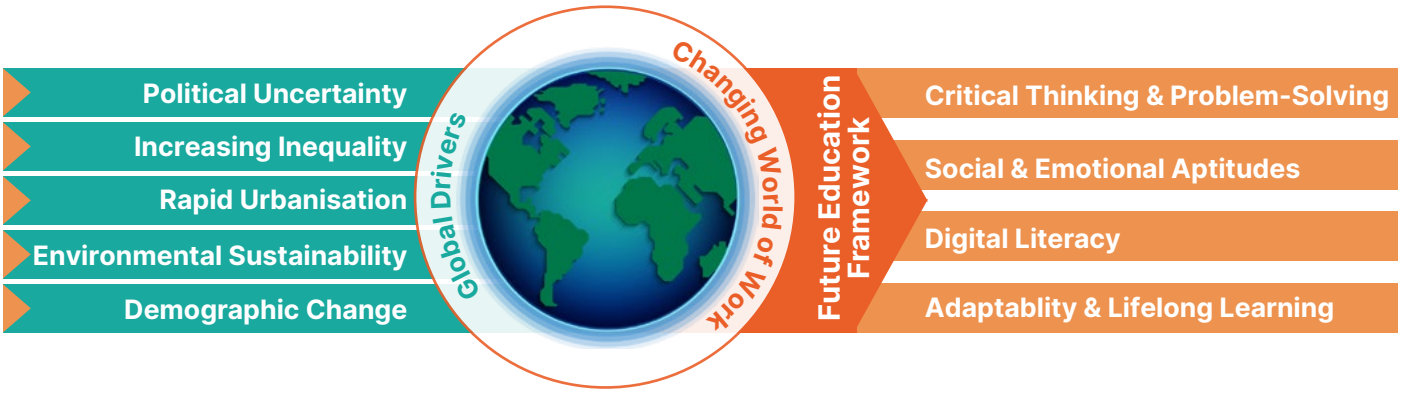


Figure 2: Global drivers necessitating a future ready educational framework

Status Quo of Futures in Education

Adaptive education systems are imperative in our evolving world. A report by UNESCO (2021) expands these needs, reviewing how the world is grappling with the paradoxes of economic growth against the backdrop of finite planetary resources. It also highlights disparities between affluence for some and well-being for many, rapid technological changes that may not address pressing social needs, and a paradoxical loneliness and voicelessness despite increased connectivity. This contrast calls for clear guidance in education to ensure it empowers individuals, especially the youth, to prepare them not only as professionals but as engaged citizens and fulfilled individuals (Gómez-García *et al.*, 2022; Papadakis, 2016).

It is here that futures thinking plays a critical role in education by enabling institutions, schools, and other stakeholders to anticipate and navigate complex changes, ensuring that the education systems are resilient, relevant, and capable of preparing learners for the uncertainties and opportunities of tomorrow. To this end, we review several key topical areas.

Strategic Anticipation and Policy Making for Education for Multiple Futures

Anticipating the future of education involves more than projecting current challenges into the future; it necessitates a proactive approach where future possibilities inform present decisions. This strategic foresight is crucial for education systems to remain relevant and effective in a rapidly changing global context (Martins *et al.*, 2023). It is about questioning how global trends will redefine education and what actions can be taken today to prepare for tomorrow's realities. This approach is encapsulated in the inquiry into how climate change, the digital revolution, and shifts in societal values will impact educational institutions, research, and societal integration in the coming decade (Bugallo-Rodríguez and Vega-Marcote, 2020; Stats SA, 2023).

Consequently, the future of education is not linear; it is subject to the complex interplay of continuing, emerging, and unforeseen trends (Yousefi Hamedani *et al.*, 2023). The publication introduces situations ranging from the expansion of formal education and digital learning environments ("Schooling Extended") to the diversification of education through outsourcing ("Education Outsourced"), to the transformation of schools into collaborative learning

hubs ("Schools as Learning Hubs"), and finally to a radical redefinition of learning in a digital age ("Learn-as-you-go"). These developments are not predictions but rather frameworks for imagining diverse educational futures, stimulating strategic reflection, and planning.

Many arguments conclude that the future of education is inherently uncertain, influenced by a myriad of evolving and emergent trends. Reports by Bakhshi *et al.* (2017), OECD (2022) and UNESCO (2021) underscores the importance of adaptable, strategic thinking in navigating this uncertainty. By engaging with these trends and scenarios, educators, policymakers, and stakeholders are better equipped to mould an education system that not only adapts to but also shapes the future.

Future Intersections of Economic Growth and Education

Economic growth is increasingly recognised as a pivotal driver for evolving skills needs, shaping educational objectives and methods. According to Cunningham *et al.* (2019), Égert *et al.* (2020) and World Economic Forum (2023a), this dynamic interaction suggests a future where education systems must adapt to meet the demands of a changing economic landscape. Guided by the OECD Scenarios for the Future of Schooling, there could be several changes. For example, the implementation of reforms such as the 24/7 Schools initiative demonstrates a dedication to ensuring that quality education is perpetually accessible, including access through mobile applications. This approach emphasises a commitment to round-the-clock learning opportunities, ensuring that learners can engage with educational content at any time (Hwang *et al.*, 2019; Wang *et al.*, 2021). This archetype underscores the role of digital technology in education, merging learning resources with cutting-edge delivery methodologies. In this context, educators are reimagined as architects of tailored learning journeys, with support from digital assistants and virtual learning environments (Hwang *et al.*, 2019). This scenario emphasises the necessity for digital literacy and technological competencies as indispensable for educators and learners alike, preparing them for a technologically driven economy. For instance, a study by the OECD, (2018) found that learners who use computers moderately in school perform better in digital reading than those who use computers rarely or extensively, suggesting a nuanced approach to digital education is most beneficial.

The progression towards home-based, AI-driven education models illustrates a future where education is profoundly personalised, and digital platforms dominate. Liu (2022) and Nieto-Márquez *et al.* (2020) notes that such a vision challenges traditional educational structures driving learning to digital platforms. Here, the economic valuation of education is intrinsically tied to its efficacy in delivering customised learning trajectories, dictated by market requisites. Consequential to this are several implications, such as:

Diversification of Teaching Roles and Environments

By 2044, an increase in the variety of teaching activities and profiles is anticipated, propelled by technological advancements, and shifting societal demands. This evolution may necessitate a reconceptualization of educational spaces and the educator's role.

Innovation in Learning Content

The expected integration of global competencies and climate change into educational curriculums represents a broad redefinition of essential knowledge and skills for future cohorts.

Evolution of Stakeholder Engagement

The transformation in the roles of governments, market dynamics, and civil society within the educational sector underscores the importance of inclusive and transparent decision-making processes. The geopolitical landscape could further impact the provision and accessibility of education, highlighting the necessity for flexible governance structures.

Although there is recontextualising and the use of AI to teach both teachers and learners, in South Africa, varying infrastructure support and prevalent fears limit access and uptake, despite the benefits. The recontextualization involves adapting basic educational content and delivery methods to incorporate AI tools, which can personalise learning experiences, provide real-time feedback, and support educators in curriculum development and classroom management. However, the disparity in infrastructure support, such as inconsistent internet access, lack of reliable electricity, and insufficient technological resources, poses significant challenges. These infrastructural limitations mean that while some schools and learners can fully benefit from AI-driven education, others are left behind, widening the educational gap.

Moreover, fears surrounding AI, including concerns about data privacy, job security for teachers, and the potential for reduced human interaction in learning environments, contribute to hesitation and resistance among educators, parents, and policymakers. These fears are compounded by a lack of comprehensive training for teachers to effectively integrate AI into their teaching practices, leading to underutilisation of available technologies.

Future educational models could address these dynamics by ensuring equitable access to necessary infrastructure, fostering trust, and understanding of AI through transparent practices, and providing robust training programs for educators. This involves not only investing in physical infrastructure but also creating policies and frameworks that support the ethical and effective use of AI in education. Additionally, guiding learners in their usage of AI tools is crucial, emphasising digital literacy, critical thinking, and the responsible use of technology to prepare them for a future where AI is an integral part of both their personal and professional lives.

As new patterns emerge and unforeseen economic demands occur, the adaptability of education systems to these changes will be critical, where work-life balance of learners is already being disrupted (Bakhshi *et al.*, 2017).

Work-Life Balance and Employment Dynamics

With changing economic conditions, the interplay between lifestyle, employment, and education is being significantly transformed (World Economic Forum, 2023a). The COVID-19 pandemic significantly influenced this, as we experienced the mass resignation phenomenon globally. This trend, often termed "The Great Resignation," involved a substantial number of employees voluntarily leaving their jobs. Many workers re-evaluated their work-life priorities during the pandemic, seeking more flexible and fulfilling employment opportunities. The desire for improved mental health, better working conditions, and the ability to work remotely has driven this shift. Consequently, organisations are compelled to rethink their employment practices to retain talent, focusing on flexibility, wellbeing, and work-life integration to meet the evolving expectations of the workforce. Consequently, some roles have seen a notable reduction in working hours over the last century, accentuating the global shift towards prioritising personal well-being alongside professional commitments. This global trend emphasises the need for education systems to prepare individuals for a life that harmoniously integrates work and personal time (Slaughter, 2012). Concurrently, the emergence of non-standard employment forms, such as temporary roles and digital freelancing, presents unique opportunities and challenges, including job insecurity and blurred boundaries between personal and professional spheres (Deloitte, 2020; World Economic Forum, 2019).

Digital technologies have significantly impacted personal life, encouraging self-monitoring and algorithm-driven interactions, which necessitates education fostering critical thinking and genuine engagement in a digitally quantified society (Nasiri *et al.*, 2020; OECD, 2022). Moreover, evolving family structures and caregiving roles reflect broader societal and economic shifts, calling for education policies that support these changes by promoting gender equality and community care. Yet, despite improvements in digital technology, personal safety and housing conditions, persistent inequalities underline the crucial role of education in ensuring a supportive environment for all learners, regardless of their background (Edoho, 2015). Looking forward, adapting to unforeseen shocks and trends requires agile and foresighted educational policies and practices to stay aligned with the evolving societal and employment landscapes (Mbanda and Fourie, 2020).

Educational policy and practice must develop adaptive systems responsive to the evolving dynamics of work and family life. This includes integrating skills that enhance adaptability, resilience, and well-being for both learners and educators.

Transformative Trends in Knowledge and Power | The Role of Education

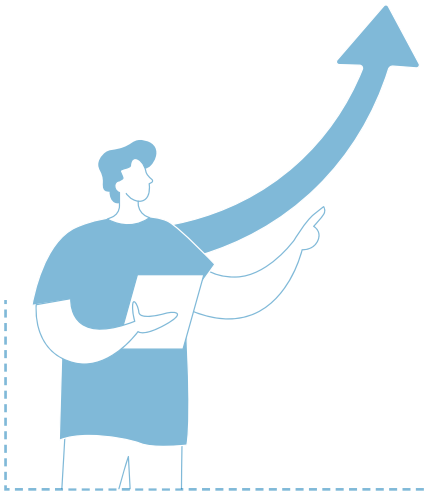
The proliferation of open knowledge sources coupled with the expansion of big data analytics marks a noteworthy shift in the acquisition and dissemination of knowledge (Sánchez-Prieto *et al.*, 2016). Education systems are now faced with the challenge of navigating these changes, tasked with ensuring equitable access to information and honing critical thinking skills necessary for analysing and interpreting data (Adu *et al.*, 2016). This trend underscores the increasing importance of fostering an analytical mindset in learners, preparing them for a data-driven world. Simultaneously, the integration of AI into educational settings is redefining the landscape of learning and administration. AI presents opportunities for creating more personalised learning experiences and streamlining administrative processes (Chiang *et al.*, 2023). However, this integration brings forth challenges in maintaining ethical standards and unbiased application of AI technologies. The balance between leveraging AI for educational advancement and addressing potential ethical dilemmas and privacy concerns is becoming a critical focus for the future direction of education. Moreover, the entrenchment of digital platforms and AI technologies

in education prompts a re-evaluation of power dynamics concerning knowledge creation, distribution, and access (Zhang *et al*., 2023). The roles of educators, the influence of technology companies, and the empowerment of learners are evolving, setting the stage for a future educational landscape that is both enriched and complicated by these shifts.

The changing nature of democracy, characterised by increased digital engagement, places education at the heart of preparing learners who are informed, engaged, and capable of participating in democratic processes. As noted by Mbanda and Fourie (2020), World Economic Forum (2023a) and Zhang *et al*. (2023), educational systems may find themselves adapting to enhanced understandings of digital citizenship and democratic participation, reflecting the growing interconnection between digital literacy and civic engagement. This would include anticipating developments like stateless digital citizenship, AI citizenship, the emergence of deepfakes, and digital conflict highlights the need for educational systems that are both resilient and adaptable, capable of addressing ethical, social, and technological challenges as they arise.

Summary

Futures research in education offers a powerful tool for anticipating and preparing for the evolving landscape of learning and teaching. Various pressing issues currently affect education, requiring futures thinking to navigate effectively. While its application and methodologies vary across different countries and education levels, the goal remains the same: to create resilient, adaptive educational systems capable of meeting the needs of future generations. Acknowledging the challenges these issues present, futures thinking can aid in addressing them and mapping strategic needs, ensuring that education systems remain relevant and effective. As this field continues to develop, its potential to enhance educational planning and policymaking around the world, including in South Africa, is urgent.



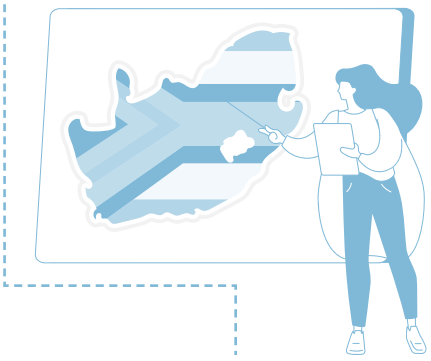
Further research and investment in futures thinking within the education sector could unlock significant improvements in educational outcomes and better prepare learners for the uncertainties of the future.

The Importance of Future-Aligned Educational Systems

Education systems, from basic to tertiary, face the dual challenge of adapting to the individualisation of identity while providing environments that nurture diverse identities and foster a sense of belonging (Plozer-Ngwato *et al.*, 2023).

The integration of digital technologies into identity formation necessitates educational guidance to ensure learners navigate these spaces ethically, highlighting the importance of digital literacy and critical thinking skills. Moreover, education plays a pivotal role in promoting inclusion and equity, fighting discrimination, and supporting universal human rights to ensure equitable learning opportunities for all (Gómez-García *et al.*, 2022; Liu, 2022). Exploring the future of education necessitates a broad toolkit that considers diverse futures, from the normalisation of non-human identities to technology-enhanced individual learning experiences. In so doing, we can fully understand the evolving role of education in supporting identity and belonging.

With anticipated shifts in globalisation, social diversity, and the blending of virtual and real-life identities, profound effects within the education landscape are expected. Therefore, education systems must be forward-thinking, creating environments that nurture not only individuals, but the collective cohort, enhancing their globally relevant and digital competencies (Yousefi Hamedani *et al.*, 2023). Globally, countries such as Finland, Singapore, and South Korea stand out for taking proactive approaches in this regard by incorporating futures research into educational planning and reform. Finland's innovative use of futures research in shaping its national curriculum and teacher training programs demonstrates its commitment to keeping education responsive to societal and economic changes (Niemi, 2021). For example, they used research in shaping its national curriculum and teacher training programs is evident in their adoption of the Delphi method for futures studies. The "Futuribles of Learning 2030" initiative, for example, gathered diverse perspectives on the future of education. It involved various panels of experts, including those directly involved in education and others from different societal sectors, to ensure a comprehensive view of future educational needs. The process facilitated ongoing dialogue and adjustment of the curriculum to reflect probable and preferred futures, demonstrating Finland's commitment to keeping education responsive to societal and economic changes (Airaksinen *et al.*, 2017). Singapore's Ministry of Education leverages futures thinking to remain at the forefront of global technological and workforce trends, embedding skills like digital literacy and critical thinking within its curriculum (Tay *et al.*, 2017). In South Korea, a strong emphasis on futures research underpins significant investments in educational technology and policy reforms aimed at boosting innovation and creativity among learners (Min, 2023).



However, in South Africa, significant disparities exist, particularly in rural communities where learners often lack access to the basic digital infrastructure needed to begin building a digital persona. Where access does exist, it is often limited, hindering the ability to fully integrate digital technologies into education. These limitations exacerbate existing inequalities and prevent many learners from developing essential digital literacy and critical thinking skills, crucial for navigating the modern world. This digital divide underscores the urgent need for futures thinking in education to address these challenges and map strategic needs effectively. By considering international examples of futures thinking, successful practices can be mapped into better education strategies that ensure all learners, regardless of their location or socio-economic status, have the opportunity to thrive in a digitally connected world. (Yousefi Hamedani *et al.*, 2023).

To do so, the study examined Multiple Country Publications (MCP). China leads, followed by Spain and then the USA. This ranking could be indicative of China's strategic emphasis on international collaboration and its global integration in the research community. China's leadership in MCP suggests its success in establishing partnerships and networks with researchers across different countries, possibly driven by its investment in global scientific initiatives and desire to enhance its international academic stature. Spain's prominent position in MCP highlights its active participation in international research collaborations, possibly supported by EU funding programs like Horizon 2020, which encourage cross-border research partnerships. The strong showing of the USA in MCP, while trailing behind China and Spain, might reflect its established role in global research networks, though it also suggests that American research has substantial international influence even if it's not leading in the number of collaborative publications. The MCP and Single Country Publications (SCP) distribution is shown in **Fig. 3**.

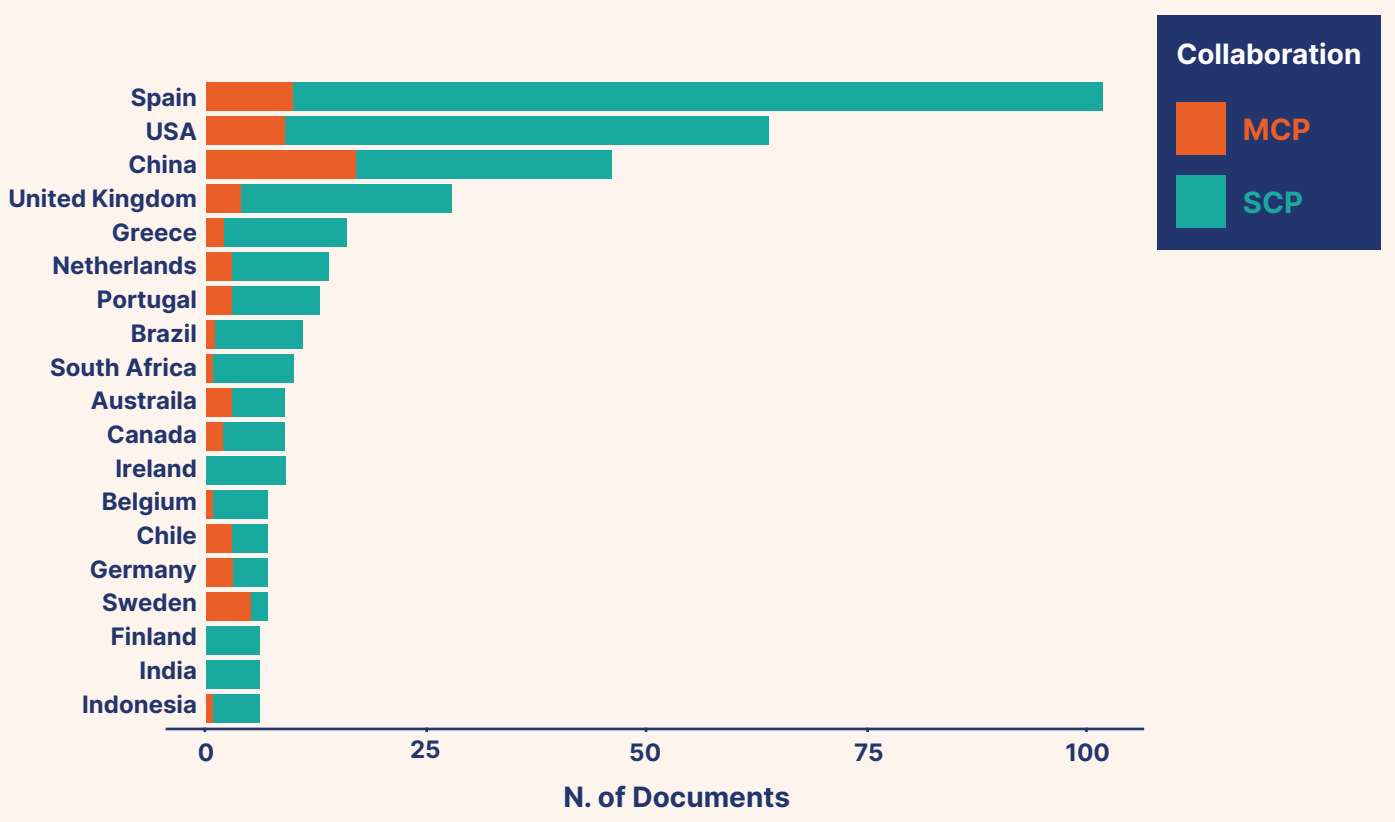
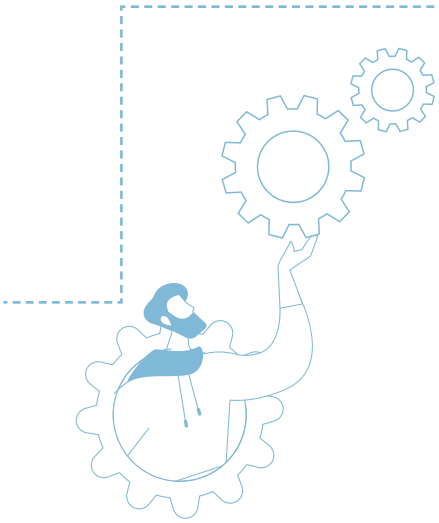


Figure 3: Countries publishing on futures based on impact (citations)

Within this scope, this is not to say South Africa is completely behind, sitting in ninth place. Although developed regions lead in the field of research, South Africa alongside a known collaborator Brazil is working towards futures thinking in education. This means that there are strategic elements of futures in the National Development Plan (NDP) and efforts towards Sustainable Development Goal (SDG 4).



Futures Education Alignment to SDG 4 and the NDP

Statistics SA (2023) alongside UNESCO (2023) notes that SDG 4 aims to ensure inclusive and equitable quality education for all, fostering lifelong learning opportunities. Its global indicators span various educational dimensions, including accessibility to primary and secondary education, early childhood development, participation in technical, vocational, and tertiary education, proficiency in literacy and numeracy, gender equality in education, and the provision of qualified teachers. Although it provides a comprehensive framework for enhancing educational quality and access worldwide, including South Africa, the current discourse around SDG 4 does not explicitly address "futures education" or the cultivation of skills tailored for emerging work opportunities.

The task, therefore, involves extending the scope of SDG 4 within South Africa to incorporate futures thinking and education, ensuring the development of skills that are pertinent to navigating future labour markets and societal shifts.

This extension is crucial for aligning educational policy and practice with both the aspirational goals of the SDGs and the practical, evolving needs of South African society. By undertaking a qualitative analysis grounded in a robust methodology, this research offers a roadmap for harmonising national and global development agendas.

Such alignment is instrumental in enhancing decision-making processes, identifying opportunities, and addressing potential risks within the education sector, thereby ensuring that South Africa's education system becomes more adaptive, innovative, and prepared for the demands of the future (Fourie, 2018).

Artificial Intelligence Education (AIEd)

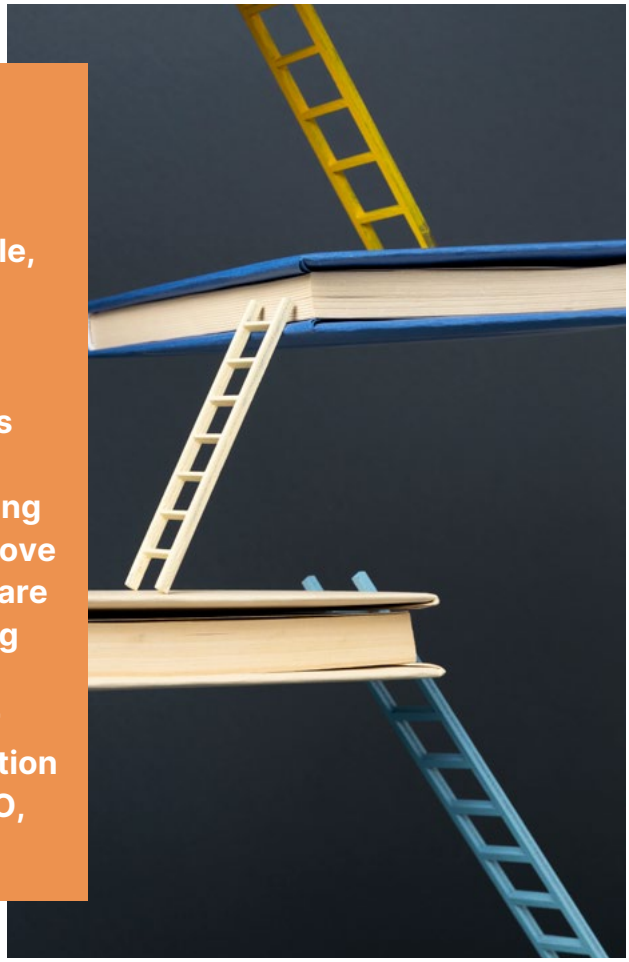
Artificial Intelligence in Education (AIEd) is transforming the landscape of learning by providing insights into the intricate processes of how education unfolds (Zhang *et al.*, 2023). AI employs a combination of world knowledge and sophisticated algorithms to intelligently manage data across three main models: pedagogical (teaching methods), domain (subject matter), and learner (learner interactions). These models use real-time data, such as current activities and emotional states, to assess learning outcomes, offering continuous feedback to enrich the educational experience. The potential of AIEd is vast, enhancing productivity and engagement in the educational sphere. It promises personalised learning experiences, with technologies like lifelong learning platforms, global classroom access, and individual virtual mentors (Holmes, 2024). Moreover, AI's capacity to analyse interaction data can pinpoint and address skill gaps, catering to the demands of the knowledge economy (Užule *et al.*, 2021).

AI's influence extends to reshaping traditional educational methodologies. Intelligent Tutor Systems (ITS), for example, can monitor learners' problem-solving processes, identify misconceptions, and tailor feedback and learning activities to promote independent learning skills. While the notion of humanoid robot teachers in classrooms may still be futuristic, AI's role in education is already reshaping how, where, and what learners learn (Holmes, 2024). Despite the transformative potential of AI in education, challenges persist. The integration of AI must be navigated carefully to complement, not replace, the human element in teaching. The focus should be on leveraging AI to enhance the effectiveness

and efficiency of educators, allowing them to devote more time to the critical aspects of teaching that require human empathy, judgment, and interaction (Zhang *et al.*, 2023). For basic education, AIEd could revolutionise learning by offering adaptive learning environments tailored to individual learner needs, thus democratising access to quality education. AI can facilitate early detection of learning difficulties, allowing for timely intervention to support learners' educational journeys (Kulikov and Shirokova, 2020; Piamsa-nga and Poovarawan, 2020). The use of AI in basic education should be strategic, aiming to support teachers and enrich the learning experience rather than displacing the essential human touch that is fundamental to nurturing young learners.

Need for Futures Research in South Africa

The primary motivation for futures research in South Africa stems from the need to address the systemic challenges noted and to ensure that the education system is resilient, adaptable, and capable of meeting the needs of all learners (Mkansi and Landman, 2021). Futures research can guide policymakers, educators, and stakeholders in making informed decisions that anticipate future trends in technology, demographics, and the global economy. By doing so, it aims to enhance educational equity, improve quality across all levels of education, and prepare learners for future careers in a rapidly changing world. Such research is crucial for identifying strategies to close the educational gap and for fostering an environment that nurtures innovation and critical thinking skills (Shay, 2017; UNESCO, 2023).



This research needs to be conducted in the context of other cascading issues such as climate change, particularly on agriculture and food security, as it offers a critical lens through which to understand future challenges and opportunities for the education system. Climate change is poised to significantly affect agricultural productivity and food security in South Africa, exacerbating existing vulnerabilities. The country is experiencing more extreme weather events, including prolonged droughts and heatwaves, which negatively impact water availability and crop yields. These environmental changes, in turn, threaten food security and livelihoods, especially for smallholder and subsistence farmers who lack the resources to adapt effectively (Magwentshu *et al.*, 2019; Manyika *et al.*, 2018).

In the context of education, the cascading effects of these agricultural and food security challenges could be profound. Schools in rural and agricultural-dependent areas may face increased pressure as communities grapple with food scarcity and economic instability. Learners' nutrition and health, crucial for effective

learning, could be compromised, impacting attendance and academic performance. Moreover, the future workforce will need to be equipped with skills to adapt to these changing realities, underscoring the need for an education system that is responsive to the multifaceted challenges posed by climate change (Kamilaris *et al*., 2017; Manyika *et al*., 2017). To future-proof education against such scenarios, it is imperative to integrate climate change education, sustainable agricultural practices, and food security considerations into the curriculum. This will not only raise awareness among learners but also prepare them with the knowledge and skills to innovate and adapt in a climate-affected future. Furthermore, building resilient educational infrastructure and support systems that can withstand environmental stresses will be crucial in ensuring continuous access to education during adverse conditions (El Hilali and El Manouar, 2019; Stats SA, 2023; Walter *et al*., 2017).

Furthermore, according to Stats SA (2023), Southern Africa is increasingly recognised as a climate change 'hot spot', facing escalating temperatures, droughts, floods, and erratic weather patterns. Over the past sixty years, South Africa has witnessed substantial climatic shifts, with changing climate zones, deteriorating ecosystems, and landscapes due to fires, droughts, and heatwaves. These changes have led to natural disasters, the spread of diseases, and issues of food and water insecurity, undermining livelihoods. Environmental migration, driven by factors like the severe droughts of 2015–2016 and ecosystem service losses, has led to significant internal and regional displacement. Notably, in 2017, around 15,000 South Africans were internally displaced due to disasters, with weather-related displacements in sub-Saharan Africa reaching millions in subsequent years. These environmental challenges also impact agricultural productivity and food security, intensifying vulnerabilities. The increased frequency of extreme weather events, such as prolonged droughts and heatwaves, adversely affects water availability and crop yields. This situation poses a risk to food security and the livelihoods of smallholder and subsistence farmers who struggle to adapt.

The repercussions for the education sector are significant, with rural and agricultural-dependent communities facing heightened pressures. Food scarcity and economic instability can affect learner nutrition and health, impacting educational outcomes (Walter *et al*., 2017).

The evolving landscape necessitates an education system that can adapt to climate change challenges, emphasising the integration of climate education, sustainable practices, and food security into the curriculum. This approach will prepare learners to navigate and address the complexities of a climate-impacted future, underscoring the need for resilient educational infrastructure and support systems (Aznar-Díaz *et al*., 2019; Bugallo-Rodríguez and Vega-Marcote, 2020).

The quality of school education for black people is considered poor (National Science and Technology Forum (NSTF), 2022:6). Moreover, 81% of South African Grade 4 children were not able to reach the lowest benchmark in terms of literacy (Department of Basic Education, 2022).

A total of 44% of South African Grade 6 children were able to reach the "Low Benchmark". Moreover, according to Stats SA (2023), less than 33% of young South Africans feel equipped with necessary skills for the workforce, casting doubt on the efficacy of the education system's preparation for the professional realm. Finland's future-ready education system, noted for equipping learners with relevant modern workplace skills, contrasts sharply with South Africa's situation, where only 9.7% are enrolled in Technical Vocational Education and Training (TVET) colleges, compared to Finland's 55.1%.

Despite shifting dynamics shown in **Fig. 1**, educational curricula are struggling to adapt to new realities. With Africa's youthful demographic poised to expand, the urgency to reform education and skills development becomes critical to avert potential socio-political instability and to promote productivity and innovation-driven growth. Despite this, South Africa's educational trajectory shows a worrying trend of under preparedness among school leavers, with a significant portion not achieving basic competencies in key subjects like Mathematics and Physical Science (Department of Basic Education, 2023; Stats SA, 2021; UNESCO, 2023). The National Development Plan (2030) and the White Paper for Post School Education and Training (PSET) outline ambitious targets to enhance TVET college and community college enrolments, improve higher education participation rates, and increase the qualifications of academic staff and PhD graduates. These goals reflect a strategic intent to enhance the education and training landscape, aiming for a substantial uplift in quality and accessibility to meet the demands of the future workforce.

South African Landscape

The NDP commission identifies two critical and interconnected challenges in South Africa: the inadequacy of the workforce and the substandard quality of education, both of which exacerbate socio-economic disparities.

This linkage is underscored by the Gini Index, a measure of income inequality, reflecting how educational inequities contribute to socio-economic stratification.

In tackling these challenges, future-oriented education in basic schooling plays a pivotal role. By prioritising quality education, especially in underserved communities, South Africa can mitigate the Gini Index's impact by fostering equal access to opportunities. Investing in education not only empowers individuals with skills essential for employment but also cultivates a more equitable society by narrowing socio-economic gaps. The landscape itself is reviewed in **Fig. 4**.

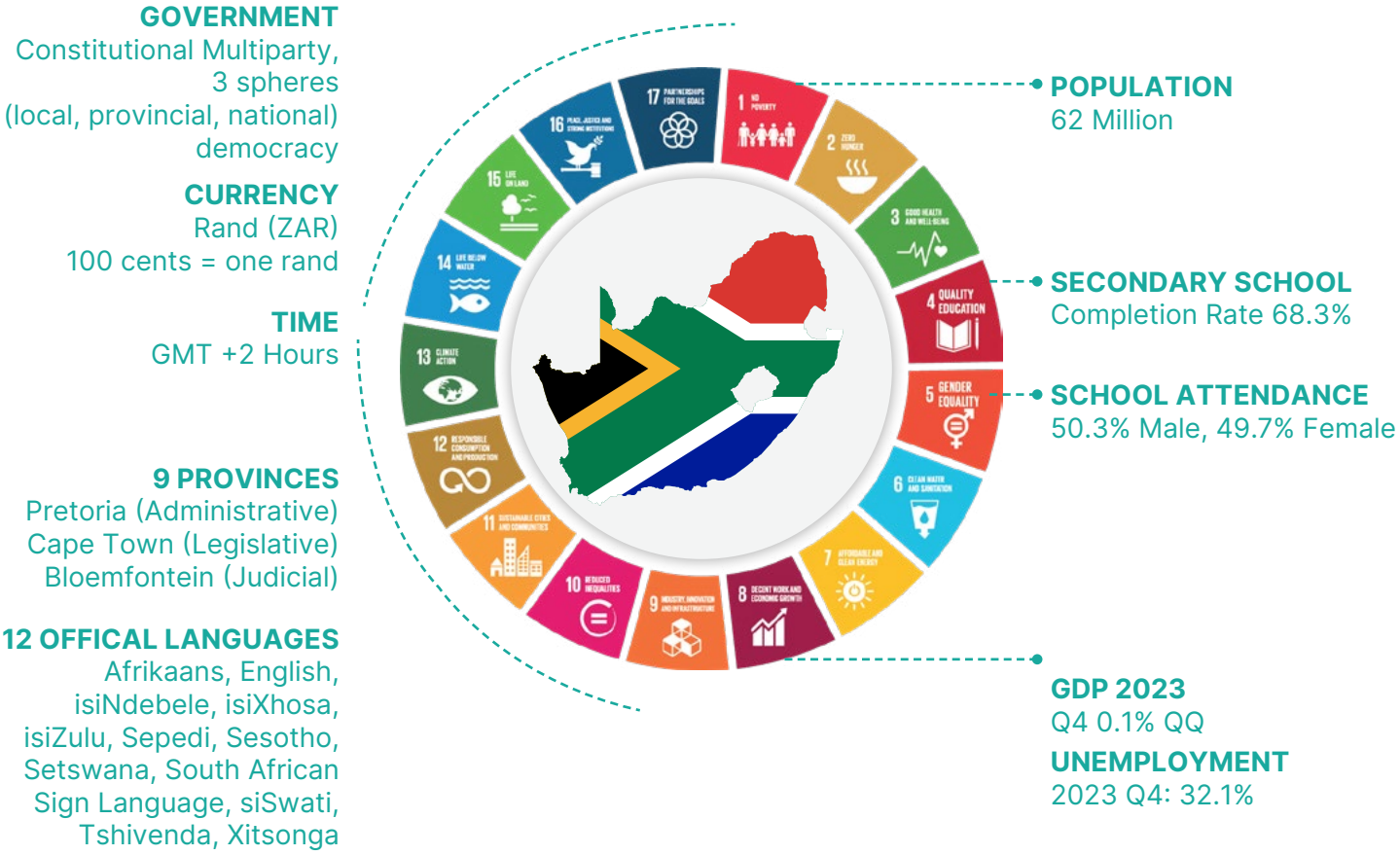
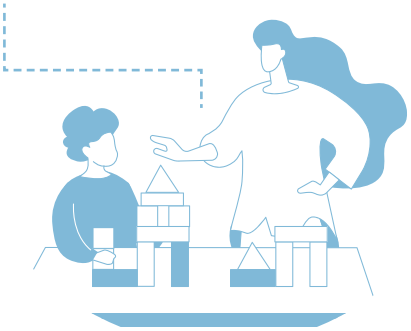


Figure 4: Overview of South African landscape

Basic Education Landscape

The landscape of basic education in South Africa has been characterised by significant advancements and challenges, notably influenced by the COVID-19 pandemic. Early Childhood Development (ECD) programmes, essential for foundational learning, saw an increase in participation from 63% in 2010 to 73.5% in 2019 among 0–4-year-olds, before experiencing a sharp decline to 56% in 2020 due to the pandemic, partially recovering to 64.1% in 2021 (Department of Basic Education, 2022). Despite the disruptions, primary education maintained a high Age-Specific Enrolment Rate (ASER) of over 99% since 2010, demonstrating strong access to education for children aged 7 to 13 years. Compulsory education for the 7 to 15 age group also showcased near-universal attendance, with rates consistently over 98% since 2009, indicating substantial success in ensuring basic educational access across different demographics.

Secondary education participation has been stable around 90% since 2010, with a slight increase to 91% in 2019, illustrating considerable engagement among the 14 to 18 age group. However, the pandemic's impact was most acute in the early years, with significant drops in ECD attendance, highlighting the vulnerability of foundational learning phases to disruptions. The resilience of primary and secondary education participation rates amidst the pandemic underscores a strong foundation in basic education, yet the initial setback in ECD programmes calls for focused recovery efforts to support the youngest learners. This balance of progress and setbacks encapsulates the current state of basic education in South Africa, driving home the importance of sustaining achievements and addressing vulnerabilities exposed by the pandemic (Department of Basic Education, 2023).



Rapid Digital Transformation and Need for Basic Educational Reform

***"The current education and skills base of the country continues to reflect extreme inequality particularly for those at the intersection of various forms of historical and traditional discrimination and marginalisation. A recent study on AI at global level found that 'there is a diversity crisis in the AI sector across gender and race', which is unlikely to be any different for South Africa if not addressed."* (National Planning Commission, 2020:102)**

South Africa's journey towards embracing the Fourth Industrial Revolution (4IR) and enhancing digital readiness is pivotal for its success. This foundation is essential for fostering economic enterprise, active citizenship, social engagement, and innovation. However, as the nation seeks to realise this digital vision, a broader, inclusive, and equitable digital policy is imperative to address existing inequality and promote human development as central pillars of digital transformation (Kindei *et al.*, 2022). At the heart of this transformation is education (Mkansi and Landman, 2021). Consequently, the South African education system is undergoing significant changes, with growing recognition of the importance of futures research in navigating the complexities of 21st-century education (Department of Basic Education, 2019). While various curricula have been implemented in basic education, potentially leading to "reform fatigue," it is crucial to infuse certain 21st-century skills into the curriculum regardless of the specific framework adopted. Compared to global benchmarks, the integration of futures research into South Africa's educational planning and policy-making processes is still developing (van Laar *et al.*, 2017).

The COVID-19 pandemic furthered underscored the urgency of digital readiness, revealing both the strengths and gaps in South Africa's digital landscape (Deloitte, 2020; Schalk *et al.*, 2022). The pandemic highlighted the importance of accurate, demand-side digital data for public planning and the critical role of technology in managing public health crises. Yet, it also exposed the digital divide, with significant portions of the population facing barriers to access and use of digital technologies, particularly in rural areas, townships, and informal settlements (Safonov *et al.*, 2022).

Central to bridging this divide and propelling South Africa towards its 4IR goals is the strategic alignment of basic education (Barbosa *et al.*, 2022).

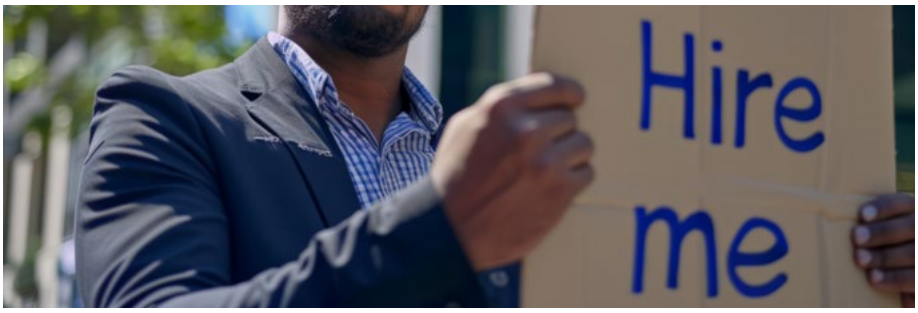
Education plays a pivotal role in preparing a digitally savvy workforce capable of thriving in a dynamic and technologically driven economy. The focus must shift towards upskilling and investing in human capital, emphasising digital literacy and skills that align with the demands of the 4IR (Kruger and Steyn, 2022). This involves not only revamping the curriculum to include 21st-century skills such as critical thinking, creativity, and digital literacy but also ensuring that educators are equipped to deliver this content effectively.

Investing in human capital for the digital era requires a multi-faceted approach. It involves improving access to quality education, fostering a culture of continuous learning and adaptation, and creating opportunities for hands-on experience with emerging technologies. The goal is to cultivate a workforce that is not only technically proficient but also adaptable and innovative, capable of driving economic growth and contributing to societal well-being. Developing future talent is essential for shaping South Africa's trajectory towards becoming a competitive player in the global digital economy. A focus on education, particularly in the realms of STEM (Science, Technology, Engineering, and Mathematics), digital literacy, and soft skills, is crucial (Vossen *et al.*, 2023). By nurturing a talent pipeline equipped with the necessary skills and knowledge, South Africa can leverage the potential of the 4IR to drive sustainable development, enhance social inclusion, and reduce inequality (Kamaruzaman *et al.*, 2021).

The motivation for developing future talent in South Africa lies in the transformative power of education and skill development to unlock economic opportunities, foster innovation, and contribute to a more equitable society. As the nation navigates the challenges and opportunities of the digital age, investing in human capital becomes not just a strategic imperative but a necessity for securing a prosperous and inclusive future (National Planning Commission, 2020).

Socio-Economic Challenges in South Africa

South Africa's socio-economic landscape presents a complex picture when examining its recent and historical economic performance and job creation statistics. The economy has experienced fluctuations, with growth rates hovering around 2% and witnessing occasional downturns over the past two years. Forecasts within the current policy framework only predict a modest uptick in growth to a maximum of 3.5%. Considering the job creation rate has maintained an average of 270,000 to 300,000 jobs annually over the past five years, compared with roughly 700,000 young individuals entering the job market each year, the imbalance between job availability and demand is pronounced. The Centre for Economic Development and Transformation indicates that achieving full economic integration of these newcomers would require an annual growth rate of around 10%, a figure starkly at odds with the 2.1% growth projected for 2021. This scenario underlines the profound socio-economic challenges impacting South



Africa's educational sphere. Stats SA highlights how poverty, inequality, and unemployment significantly influence educational outcomes and access, issues that global education futures initiatives often overlook due to a lack of consideration for South Africa's unique socio-economic conditions. The variance in educational quality and accessibility across regions further impedes the straightforward application of generalised futures research findings. For futures research to effectively contribute to South Africa, it must intricately understand and address the nation's specific socio-economic hurdles and prospects (Stats SA, 2023).

Years into the implementation of the NDP 2030, South Africa continues to confront entrenched socio-economic difficulties, with its economic advancement trailing behind other emerging countries. The National Planning Commission (2020) reports a significant slowdown in the economy since the Plan's inception, falling short of the ambitious goal to slash the unemployment rate from 27% in 2011 to 14% by 2020, and ultimately to 6% by 2030. Contrarily, unemployment surged to over 30% in 2020, peaking at 34.9% by 2021, thereby stalling progress towards realising the NDP 2030's principal ambitions. This context necessitates a re-evaluation of strategies and policies to align more closely with the realities of South Africa's socio-economic environment, emphasising the critical need for innovative solutions to overcome these pervasive challenges.

Youth Unemployment and Job loss

***"South Africa will have over 14 million young people for the next 20 years. This presents an opportunity, but unemployment remains high and is currently 65% for black youth".* (National Planning Commission, 2012:12)**

Youth unemployment in South Africa stands among the highest worldwide, posing significant challenges to the education system's capacity to ready learners not only for the dynamic labour market, but the evolving economic landscape. To tackle this issue effectively, futures research in education needs to pivot towards ensuring educational outcomes are in sync with the job market's evolving demands, Even more challenging, futures research needs to develop youth who can create future market opportunities themselves as entrepreneurs, innovators, and globally relevant start-ups. This necessitates a keen focus on skills development, vocational training, and entrepreneurship education. Crafting solutions to youth unemployment entails more than just curriculum reform; it involves establishing continuous learning and skill enhancement channels to equip young South Africans for success in a fluctuating global economy (National Planning Commission, 2020).

Considering this, the critical necessity for digital inclusion and fostering a digital-ready economy becomes apparent.

For South Africa to cultivate a digitally inclusive society conducive to economic expansion and job creation, several key conditions must be met. These include:

- improving connectivity
- implementing effective regulations
- ensuring market functionality
- enhancing consumer welfare
- rectifying educational system deficiencies, and
- developing a digital skill set aligned with the new economy's requirements.

These efforts align to the nation's sustainable development plan.

Infrastructure

In the region there is notable progress in adopting renewable energy sources, enhancing access to clean water and sanitation, and achieving reductions in CO2 emissions. Yet, challenges persist in ensuring the availability of green spaces and cultural heritage sites, improving the quality of life for urban dwellers, and fostering sustainable development. Moreover, sustainable management of ocean resources, navigating developmental trade-offs, resolving competing interests, and the lack of effective coordination and integration of ecosystem and biodiversity considerations into national planning continue to impede sustainable development efforts in the country (Castañeda-Garza and Valerio-Ureña, 2023; South African National Energy Association, 2023).

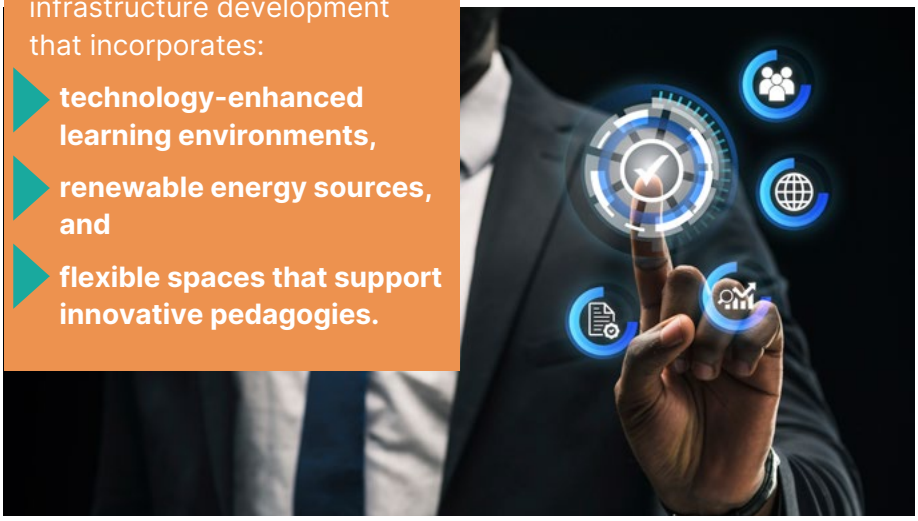
Many schools, particularly in rural areas, lack basic facilities, adequate technology, and resources necessary for 21st-century education. In the KwaDukuza municipality of South Africa, 12.8% of the population lives in informal settlements, equating to approximately 11,674 people in precarious conditions. The municipality faces significant service delivery backlogs due to urban overcrowding, exacerbated by rural-urban migration. The influx of migrants, often unskilled or with minimal education, struggles with unemployment, sometimes resorting to criminal activities. This migration stresses municipal resources, leading to environmental and health hazards (Statistics South Africa, 2021).

It is not all negative though; consider the need for new forms of power, where a small percentage has support to change over during load shedding should a future fit digital perspective be taken. In South Africa, the increase in independent power production, particularly through solar

energy, reflects a potential for schools and other institutions to not only power themselves but also contribute to the national grid. Following energy sector liberalization in July 2022, businesses, including potentially educational institutions like Curro, have greater freedom to generate their own power without requiring a license for systems of any size, which could enable schools to become power producers. This shift is driven by the need to alleviate the strain on the national grid and reduce dependence on the troubled state utility, Eskom. The concept of schools as power producers aligns with the broader trend towards decentralised power generation and the use of renewable energy sources in the country (South African National Energy Association, 2023). The status of energy distribution across the 9 provinces is shown in **Table 1**.

Futures in this regard can aid in planning for sustainable infrastructure development that incorporates:

- **technology-enhanced learning environments,**
- **renewable energy sources, and**
- **flexible spaces that support innovative pedagogies.**



Addressing infrastructure challenges through futures research can significantly improve access to quality education across the country (Poli, 2021).

Table 1: *Energy distribution amongst schools across provinces*

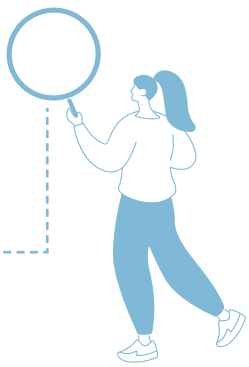
Province	Number of Site	Without Electricity	With Electricity Supply	Generator	Solar	Grid Connection
EC	5,046	0	5,046	231	590	4,441
FS	945	0	945	24	5	945
GP	2,066	0	2,066	2	6	2,064
KZN	5,797	0	5,797	51	440	5,068
LP	3,649	0	3,649	97	227	3,470
MP	1,649	0	1,649	156	1	1,614
NC	545	0	545	11	12	525
NW	1,448	0	1,448	59	2	1,421
WC	1,452	0	1,452	4	2	1,452
National	**22,597**	**0**	**22,597**	**635**	**1,285**	**17,887**

Access to toilets and basic sanitation is universally acknowledged as a fundamental human right, essential not only for individual health and well-being but also as a foundation for broader socio-economic development and future thinking. The provision of adequate sanitation facilities is intrinsically linked to numerous benefits, including enhanced public health, improved educational outcomes, increased economic productivity, and environmental protection. Consequently, disease outbreaks alongside inadequate sanitation in schools underscores the critical need for proactive health and safety planning. In South Africa, the state of sanitation varies, as can be seen in **Table 2**.

Table 2: *Sanitation status based on toilet distribution in schools across provinces*

Province	Site Pit	Enviro Loo	VIP	Flush Toilet (Septic Tank)	Flush Toilet (Municipal)	Mobile Toilet	Chemical Toilet	Without Facilities
EC	5,046	841	151	3,029	262	1,087	8	13
FS	945	6	11	116	111	733	4	0
GP	2,066	0	10	10	142	1,883	99	0
KZN	5,797	535	194	2,525	616	1,573	74	6
LP	3,649	1	982	1,306	1,558	693	403	3
MP	1,649	46	556	588	789	667	3	0
NC	545	5	68	58	197	307	2	0
NW	1,448	517	45	316	859	697	7	7
WC	1,452	0	0	2	239	1,387	3	0
National	**22,597**	**3,932**	**2,341**	**8,202**	**3,908**	**17,887**	**200**	**29**

Foresight in identifying potential sanitation failures and related health risks allows for timely interventions and infrastructure improvements, ensuring a healthier school environment and mitigating the risk of disease outbreaks (Department of Basic Education, 2023).



Educators

Educator development is essential for the successful implementation of futures research in education. Teachers need ongoing professional development and support to adapt to new pedagogies, integrate technology into their teaching, and respond to the changing needs of their learners (Niemi, 2021). Futures research can inform the design of teacher training programmes, focusing on building skills in critical thinking, adaptability, and innovative teaching methods. However, feedback from focus sessions with teachers, as well as insights from the literature, highlight a prevalent issue of training fatigue. Therefore, it is essential that these programmes are designed with an awareness of this challenge, ensuring that training is engaging, relevant, and mindful of teachers' existing workloads (Department of Basic Education, 2022).

The COVID-19 Pandemic

The COVID-19 pandemic had widespread impacts in South Africa, disrupting societal and economic structures. Following the first confirmed case in March 2020, the government enforced strict lockdown measures and launched a substantial US$26 billion stimulus package, with a portion directed towards social assistance (Department of Basic Education, 2022). These actions, however, led to constrained mobility, job losses, income reduction, business shutdowns, supply chain interruptions, heightened food insecurity, and health challenges.

The pandemic then, exacerbated existing inequalities, hitting the poor, unemployed, informal sector workers, and women the hardest. Since then, the crisis has deepened unemployment and hindered economic progress, exacerbating the existing inequalities within the nation. According to The World Bank (2020), South Africa is identified as one of the countries with the highest inequality levels worldwide, a condition detailed by the International Monetary Fund (IMF) (2023) which highlights the stark income disparity: the top 20% of earners capture 68% of the income, while the bottom 40% holds only 7%. This growing inequality gap signals a critical need for innovative measures to meet the NDP 2030's ambition of reducing inequality and fostering a more equitable society (Department of Basic Education, 2023).

The COVID-19 pandemic also disrupted the education sector, challenging its resilience and highlighting the vulnerability of traditional learning models to global crises. Before the pandemic, South Africa's education system showed positive trends, with high school attendance rates and improvements in literacy and numeracy. However, the pandemic significantly altered the educational landscape, leading to lost instructional time, adjusted school schedules, and complex dynamics in learner enrolment and attendance patterns. The impact varied across different age groups, with a notable increase in education participation among 16-18-year-olds and stability in the 8-15 age group, but a significant decrease in early childhood development (ECD) engagement among 4-7-year-olds. This shift suggests changes in ECD and school entry patterns, rather than mere dropout rates. Examination out-comes like the National Senior Certificate (NSC) showed both declines and increases, indicating nuanced effects of the pandemic, possibly influenced by more lenient grade repetition policies.

Overall, the COVID-19 pandemic exposed vulnerabilities in South Africa's basic education system, particularly in the crucial early childhood development programs. However, this crisis also spurred innovation, with the rise of mobile communication platforms like WhatsApp enabling the dissemination of educational materials and fostering communication across various stakeholders.

Looking forward, by acknowledging these vulnerabilities and the demonstrated capacity for change and resilience, we can build an even stronger education system. This includes harnessing the potential of technology while prioritising initiatives to bolster ECD programs and ensure a seamless learning journey for all South African children. At the heart of which is futures thinking (Chigova, 2021).

Migrants

In the dynamic socio-economic landscape of South Africa, the phenomenon of international migration brings to the fore a blend of opportunities and challenges, especially concerning the labour market and educational frameworks. The significant increase in border crossings, from 5.1 million in 1996 to 7.5 million, signals a surge in tourism and potentially a rise in migration flows. Current estimates place the foreign population in South Africa at approximately 1.6 to 2 million people, with Zimbabweans constituting the largest migrant group (National Planning Commission, 2022).

This changing demographic landscape necessitates a strategic reassessment of South Africa's approach to education and workforce development. The anticipated impact of migrants on the future labour market and the sectors they may populate calls for an innovative educational curriculum and vocational training programs. Migrants, particularly young individuals, women, and those displaced by environmental changes, add layers of complexity to the labour market. Their presence underscores the imperative for an education system attuned to the evolving skills and competencies required in a shifting economic milieu. Moreover, migration trends shed light on the relationship between job creation and mobility within South Africa's provinces. Notably, Gauteng and the Western Cape have seen population increases due to internal migration and natural growth, whereas the Eastern Cape and Limpopo have experienced net losses. These movements are indicative of underlying economic prospects and challenges, influencing the demand for education and workforce skills development.

Current Status of Futures Education in South Africa

Globally, education futures research is gaining traction, with many countries incorporating futuristic studies into their education systems to better prepare for impending changes. In South Africa, there is a budding interest in adopting futures research methodologies to enhance educational planning and policy.

Focus areas for futures research within the South African context include:

- disaster management
- curriculum reform
- teacher development
- infrastructure improvement, and
- innovative pedagogies

These focus areas are crucial for creating a resilient education system that can adapt to both current and future challenges. However, the lack of comprehensive futures research in South Africa's basic education could have long-term implications, potentially exacerbating existing disparities in access to quality education and hindering the country's ability to prepare learners for future labour market needs.

Futures | Tools, Methodologies, and Frameworks

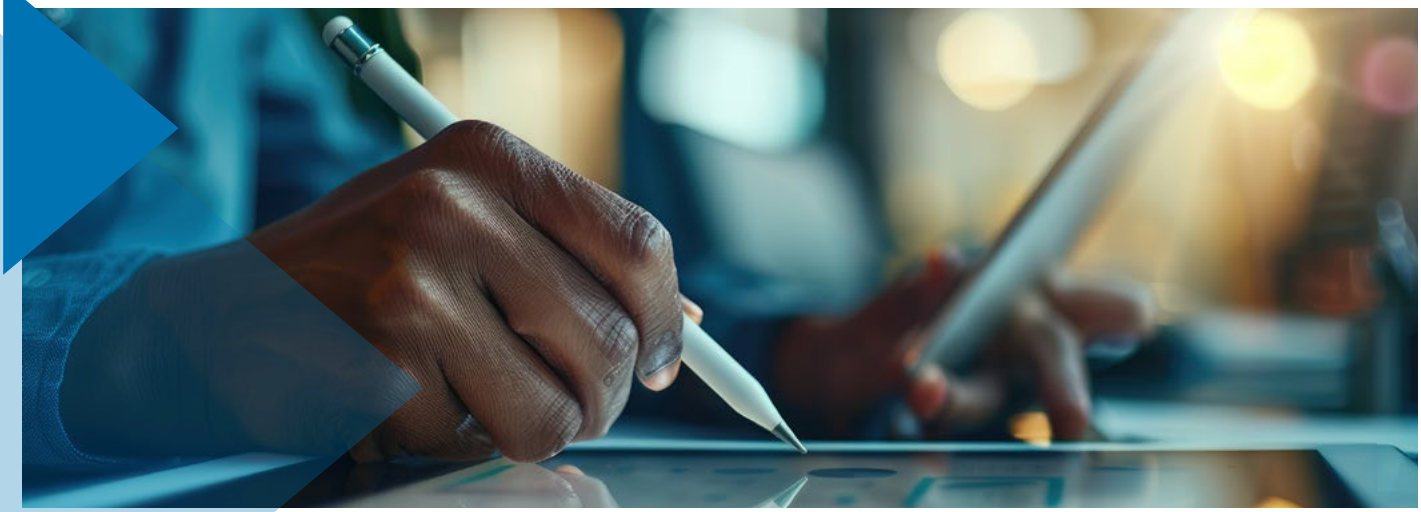
Globally, initiatives related to education futures often lack a detailed examination of their implications on basic education (Honorato-Errázuriz and Ramírez-Montoya, 2020), especially in contexts like South Africa (Department of Basic Education, 2022). However, by drawing lessons from countries that have successfully integrated future-oriented skills into their education systems as shown in **Fig. 1** and **3**, there is an opportunity to tailor these tools and methodologies to fit local contexts and needs. It involves not only adopting innovative educational strategies but also ensuring that these strategies are adaptable to the specific cultural, economic, and social landscape of South Africa to prepare education systems for imminent transformations and to explore education's potential to positively influence these global trends. **Table 3** provides a succinct overview of current tools used in futures from a global perspective.

***Table 3**: Overview of tools used in developing future insights*

Tool	Source	Description
Foresight Modelling Software (STELLA, Vensim)	System Dynamics Society	Software for system dynamics modelling to understand and predict changes in complex systems.
Scenario Planning Tools (Morphological Analysis)	Scenario Thinking	Tools for developing and analysing multiple future scenarios for strategic planning.
Trend Analysis Software (Google Trends)	Google	Platforms for identifying emerging trends impacting various fields, including education.
Data Analytics and Visualisation Tools (Tableau, Power BI)	Tableau; Microsoft	Software for analysing data, identifying patterns, and visualising future outcomes in education.
Educational Simulation Models (Minecraft: Education Edition)	Minecraft Education	Game-based platforms for engaging learners and exploring complex subjects.
Conceptual Framework for Futures Thinking in Science Education	Jones *et al.*, 2012	Framework supporting teachers in fostering learners' futures thinking through current understanding, trend analysis, and exploring futures.
Futures Education (FE) Tools	Bateman, Gidley, & Smith, 2006	Tools like timelines and futures wheels for enhancing critical and creative futures thinking.
Systems Thinking and Metagame Analysis	Schlange, 1995	Framework combining systems thinking with metagame analysis for strategic decision-making.
Exploratory, Predictive, and Normative Methods	Schuck *et al.*, 2018	Methods including scenario building and Delphi panels for researching educational futures.
Cross-Impact and Causal-Layered Analysis	Siraj, 2017	Methods for forecasting and analysing the consequences of actions in education planning.
Futures Methodologies in Teacher Education	Schuck *et al.*, 2018	Uses futures tools for critiquing and investigating change drivers in education.
Abduction-Based Futures Research	Patokorpi & Ahvenainen, 2009	Method proceeding from imaginary future states to alternative frameworks.
Environmental Foresight and Futures Research	Bengston, Kubik, & Bishop, 2012	Methods for exploring futures to increase adaptive capacity in environmental fields.
Futures Research Methods in Natural Resources	Bengston, 2019	Framework categorising futures research methods applicable to environmental issues.
Incorporating Futures Research into Regional Knowledge Creation	Uotila, Melkas, & Harmaakorpi, 2005	Combines futures methods with knowledge management for regional development.
Classification of Future-Related Methods	Poli, 2018	Proposes a typology for organising futures methods.
Frontiers of Futures Research	Gordon, Glenn, & Jakil, 2005	Integrates technology with futures research methods to enhance the field.
Futures Education as Temporal Conscientisation	Ramos, 2005	Discusses futures education's potential for democratically oriented consciousness.

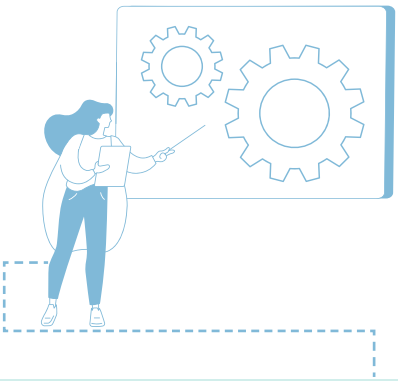
Assessing the various tools, there are several that can be utilised by the DBE. To influence policy, and educate the sector on foresight, the following can provide insightful outputs for strategic thinking at policy level.

Scenario Planning (Morphological Analysis)	This tool facilitates the development and analysis of multiple future scenarios, crucial for strategic planning at a policy level. An example is the **Mont Fleur Scenario Exercise (1991)**, which brought together diverse stakeholders to explore potential post-Apartheid futures for South Africa. Scenario planning helps anticipate different futures and guide policy formulation, ensuring the education sector remains resilient and adaptable to change.
Trend Analysis Software (Google Trends)	Google Trends and similar platforms are valuable for identifying and analysing emerging trends that impact education and other fields. These insights can inform policymakers and stakeholders about shifts in societal, technological, and economic landscapes, aiding in the development of forward-looking policies. The **CSIR** (Council for Scientific and Industrial Research) Futures Unit in South Africa leverages such tools to explore trends specific to the country's context.
Data Analytics and Visualisation Tools (Tableau, Power BI)	Tools like Tableau and Power BI enable the analysis of complex data sets and the visualisation of potential future outcomes. They can provide a solid evidence base for policy decisions, helping to illustrate and communicate complex scenarios and trends in an accessible way. University-based Futures Thinking Programs in South Africa, like those offered by Stellenbosch Business School, equip learners with these tools specifically applied to the South African context.
Cross-Impact and Causal-Layered Analysis (Siraj, 2017)	These methods are crucial for understanding the broader implications of policies and actions in the education sector. They facilitate a deeper analysis of potential futures, allowing for more nuanced strategic planning and policy development.
Futures Education as Temporal Conscientisation	This approach combines systems thinking with strategic decision-making. It can help policymakers and education leaders understand the interconnections within the education system and the potential ripple effects of their decisions, while considering the specific historical and social context within which they operate.



Organisational frameworks

In the rapidly evolving landscape of global business, multinational corporations (MNCs) are increasingly seeking innovative organisational frameworks that enable them to navigate complexities, anticipate future challenges, and leverage emerging opportunities. Organisational frameworks offer MNCs a strategic lens through which to view the future, enabling them to align their operations with anticipated industry trends and emerging global challenges. By embracing these methodologies, organisations, and by extension the Ed-futures unit, can enhance their strategic planning, innovation capabilities, and global competitiveness, positioning themselves as leaders in the future of their industries.



Systems Thinking and Metagame Analysis, as outlined by Schlange (1995), presents a holistic framework that delves into socio-political mechanisms and conflict resolution processes. This approach is instrumental for MNCs dealing with intricate global issues, offering a structured methodology for strategic decision support and the development of effective communication strategies. By understanding the interconnectedness of various elements within and outside the organisation, MNCs can better anticipate potential conflicts and align their strategies, accordingly, ensuring more cohesive and adaptive operations worldwide.

(Patokorpi and Ahvenainen, 2009) introduced **Abduction-Based Futures Research** as a method that transitions from fixed, imaginary future states to dynamic, open-ended theoretical frameworks. This approach is particularly valuable for MNCs operating in fast-paced environments, as it encourages the exploration of innovative solutions and strategic pathways that go beyond traditional logical reasoning. By adopting abduction-based thinking, organisations can uncover unique insights and foster a culture of creativity and flexibility, positioning themselves effectively for future success.

Technology Futures Analysis (TFA), as described by Porter (2004), encompasses a comprehensive set of methods including technology intelligence, forecasting, road mapping, assessment, and foresight. This multifaceted approach is essential for MNCs focused on navigating technological advancements and managing investments in emerging technologies. TFA facilitates informed decision-making regarding technology management and policy, helping organisations stay ahead of technological shifts and maintain a competitive edge in their respective industries.

Corporate Foresight in Emerging Markets by Alsan (2008) emphasises the importance of implementing corporate foresight processes within the regional subsidiaries of MNCs operating in emerging markets. This methodology is crucial for adapting to local contexts and customising foresight practices to regional peculiarities. By addressing challenges such as altering mental models about the future, MNCs can harness regional insights for global strategic planning, ensuring that their operations are both locally relevant and globally integrated.

Futures Research in Regional Knowledge Creation and Management by Uotila *et al*. (2005) advocate for the integration of futures research methods into the management of regional knowledge creation and innovation networks. This approach underlines the significance of developing regional visionary capabilities, enabling MNCs to stimulate innovation and strategic planning at the regional level. By fostering strong regional innovation networks, organisations can secure a sustainable competitive advantage, ensuring agility and responsiveness in diverse markets.

A competency framework is a structured tool defining the essential skills, knowledge, behaviours, and attributes necessary for effective performance in various roles. It serves two main purposes: aligning individual capabilities with an organisation's strategic goals and providing benchmarks for performance evaluation (Department of Basic Education, 2019; Nkrumah and Sinha, 2020). In the context of futures and Education 4.0, competency frameworks are vital for preparing individuals for rapidly evolving job markets. They categorise competencies into cross-functional (like critical thinking and teamwork) and subject-specific (such as technical skills), ensuring holistic development (Falloon, 2020).

As noted, there are strong focal points in developed regions that use futures thinking. To this end, the European Commission (2020) developed competency frameworks to provide structured approaches for developing, assessing, and certifying key futures orientated competences. These competences, designed to prepare individuals for success in a dynamic world, encompass literacy, multilingualism, mathematical and scientific reasoning, digital literacy, personal and social abilities, citizenship, entrepreneurship, and cultural awareness. For example, the LifeComp framework, devised by the Joint Research Centre of the European Commission (2020), focuses on personal, social, and learning-to-learn skills. It outlines nine competencies, each with three descriptors, essential for thriving in the 21st century. These competencies, applicable across formal, informal, and non-formal educational settings, include self-regulation, flexibility, well-being, empathy, effective communication, collaboration, growth mindset, critical thinking, and managing learning.

LifeComp serves as a versatile tool for curriculum development, personal growth, and fostering essential life skills, supporting individuals in adapting to the evolving global landscape. Its flexibility allows it to be used for self-assessment, organisational training needs, and informing policy decisions related to education and lifelong learning. The overview of the framework is shown in **Fig. 5**.

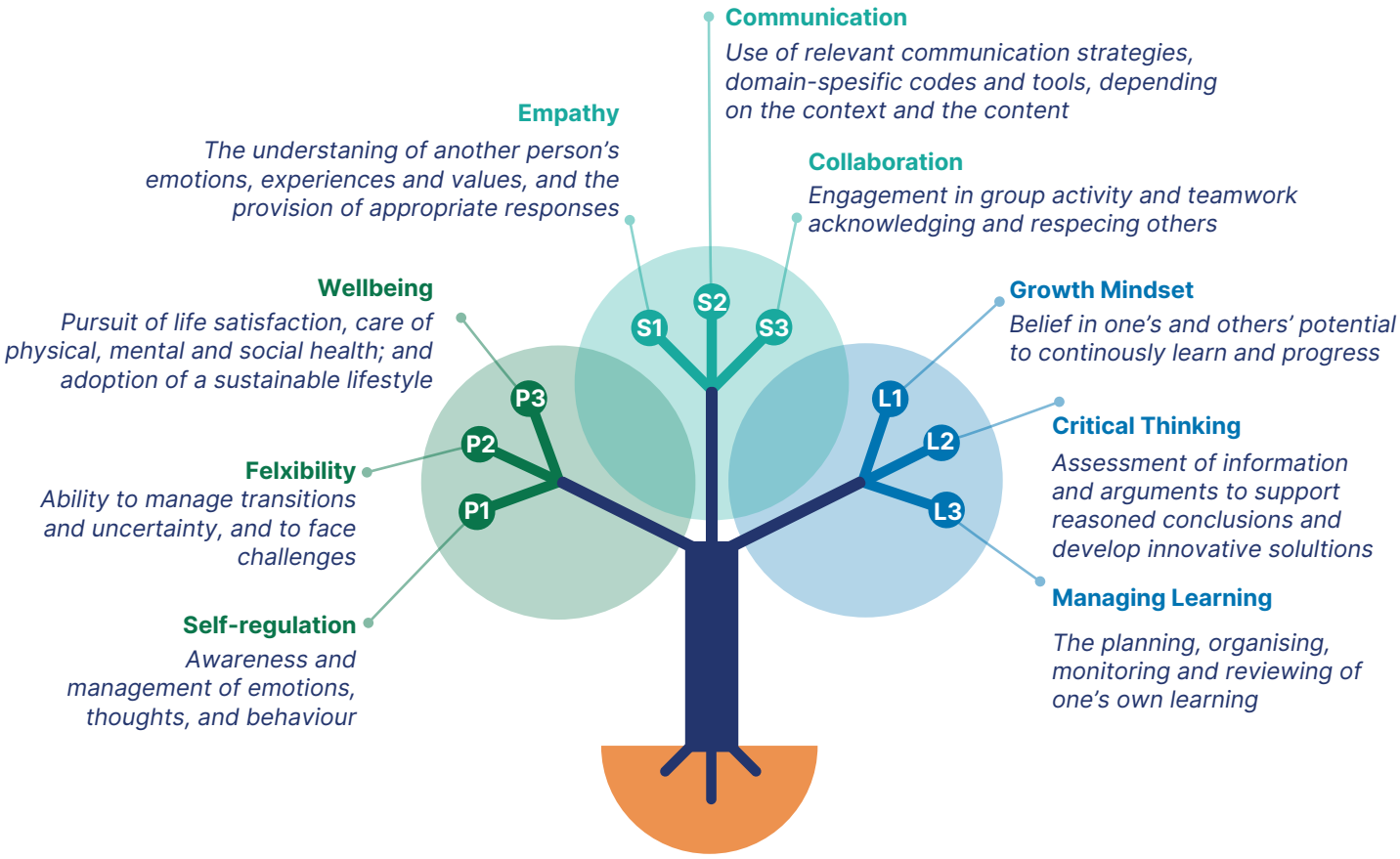


Figure 5: LifeComp framework

The EntreComp framework, shown in **Fig. 6**, created by the European Commission's (2019) Joint Research Centre, is designed to foster entrepreneurship skills, crucial for driving economic growth and personal fulfilment. It defines fifteen competencies within three main areas: 'Ideas and Opportunities', 'Resources', and 'Into Action'. These areas cover skills from identifying and acting on opportunities to managing resources and executing plans. It emphasises the progressive development of entrepreneurial skills, from basic to advanced levels, supporting individuals in navigating the complexities of the modern economy and facilitating sustainable economic progress.

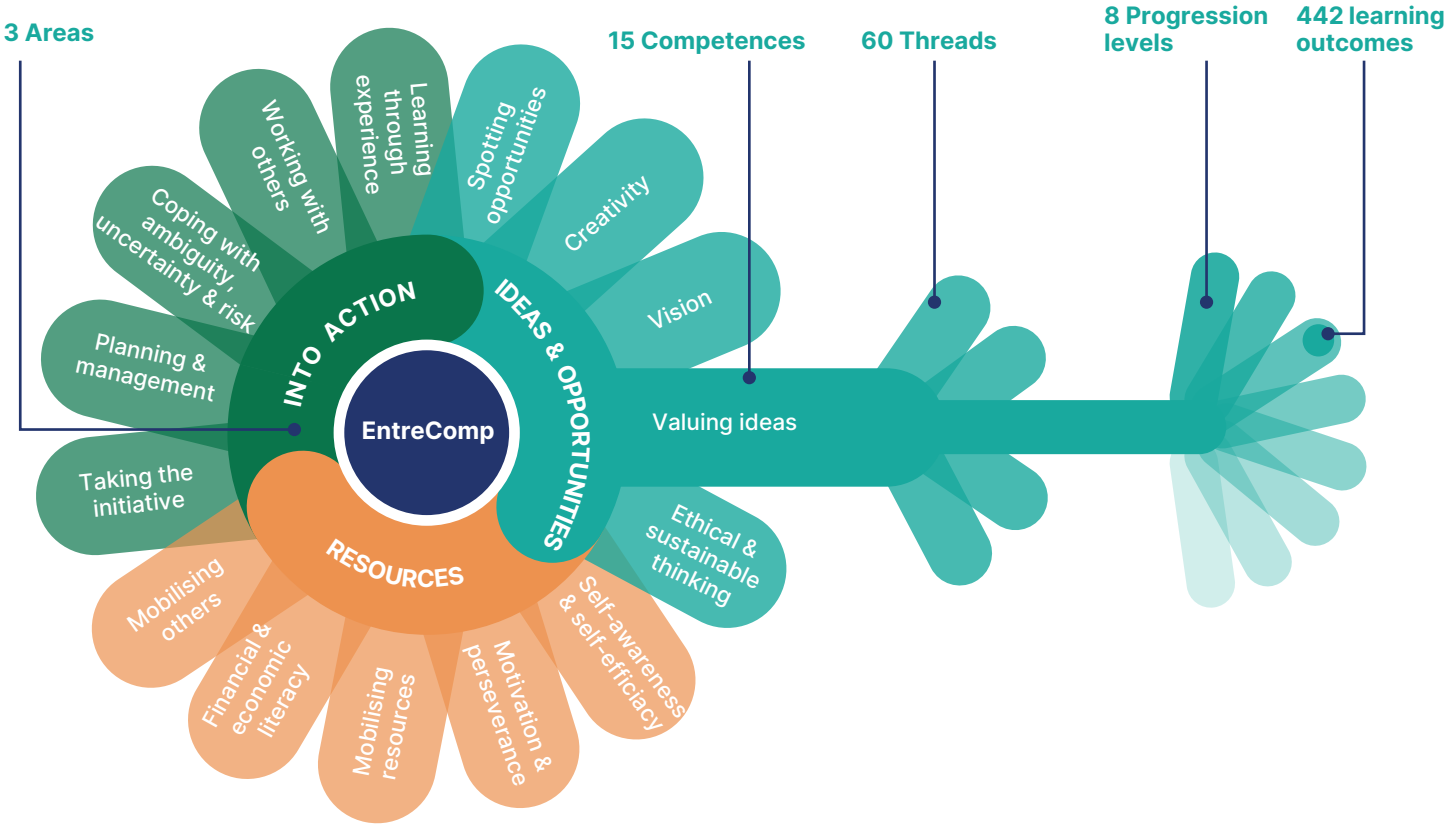


Figure 6: DigiComp framework

Through this framework, entrepreneurship is positioned as a dynamic force for innovation, adaptability, and societal well-being.

Finally, the DigiCompEdu framework, shown in **Fig.7**, is a comprehensive model that defines the digital competencies required for educators. It includes six areas: Professional Engagement, which emphasises digital collaboration and reflective practice; Digital Resources, focusing on the effective use of digital materials; Teaching and Learning, which involves the implementation of digital strategies to enhance learner engagement; Assessment, covering the use of digital tools for evaluative purposes; Empowering Learners, aimed at nurturing digital creativity and innovation; and Facilitating Learners' Digital Competence, which encourages the development of safe and effective digital skills among learners. This framework equips educators with the necessary skills to effectively integrate digital technologies into their teaching practices, ensuring they can navigate and enhance the learning experience in a digital-centric educational setting (European Commission, 2017).

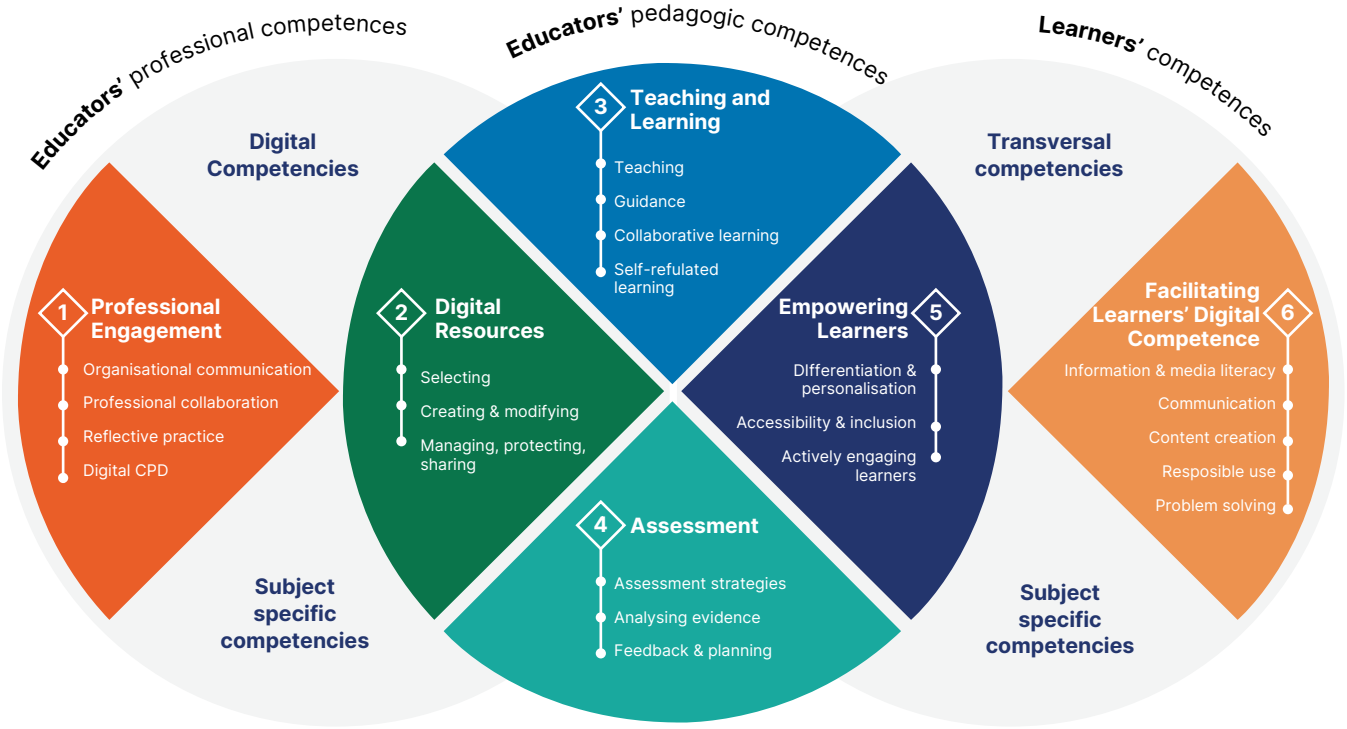
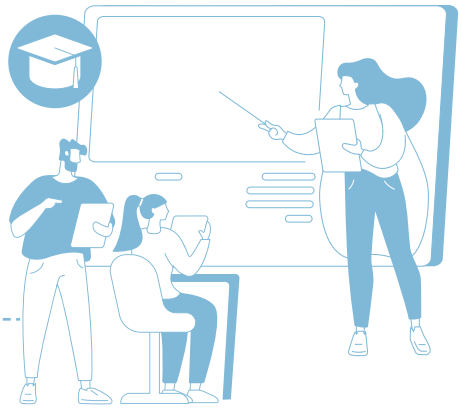


Figure 7: DigiCompEdu framework



A South African Basic Education Framework

In a move towards the future, the DBE has unveiled a competency framework that shifts the focus from rote memorisation to the development of essential 21st-century skills. Although the term "futures-oriented" is not explicitly used, the framework's core principles align closely with this concept, as seen in similar European examples. This approach aims to prepare learners and the education system to thrive in an unpredictable future.

The framework prioritises the cultivation of well-rounded individuals equipped with critical tools for success in the 21st century. It aims to go beyond knowledge acquisition by fostering critical thinking, collaboration, and adaptability to new challenges. These transferable skills empower learners to excel not only in the present but also to adjust and thrive amidst unforeseen circumstances. Envision a network of learners capable of analysing information, solving problems collaboratively, and readily adapting their skillsets – this is the potential that the framework seeks to unlock.

Furthermore, the framework recognises the importance of character and values. By nurturing resilience and fostering ethical decision-making through core values, it empowers learners to become not only successful individuals but also responsible and engaged citizens. This holistic approach ensures that learners contribute meaningfully to building a brighter future.

In essence, the DBE's Competency Framework shown in **Fig. 8** provides a benchmark that aligns with EU examples, highlighting its potential to prepare a generation of learners equipped to navigate and shape the future.

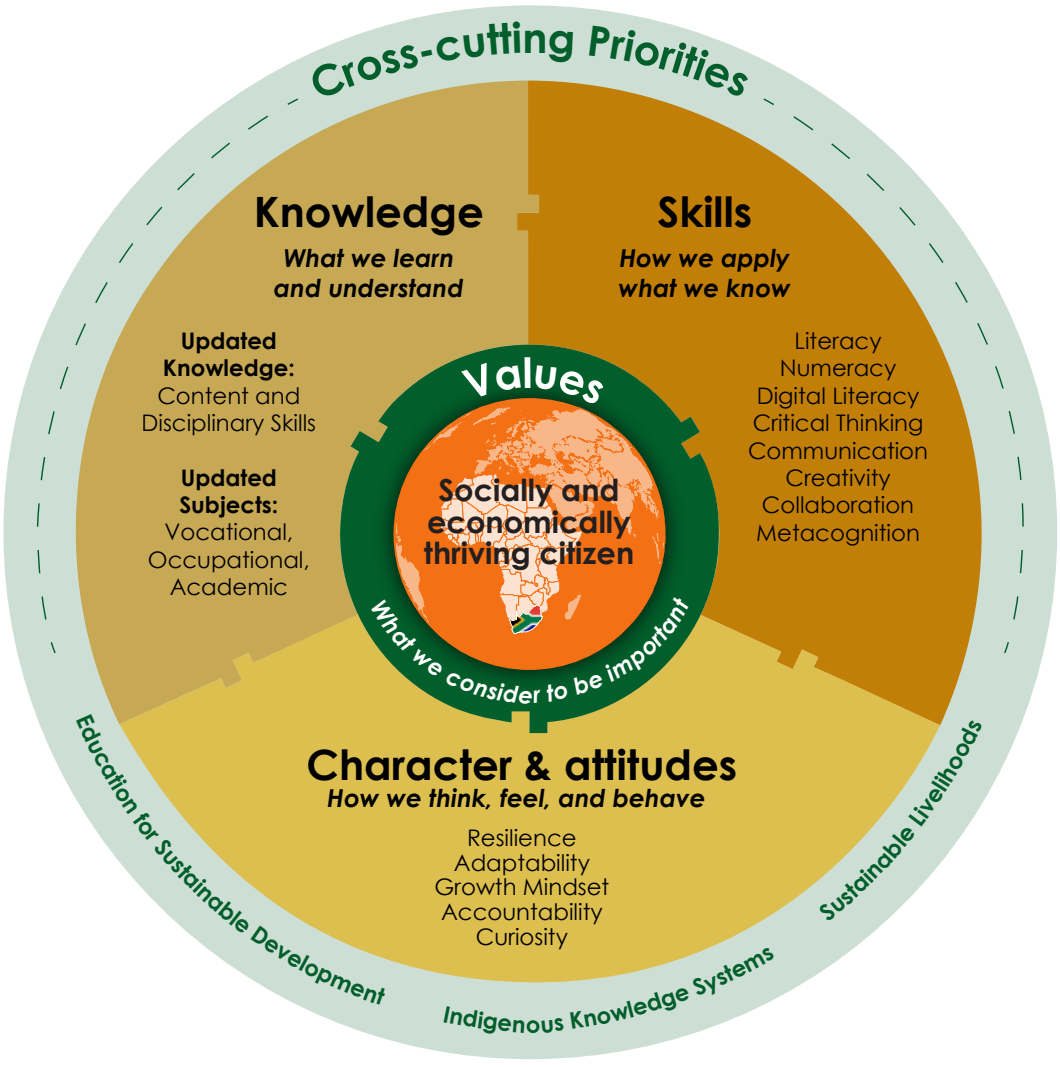


Figure 8: DBE 21st-century competency framework

Section 3

Research Report Contextualising Future Fit Programs in Africa

"Having a relatively young and healthy population can help countries achieve strong economic growth – but many more people, especially the youth, have to be employed for South Africa to reap the benefits". **(National Planning Commission, 2012:16)**

Aligning with the literature, this research, following the methodology in Annexure A, several stakeholders were engaged with to further insights around futures in education, noting critical gaps, successes, alignment to the NDP and needed action towards enabling youth to engage in the future of work. Several perspectives were noted and are covered in detail below.

Government Involvement

In discussions with key stakeholders, it was evident that the South African government has limited experience and understanding of futures research in education. However, there is a growing appetite to support and integrate such approaches to enhance the educational system. From a systems perspective, while the government has not explicitly wrapped its initiatives in the language of futures research, there are elements within their strategies that align with futures-oriented thinking. Here is a review of how these elements manifest in the government's educational reforms and proposals.

Science, Technology, Engineering, Arts, Mathematics, and Entrepreneurship (STEAME)

Aligning with the NDP and several discussion points during focus group sessions, to drive progress, there was emphasis on the critical role of Science, Technology, Engineering, and Mathematics (STEM) education. This strategic focus is well-placed, given the increasing global shift towards knowledge-based economies, also referred to the cognitive economy. A significant area that warrants further attention is the integration of 4IR technologies into the educational and economic framework. The integration of 4IR technologies, such as AI, blockchain, and IoT, into both education and industry, remains a pressing need. While there are pockets of excellence and innovation in teaching needed skills to leverage such advancing technology, a cohesive and comprehensive strategy is required to scale these efforts.

One promising approach raised to address these challenges is the adoption of successful initiatives like STEAME (Science, Technology, Engineering, Arts, Mathematics, and Entrepreneurship). By broadening the scope to include arts and entrepreneurship, STEAME offers a more holistic educational framework that encourages creativity, critical thinking, and business acumen alongside technical skills. The implementation or expanse of STEAME could enhance learner engagement, better prepare graduates for the dynamic job market, and stimulate innovative capacities across various sectors. There have been instances of this used in teaching in South Africa as learnt from participants. Moreover, fostering a STEAME-driven educational environment could bridge the gap between academic learning and practical, industry-relevant skills.

Finally, collaboration between academic institutions, industry stakeholders, and government bodies was noted as difficult, yet essential to ensure that curricula is aligned with current and future economic needs. Such synergies could lead to the development of specialised training programs, internships, and research opportunities that directly contribute to economic growth and technological advancement envisaged by the NDP.

Gender And Cultural Diversity Dynamics Government Needs to Consider

To truly prepare scholars for future work and literacy, government's strategy must also include improving education on gender-based violence (GBV) and building capacities to support victims.

While the NDP lays a strong foundation for economic growth through STEM education and technological integration, addressing social issues such as GBV was noted as equally crucial for creating a safe and inclusive environment conducive to learning and productivity. However, the implementation of these measures has been notably slow, posing significant challenges. GBV remains a pervasive issue in South Africa, especially in schools, impacting individuals across all demographics. The education system has a pivotal role in not only raising awareness about GBV but also in fostering a culture of respect and equality. Incorporating comprehensive GBV education into the curriculum can help break the cycle of violence by educating young people about consent, respect, and healthy relationships. This education would need to start early and be reinforced throughout a learner's academic journey, ensuring that future generations are better equipped to challenge and change harmful behaviours. Building capacities to support GBV victims is equally important. Educational institutions should be safe havens where victims can seek help without fear of stigma or retribution. This requires establishing clear policies and protocols for reporting and addressing GBV, training staff to handle disclosures sensitively, and providing access to counselling and legal support. Collaboration with external organisations specialising in GBV can enhance the support network available to learners and staff.

During discussions around GBV, the cultural dynamics of mental health were also raised as key touchpoints. In South

Africa, mental health issues are deeply intertwined with cultural perceptions and gender norms. Notably, many boys and men in South Africa do not prioritise mental health, often viewing it as a non-essential or even taboo subject. This reluctance to seek mental health support is rooted in traditional gender norms that discourage vulnerability and emotional openness in males. As they age, men become even less likely to access mental health services, resulting in significant underutilisation of available resources. Consequently, this cultural barrier has far-reaching implications, particularly in the education sector. This is because our cohort of educators, especially within African communities, may themselves have cultural reservations about mental health. This creates a challenge in fostering a supportive environment for learners who might be dealing with mental health issues. Moreover, these social and cultural barriers extend beyond mental health to issues of sexual and gender diversity, where binary gender norms further complicate acceptance and understanding. The DBE has recognised these challenges and has structures in place designed to address them. While the sector was noted by participants as structurally equipped to handle these issues, there is a need for a system that allows individuals to integrate these structures effectively. Moreover, despite the presence of these structures, political unease, and societal resistance often hinder progress. For instance, debates around comprehensive sexual education, crucial for preventing HIV and teenage pregnancies, face significant barriers from philosophical and religious perspectives. This resistance turns what should be scientific and educational discussions into moral debates, stalling implementation. In 2024, it was noted that we there needs to be movement beyond such discussions to address more pressing issues like the inclusion of transgender learners, yet progress is hampered by outdated societal norms and resistance to change.

It was noted that a dedicated task team within the DBE exists to navigate these complexities, but the team must negotiate with a society that may not be ready for rapid changes. Administrative processes can further delay these efforts. Thus, while structures are in place, the challenge lies in bridging the gap between structural capabilities and societal readiness.

Addressing these social issues is not only vital for the present but also frames an educational system that supports futures readiness and the holistic development of learners.

Erosion of Trust as a Barrier

The success of educational reforms hinges on robust public-private partnerships (PPPs) built on mutual trust. However, post-COVID-19, there has been a significant erosion of trust in government, complicating the establishment and maintenance of these partnerships. Stakeholders must exhibit boldness and a willingness to invest despite uncertainties, but this is increasingly challenging in an environment where trust is lacking. Several participants noted that while senior government officials advocate for the 4IR, there is a notable gap in their ability to effectively utilise and integrate these technologies. To bridge this gap, there is a critical need for openness to sharing knowledge and learning from failures. Unfortunately, the corruption observed during the COVID-19 pandemic further eroded citizens' trust in politicians, making it difficult to establish the legitimacy of government-led initiatives.

One proposed approach to rebuilding trust involves adopting a positivist perspective, where traditional metrics and methodologies are critically examined and expanded. Digital ethnography, for instance, can amplify marginalised voices and offer a decolonised perspective on education. However, budget constraints and pervasive mistrust between public and private sectors hinder the effective implementation of such future research initiatives. Educational reforms must transcend mechanistic functions, encompassing the complex social dynamics influenced by support, encouragement, and environmental factors. Cultural dynamics, including intrinsic motivation, play a significant role in the effectiveness of these reforms. Educators need to be equipped to guide learners in this context, potentially incorporating home-schooling methodologies and addressing mental health issues, particularly among male teachers who face cultural barriers against seeking help.

Government Needs for Inclusive Education Towards Indigenous Knowledge Retention

It was highlighted that South Africa grapples with deepening structural inequalities and historical injustices affecting the education system. Exploring alternative perspectives, including indigenous systems and bilingual education, can create a more inclusive framework, where futures is key. Initiatives should consider the informal economy's impact and address trauma and ethnogenetic factors influencing learning. Policymakers must integrate futuristic technologies into education judiciously, ensuring their adoption benefits the educational landscape. Successful examples include Click Learning, which uses literacy and numeracy platforms to improve learner outcomes. However, large class sizes, township and rural schools, and an ageing teaching workforce pose significant challenges. Moreover, learners struggle with self-study, resilience, and adaptability, compounded by limited access to resources, impacting the effectiveness of education. To this end, it was highlighted that developing a clear and supportive ecosystem is crucial.

A strategic unit within the DBE could add to this, where they could analyse market and technological trends to enable a proactive ecosystem to educational changes. Learning from international models such as "Teach the Future" in the U.S. and Japan's specialised training can help South Africa balance specialist knowledge with broad-based education. One option was to also restructure existing units such as the "Research, Monitoring and Evaluation" unit. This would require sufficient resources, specifically human resources. To this end, effective structures and guidelines would have a significant impact going forward, where global examples could assist in terms of best practice.

Effective government structures are vital for enabling successful outcomes in educational innovation. Strong leadership and clear policies are essential for integrating technology and futures thinking in education. Additionally, partnerships with the private sector can introduce the necessary innovation and resources to support these advancements. It was explicitly noted that the input of young people and incorporating their perspectives could lead to more relevant and innovative educational strategies.

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Considering this, several examples were raised by delegates to balance competitiveness with learner well-being while creating sustainable educational environments. Analysing global examples provides critical insights into how different countries incorporate futures thinking and technology in education. These case studies are particularly valuable for South Africa, highlighting the necessity of adapting successful international practices to local contexts.

Kenya's EIDO initiative illustrates a successful model of integrating technology into early childhood education, driven by proactive government support. The Kenyan government, committed to leveraging technology for teaching, collaborates with the private sector to introduce innovative solutions in classrooms. This approach, seen across East and West Africa, emphasises the importance of government willingness to experiment and adapt, rather than waiting for perfect solutions. This model underscores the significant role of government-private sector partnerships in advancing educational innovation.

Adopting educational strategies from Finland can offer South Africa practical insights, given Finland's emphasis on learner well-being and holistic development. Additionally, examining successful practices within African contexts, such as those in Kenya and Botswana, can provide relevant examples of effective technology integration and youth engagement in educational strategies. These models demonstrate the potential for regional adaptation and innovation in educational practices.

A key element in effective educational strategies is the encouragement of learning from failures and valuing the contributions of young people. Botswana's approach, characterised by a relatively young average age of government ministers, highlights the benefits of incorporating youthful perspectives and innovative ideas. For South Africa, a commitment to continuous learning, adaptability, and openness to

innovation is essential for effectively integrating futures research into its educational strategies.

Singapore serves as a cautionary example of a highly competitive education system that has led to increased stress and higher suicide rates among learners. This underscores the importance of creating educational environments that balance academic rigour with the holistic well-being of learners. South Africa can learn from Singapore's experience by striving to create educational environments where learners are not only academically proficient but also emotionally and socially healthy. However, there are sector-specific considerations within the region. For example, while STEM education may thrive under rigorous academic standards, creative fields might require a different approach to foster innovation without overwhelming learners.

Strategic integration of technology and futures thinking in education requires effective government structures, strong leadership, and private sector partnerships. Learning from global and regional examples can help South Africa develop educational strategies that are innovative, sustainable, and well-balanced, prioritising both academic excellence and the well-being of learners.

Geographically Rural Area Considerations

For rural South Africa, delegates noted that aligning futures education with the unique economic dynamics of these areas is crucial to unlocking their potential. An inclusive rural economy strategy requires integrating agricultural advancements, land reform, infrastructure enhancements, and education tailored to the rural context. This multi-faceted approach aims to transform rural regions into significant contributors and beneficiaries of national economic growth, improving employment, entrepreneurship, and quality of life.

Tailored Futures Education

In rural settings, futures education must be adapted to equip individuals with the necessary skills for the evolving agricultural sector and broader rural economy. Integrating practical agricultural training, digital literacy, and entrepreneurial skills within the educational framework is vital. Emphasis on agricultural sciences, water management, sustainable farming, business, and technical skills for agro-processing and tourism will prepare learners for future opportunities, fostering innovation and productivity in the rural economy.

Agricultural Job Creation

Expanding irrigated agriculture is a cornerstone for rural job creation. Efficient use of existing water resources and the development of new schemes can boost agricultural output and employment. Futures education can support this growth by including advanced irrigation and water management strategies in the curriculum, preparing a skilled workforce for these sectors.

Agro-processing and Small Enterprise Support

Diversifying the rural economy through agro-processing and small enterprise development is essential. Futures education should incorporate training in agro-processing technologies, supply chain management, and market access, enabling rural communities to add value to their agricultural products and penetrate new markets. This strategy promotes job creation, food security, and nutritional improvements.

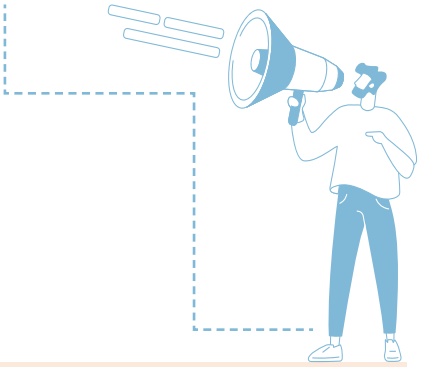
Infrastructure Development

Developing infrastructure like roads, storage facilities, and digital connectivity is vital for rural economic growth and market access. Futures education should thus extend to engineering, construction, and ICT, preparing individuals to engage in and benefit from infrastructure projects. Enhanced infrastructure supports agricultural and business activities while improving access to essential services like education and healthcare.

Department of Basic Education (DBE) & Learner Perspective

Learners are a very important stakeholder group considering that the goal of curriculum transformation is to provide high quality education to current and future learners. Although the DBE requires the support of various stakeholders for the curriculum transformation process, they are considered the main catalyst required for the success of this evolution. The DBE has faced criticism for its role as a policy monitor, particularly regarding its inconsistent approaches to curriculum updates and integration of futures research. The absence of a policy for the usage of AI within the DBE underscores a significant gap in addressing the role of emerging technologies in education. As AI becomes increasingly prevalent in various sectors, including education, the lack of guidelines and frameworks poses challenges in harnessing its potential to enhance teaching and learning experiences. Moreover, participants highlighted that within the vast bureaucracy of the DBE, the presence of silos can exacerbate this issue, leading to disjointed efforts and inefficient utilisation of resources. Silos may impede communication and collaboration between different departments or units within the DBE, hindering the development of cohesive strategies for integrating AI into educational practices.

Critics highlight the necessity for clear and cohesive messages and methodologies that resonate with grassroots educational needs. It is imperative that the integration of futures research into education policy incorporates coherent strategies aimed at fostering critical thinking skills pertinent to the challenges posed by the 4IR. However, a few barriers were raised.



Lack of Access to Computers (Hardware) in Schools

The lack of access to computers and other forms of technology in schools represents a significant barrier to equitable education. In an era where digital literacy is increasingly essential for academic success and future career opportunities, this disparity exacerbates existing inequalities. Several learners indicated that they had never interacted with a computer. Learners without access to technology miss out on crucial opportunities for skills development, research, and digital collaboration, limiting their ability to compete in a technologically driven world. Furthermore, without exposure to technology in educational settings, learners are ill-prepared to navigate the digital landscape and contribute meaningfully to the global workforce. Addressing this issue requires concerted efforts to bridge the digital divide, ensuring that all learners have access to the tools and resources necessary for 21st-century learning.

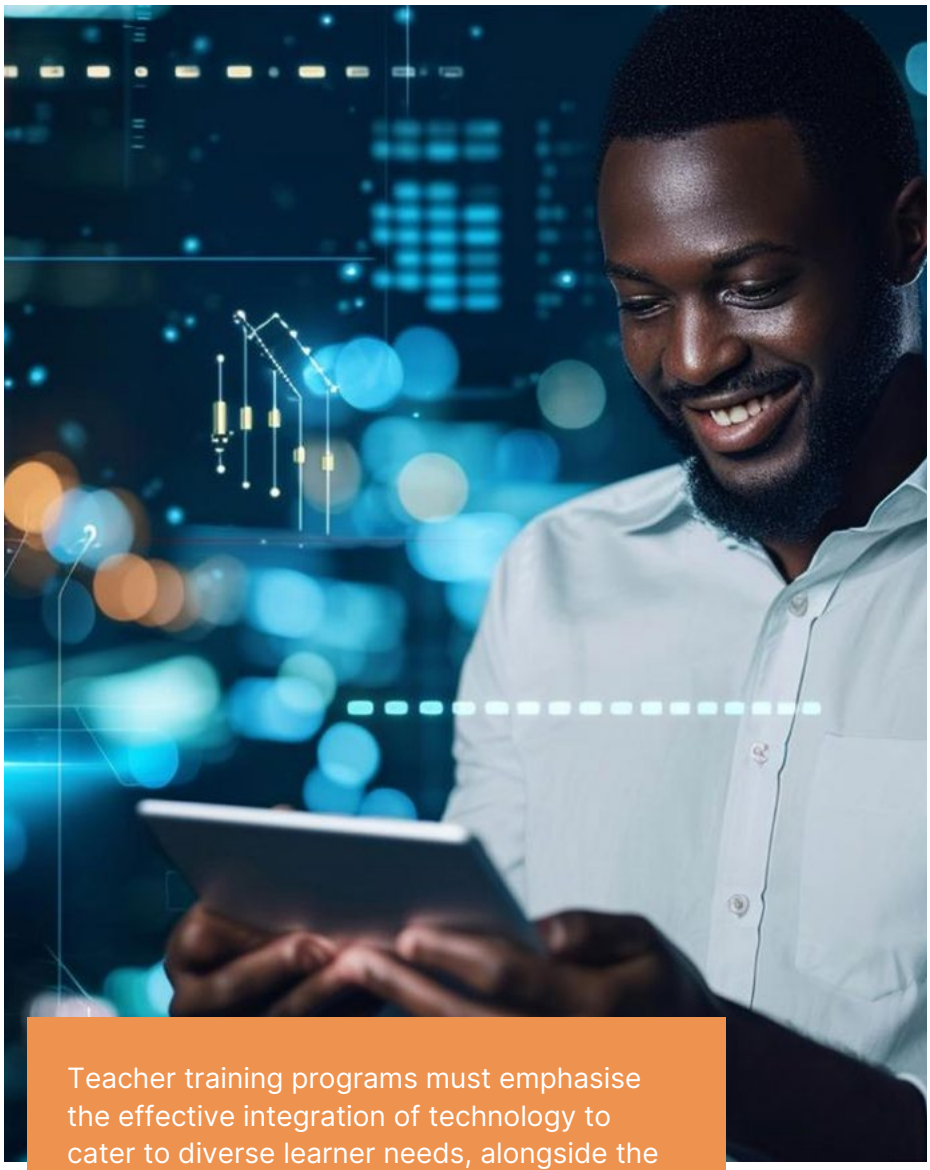
Many learners find themselves intimidated by computers due to a lack of access, which prevents them from gaining familiarity and confidence with these tools. They express a desire to utilise computers for practical applications such as creating and designing, rather than solely for typing documents. However, the limited availability of computers in many schools exacerbates this issue. Even when computers are present, they often lack proper internet connectivity, which is essential for accessing online resources and engaging with educational platforms effectively. This underscores the importance of prioritising basic infrastructure, including stable and fast internet connections, before considering the implementation of specific technological tools or platforms in the classroom.

Moreover, the discrepancy between learners' access to computers and their reliance on smartphones for studying further highlights the urgent need for improved technological resources in schools. While some learners may possess laptops, these devices are often used for leisure rather than academic purposes. This disparity in access and usage patterns raises concerns about learners' readiness for computer-based work in higher education and the workforce. To address this gap, there is a growing consensus that technology should be integrated throughout the schooling system from an early age. By infusing technology into various aspects of the curriculum, educators can ensure that learners develop essential digital skills and are better prepared for the demands of an increasingly technology-driven society.

A Vague Understanding of The Use of Technological Innovations and Tools

A vague understanding of technological innovations and tools, coupled with a lack of digital literacy was identified as a weakness amongst teachers and learners. Without a solid grasp of emerging technologies and their practical applications, individuals may struggle to harness the full potential of digital tools for personal, academic, and professional advancement. Moreover, a deficiency in digital literacy can perpetuate inequalities, as those who are proficient in technology gain a competitive edge in accessing information, communicating effectively, and participating in the digital economy. Addressing this issue necessitates comprehensive digital literacy programs that empower individuals to navigate the complexities of the digital world, critically evaluate information, and leverage technology to enhance learning, productivity, and social engagement.

Both teachers and learners stand to benefit from a comprehensive understanding of the practical applications and advantages of technology within the classroom setting. This necessitates the integration of computer studies and literacy across all levels of the education system, coupled with increased access to computers in schools. While some learners utilise platforms like WhatsApp for peer-learning, there remains a notable absence of technology-driven learning approaches in formal education. To address this gap, there is a pressing need for blended learning strategies and ongoing professional development for teachers, though fatigue from excessive workshops poses a challenge.



Teacher training programs must emphasise the effective integration of technology to cater to diverse learner needs, alongside the implementation of Learning Management Systems (LMS) to guide instructional practices. Moreover, fostering strong public-private collaborations is essential for embedding innovative teaching methodologies within teacher education and ensuring adaptability to future challenges. To facilitate this process, workshops should equip teachers with the necessary tools and knowledge to effectively leverage technology in their instruction, thereby alleviating workload pressures and enhancing learner engagement.

Learners were aware that AI exists but had a very vague understanding of what it is, existing platforms, and how it can be used in an educational context. While learners are familiar with mainstream tools like Google, there is a broader need to introduce them to emerging technologies such as ChatGPT and other AI tools to foster digital literacy and prepare them for evolving educational landscapes.

Lack of Community and Industry-Specific Education

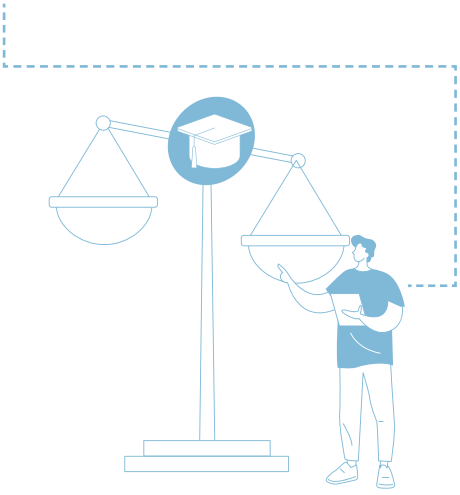
There was a call for curriculum alignment, where it looks to the needs of the economy. This can be done by tailoring educational content and skills training to align with the demands of local industries, schools can equip learners with the knowledge and competencies necessary to succeed in the regional job market. This approach not only addresses current workforce needs but also anticipates future trends, ensuring that graduates are prepared to contribute meaningfully to the local economy. Furthermore, curriculum alignment promotes community engagement and collaboration between educational institutions, businesses, and other stakeholders, fostering a symbiotic relationship where education serves as a catalyst for economic growth and social advancement. By integrating real-world experiences, internships, and project-based learning opportunities into the curriculum, learners gain practical insights and hands-on skills that directly translate to employment opportunities within their community. Overall, a curriculum that aligns with the needs and economy of a specific community fosters economic resilience, social cohesion, and individual empowerment.

South Africa boasts abundant natural resources, prompting calls for an educational approach that aligns with the country's context. This entails a shift towards practical teaching methods centred around the industries surrounding schools. Therefore, some learners would like to see agriculture and animal husbandry being brought into the classroom in schools located close to farms, augmented by technological advancements. Emphasising practical learning within communities reflects learners' belief that education should extend beyond textbooks, embracing real-world experiences and skills development.

However, South Africa's educational landscape often prioritises Western models at the expense of indigenous knowledge and practices. This overlooks valuable insights from similar African contexts, hindering the development of a truly inclusive and culturally relevant curriculum. To address this imbalance, there is a growing recognition of the need to integrate indigenous knowledge systems into education, alongside advancements in AI and technology. This balanced approach acknowledges the importance of keeping pace with technological trends while preserving and promoting physical, practical skills rooted in local traditions. By embracing a holistic educational framework that values both indigenous wisdom and technological innovation, South Africa can better equip its learners for success in an increasingly interconnected global society.

Inequality Across the Education System

Inequality permeates every facet of the South African education system, representing a persistent challenge that hampers social progress and economic development. Despite significant strides since the end of apartheid, disparities in access to quality education persist along racial, socioeconomic, and geographic lines. Historically disadvantaged communities, primarily comprised of Black South Africans, continue to bear the brunt of unequal educational opportunities, facing inadequate infrastructure, under-resourced schools, and a shortage of qualified teachers. This systemic inequality perpetuates a cycle of poverty and marginalisation, limiting the life chances and opportunities of millions of young South Africans. Additionally, the legacy of apartheid-era policies has resulted in deeply entrenched educational inequalities, exacerbating social divisions, and hindering efforts to build a more inclusive and equitable society. Addressing these disparities requires a concerted commitment to equitable resource allocation, teacher development, and curriculum reform to ensure that every child in South Africa has access to a high-quality education regardless of their background.



The link between access to quality education and socioeconomic status is undeniable, particularly evident in underprivileged schools where the lack of resources perpetuates cycles of disadvantage. Without access to better quality education, learners in these schools are at risk of further marginalisation and limited opportunities for upward mobility. In addressing this issue, inclusivity emerges as a key imperative, yet the role of technology in shaping inclusivity is complex. While technology has the potential to enhance accessibility and flexibility through online and distance learning, it also poses challenges in exacerbating existing inequalities. Therefore, the conversation about the future of education must be approached critically, recognising the contested nature of the discourse, especially from a South African and African perspective.

A critical theoretical perspective is essential in navigating these power dynamics and countering the increasing dominance of corporate influence in education. UNESCO's call for a new social contract underscores the need for direct engagement with corporate culture and a re-evaluation of past oppressive systems that have historically dominated the global south.

Embracing indigenous knowledge systems and promoting bilingual education are critical components of fostering alternative discourses on the future of education that are uniquely South African. By interrogating and challenging dominant narratives, South Africa can chart a path towards a more inclusive, equitable, and culturally relevant education system that addresses historical injustices and empowers all learners to thrive in the face of future challenges.

Lack of Holistic Learner Understanding of The Role Education Plays in Life

Learners do not seem to fully understand the relevance of education to their life in general. The focus is on education to get employment later in life - not as an important tool for holistically navigating life in a digital era. This leads to a lack of learner motivation in the education system and presents a significant obstacle to effective learning and academic success. Various factors contribute to this phenomenon, including uninspiring teaching methods, irrelevant curriculum content, and a disconnect between educational goals and learners' personal interests and aspirations. When learners perceive little relevance or meaning in their studies, they may disengage from the learning process, leading to apathy, absenteeism, and underachievement. Additionally, systemic issues such as overcrowded classrooms, resource shortages, and socioeconomic disparities can further erode learner motivation by creating environments that are not conducive to learning or personal growth. Addressing this challenge requires a multifaceted approach that encompasses learner-centred teaching practices, personalised learning experiences, and meaningful opportunities for learner engagement and empowerment. By fostering a culture of curiosity, creativity, and intrinsic motivation, educators can inspire learners to take ownership of their learning journey and realise their full potential.

In fostering motivation and providing better quality education, it's crucial to involve a diverse range of stakeholders, including well-known celebrities and influencers from disadvantaged communities. These figures can serve as powerful role models, inspiring learners to reach their full potential despite facing adversities. By showcasing success stories and emphasising the importance of education in achieving one's goals, celebrities can motivate learners to pursue their dreams and

strive for excellence. Moreover, the education system should equip learners with realistic expectations of post-education life, teaching them essential life skills such as resilience and stress management to navigate challenges effectively.

The perception is that in more industrialised economies, learners are often engaged in discussions about the future and how to prepare for it, but this does not take place as much in the South African context. Recognising that each child has unique abilities and strengths, the education system should cater to individual needs rather than adopting a one-size-fits-all approach. Psychometric testing can help identify these natural abilities, allowing educators to tailor learning experiences to suit each learner's strengths and interests. By embracing a personalised approach to education, South Africa can empower learners to maximise their potential and thrive in an increasingly competitive global landscape.

Educator Competencies in Facilitating Learning with Digital Tools and Resources

It was noted that the DBE has initiated efforts to build educator competencies in facilitating learning with digital tools and resources, acknowledging the transformative potential of digital literacy across various socio-economic landscapes. These efforts are a part of a broader vision to embrace digital learning as a cornerstone of modern education, aiming to enhance teaching methodologies and learner engagement through access to high-quality digital resources. To this end there are several awareness considerations and associated pedological needs. The needs for which in terms of advancing with digital learning as uncovered is shown in **Fig. 9** below, stemming from the DBE.

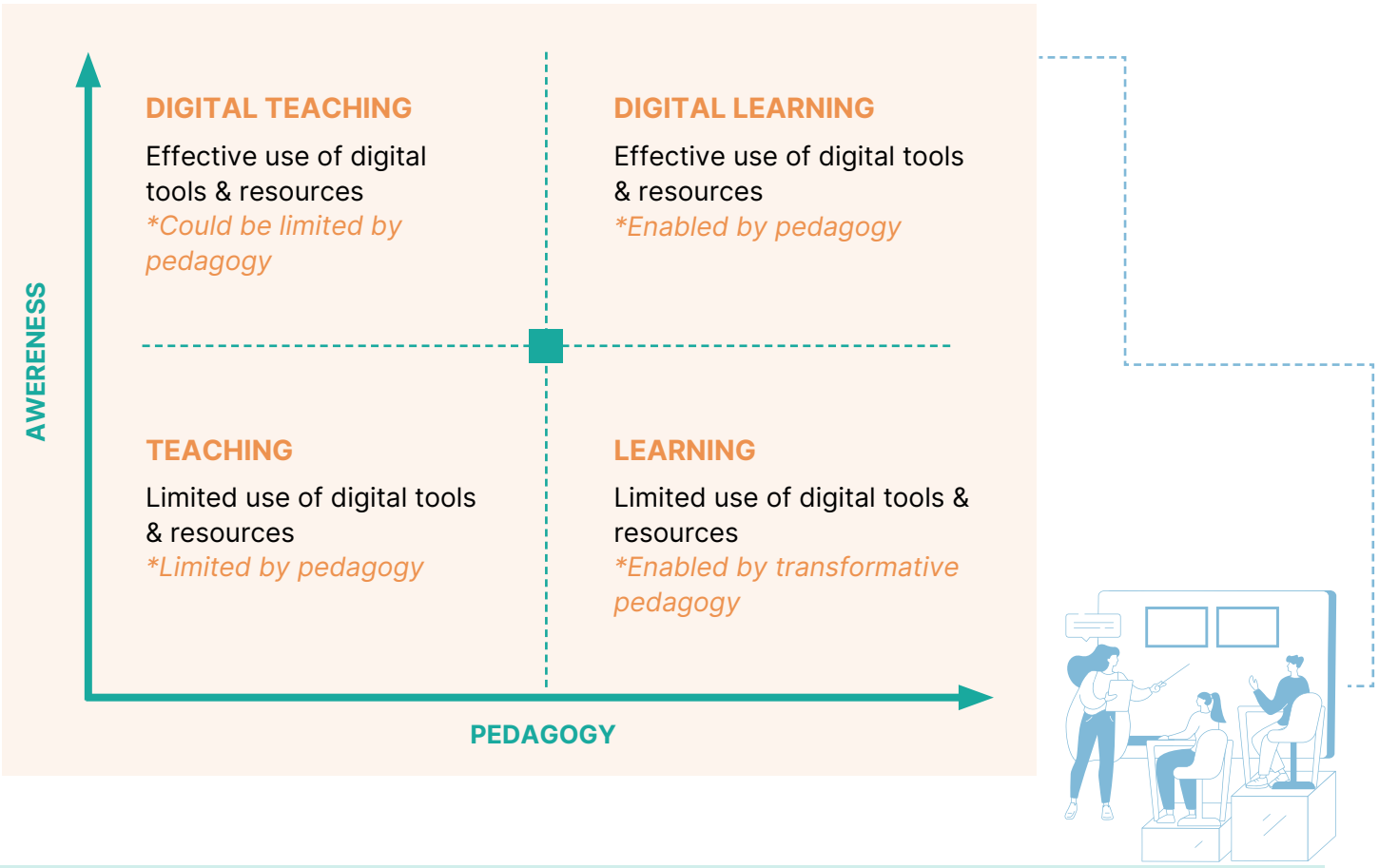


Figure 9: Pedagogy that enable digital learning

To align pedogeological approaches and develop needed digital literacy, several observations were noted, including:

Systemic Fragility and Teacher Support	The fragile state of the schooling system, coupled with a general deficiency in mathematics knowledge for teaching at the primary level, is well-documented and acknowledged. There appears to be a widespread agreement on the necessity for well-designed school improvement initiatives that reach mathematics teachers directly, supporting them with high-quality LTSM and assessment tools. The essential role of instructional leaders within schools is also highlighted, underlining the importance of ongoing teacher development and school-based coaching.
DBE Workbooks as a Positive Shift	The introduction and distribution of the DBE workbooks across all primary schools in South Africa are celebrated as a significant and transformative investment in the education sector. These resources have markedly improved access to learning opportunities, indicating a major stride towards enhancing the quality of primary schooling.
Concerns Over Multiple Interventions	The landscape of primary mathematics improvement is cluttered with numerous interventions, potentially confusing teachers, and instructional leaders with mixed messages. This situation underscores the importance of evidence-based decision-making and the need for a sample-based systemic evaluation process led by the DBE to provide clearer insights into primary school attainment in mathematics.
Curriculum Strengthening and Modernisation	There is an ongoing effort towards Curriculum Strengthening aimed at modernising knowledge, competencies, and cross-cutting priorities within the curriculum. However, the specifics appear limited.
Incremental Improvement and Stability	The proposed model for primary mathematics LTSM and assessments suggests a cycle of incremental improvement that balances stability with innovation. This model emphasises collaboration among various stakeholders in LTSM development and advocates for evidence-informed curriculum reviews to ensure that changes are predictable, aligned with governmental cycles, and responsive to the system's capacity for absorption.

At the key to enable these initiatives is teaching, that requires three clusters of expertise as shown in **Fig.10**.

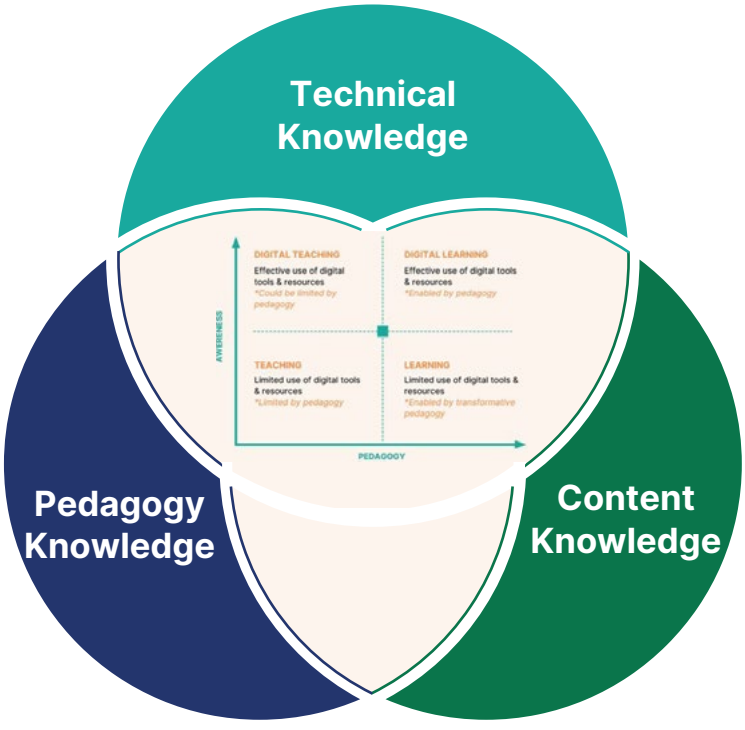


Figure 10: Overview of interlinking clusters educators need that enable digital learning

In assessing the incorporation of futures research in government planning, it is evident that there is a limited integration of these elements in the resource allocation, planning, and risk management strategies of various government departments. This lack of integration is particularly pronounced in relation to the basic education system, where a more holistic approach to futures thinking and digital literacy is needed. The current educational initiatives, while commendable in their intent, often operate in silos, lacking a unified, long-term strategy that addresses the multifaceted challenges of preparing learners for a future dominated by technological advancements and digital integration.

To bridge these gaps, a comprehensive framework for futures education could be developed by the DBE. This framework would need to extend beyond mere digital literacy to encompass critical foresight, scenario planning, and innovation skills, ensuring that learners are not only adept at using technology but are also capable of thinking critically about future trends and challenges. Embedding such futures-oriented education in the curriculum from early childhood development (ECD) onwards will ensure a seamless integration of these critical skills throughout the educational journey.

Private Sector Involvement

***"Research and innovation by universities, science councils, departments, NGOs and the private sector has a key role to play in improving South Africa's global competitiveness".* (National Planning Commission, 2012:295).**

As we delve into the intersection of futures research and basic education, the private sector emerged several times as a key player in sculpting a workforce ready to navigate and lead in this new era. The private sector, historically a powerhouse of innovation and growth, now takes on a pivotal role in education. Companies across industries are weaving futures research into their strategic fabric, aligning business goals with educational outcomes. From renewable energy firms to tech giants, businesses are not only anticipating future trends but also actively participating in creating a workforce that is skilled, adaptable, and forward-thinking.

The collaboration between the private sector and futures education is pivotal in driving forward innovative and inclusive educational practices in South Africa, as they provide necessary resources, infrastructure, and support. In this evolving landscape, strategic collaborations between businesses and educational institutions have become more than just a trend—they are essential bridges connecting the present with the future. These partnerships facilitate the development of curricula that not only include technical skills but also emphasise critical thinking, adaptability, and sustainability. The narrative of futures education in South Africa is increasingly being co-written by corporate visionaries and educational leaders, each bringing unique insights and resources to the table.

One example is the Optimi Initiative, launched in 2020. It is a suite of educational services designed to improve learning experiences for learners from Grade R to Grade 12. The initiative uses e-learning platforms to deliver educational content for both home and classroom environments, ensuring flexibility and accessibility for diverse learning needs. The services are designed to support home schooling and integrate seamlessly with traditional classroom settings. It offers curriculum-aligned content, interactive learning tools, and personalised learning paths. The initiative provides accessibility to a wider audience, bridging educational gaps, and flexibility for learners to learn anytime and anywhere. Professional development and support for educators are also provided. It saw results of over 2000 learners in several aspects, primarily pass rates. Also, the engagement of the private sector with basic education extends beyond curriculum support. It encompasses comprehensive workforce preparation through internships, apprenticeships, and targeted training programs. These initiatives could be designed to cultivate a generation that is not only technically proficient but also deeply aware of and engaged with local and global sustainability challenges.

Addressing Infrastructural Gaps and Digital Literacy

The private sector understands futures well and understands that it is crucial to address infrastructural gaps and improve digital literacy. By providing infrastructure support, such as solar power for rural schools and investing in technological infrastructure, the private sector can significantly enhance digital literacy and educational outcomes.

For example, currently Investec, a financial services company, supports an after-school tutoring system for 6000 learners in the Further Education and Training (FET) phase in South Africa. The program focuses on providing extra-curricular support, particularly in STEM subjects. The system has shown a positive impact on learners' academic performance, with an estimated 3% of learners achieving distinctions. The system is implemented based on global best practices in education but is customised to meet local needs. However, there is a disconnect between global practices and local realities, requiring significant adaptation. Small, iterative steps are effective in addressing this disconnect. Challenges include resource allocation, training of tutors, and measuring impact.

Investec's after-school tutoring system exemplifies a targeted approach to improving STEM education for FET phase learners in South Africa. By leveraging global best practices and customising them to fit local contexts, the program has shown promising results in enhancing academic performance and increasing distinction rates. However, addressing the disconnect between global standards and local realities remains a challenge that requires ongoing adaptation and iterative improvements.

Key Themes in Public-Private Sector Collaboration

The relationship between the public and private sectors is manifested through various key themes, including:

Technology Integration

Incorporating advanced technologies to enhance the learning environment.

1

Fostering Public-Private Partnerships

Leveraging resources and expertise from both sectors to support educational initiatives.

2

Enhancing Teacher Training

Focusing on continuous learning and innovative teaching methods.

3

Addressing Educational Inequities

Promoting equitable access to educational resources and opportunities.

4

Leveraging AI and Automation

Ethically integrating AI to support educational practices.

5

Enhancing Teacher Training and Professional Development

Continuous professional development for teachers is necessary to keep pace with technological advancements and new teaching methodologies. This includes training in AI and other advanced technologies to enhance teaching capabilities and prepare learners for future challenges. In South Africa, supporting and training school principals and school management is essential for driving social cohesion and transformation. Globally, institutions like the University of Johannesburg demonstrate the importance of lifelong learning for teachers through blended teaching paradigms. Innovative methodologies, such as mixed reality simulations, should be incorporated into the curriculum to better prepare teachers for future educational demands.

For example, the Oppenheimer Memorial Trust and Click Learning, an educational non-profit organisation in South Africa, focuses on literacy improvement through an innovative software platform called ReadingX. The platform uses interactive quizzes to enhance learners' reading and comprehension skills, allowing them to progress at their own pace. The programme is facilitated by an adult, ensuring adequate support and motivation. It is now operational in over 300 schools across South Africa, demonstrating its scalability and success in improving educational outcomes.

Research and anecdotal evidence suggest that children who use these apps demonstrate significant improvements in their literacy and numeracy skills. However, the programme requires substantial financial investment, including stipends for facilitators. To ensure the long-term sustainability of the programme, continuous funding and community support are essential. Facilitators must undergo comprehensive training and professional development to maintain high standards of facilitation. The software must also be adaptable to local contexts, considering language, cultural relevance, and baseline literacy and numeracy levels.

Click Learning demonstrates how technology can be harnessed to improve educational outcomes in under-resourced areas, highlighting the importance of a multifaceted approach that combines innovative software with human facilitation.

Role of Technologies

The role of technology in education, particularly through the use of AI and digital learning platforms, is pivotal in enabling the tutoring of complex problems and facilitating advanced educational opportunities. AI has the potential to personalise learning experiences, provide instant feedback, and offer tailored support to learners, thereby improving learning outcomes. For example, universities such as UJ and NWU are incorporating mixed reality simulations into their teaching programmes, using avatars to strengthen teaching practices and make educational opportunities accessible, especially in rural and township areas where physical school visits may not always be feasible. This has seen the emergence of the metaverse; a revolutionary development in digital learning, offering immersive and interactive environments that can transform the educational landscape. In the metaverse, learners can engage in virtual classrooms where they can interact with peers and educators in real time, participate in simulations of real-world scenarios, and access a wealth of resources and tools that enhance their learning experience. This digital ecosystem enables a level of engagement and interactivity that traditional classrooms cannot match, providing a platform for experiential learning

and collaboration across geographical boundaries.

However, the integration of the metaverse into education also highlights significant challenges. Many educators are still behind in terms of technological proficiency, struggling to understand and effectively use these advanced tools. Additionally, there is a notable

fear among both educators and learners regarding the rapid pace of technological change and its implications. This apprehension is often linked to concerns about job displacement, as AI and automation threaten to render certain educational roles obsolete. Therefore, it is essential to focus on reskilling and upskilling educators to ensure they can adapt to these new technologies and leverage them to enhance teaching and learning.

Moreover, the ethical considerations surrounding the use of the metaverse in education must be carefully managed. Issues such as data privacy, digital equity, and the potential for algorithmic bias need to be addressed to ensure that the benefits of these technologies are distributed fairly. The digital divide remains a significant barrier, with many learners lacking access to the necessary technology and internet connectivity to fully participate in these virtual environments.

Key Constraints

Rapid technological development is revolutionising various sectors, with education being no exception. As the future of work becomes increasingly digital, the integration of technology into educational practices has been noted as crucial. However, this transformation has in the past been met with significant resistance, primarily due to an erosion of trust in government, and the sense of "more work" being assigned to teachers and what was said as a lack of skills. Many educators view advancements and changes with scepticism, worrying that they will disrupt established pedagogical methods and diminish the human element of teaching. Without addressing this constraint, we risk falling behind in preparing learners for a future where technological proficiency and global relevance is paramount.

Resistance to Technological Change

A significant constraint in future education is the resistance to technological change. This resistance is often due to a fear of the unknown, a lack of understanding of new technologies, or a perceived threat to traditional teaching roles and job security. Many educators view technological advancements with scepticism, worrying that they will disrupt established pedagogical methods and diminish the human element of teaching. This reluctance is particularly stark when compared to sectors like healthcare, where technology integration is rapid and seen as essential for progress. This slow embrace of technology in education hampers the integration of innovative tools that could enhance learning outcomes and operational efficiency, for example, e-learning of STEAME concepts.

Policy and Strategic Misalignment

The lack of strategic units within educational departments to proactively analyse market and technological trends is a significant constraint. This results in a reactive rather than proactive approach to educational policy and curriculum development. Educational policies often lag behind technological advancements, creating gaps in preparing learners for the evolving job market. The absence of strategic alignment means that policies do not continuously monitor or adapt to changes in market dynamics and the technological landscape. This disconnect leaves learners unprepared for future skill requirements, impacting their employability and adaptability. Effective futures education requires policy frameworks that are flexible and forward-looking, incorporating ongoing assessments of technological and market trends.

Varying Teacher Training and Competencies

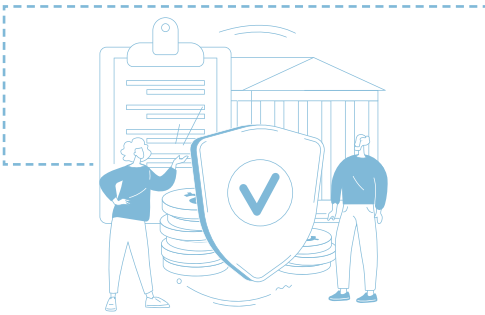
Inadequate teacher training programs are a major constraint to the effective integration of technology in education. Many existing training programs focus solely on basic technological skills, neglecting the pedagogical integration necessary for enhancing learning outcomes. Teachers need comprehensive training that not only covers how to use technology but also how to incorporate it effectively into their teaching practices. This includes understanding how technology can facilitate interactive and personalised learning experiences. The lack of such training leads to a competency gap, where teachers are ill-equipped to leverage technology to its full potential. This constraint prevents schools from fully realising the benefits of educational technology, which can significantly improve learner engagement and achievement. One comment around this was upskilling older teachers whilst ensuring relevant graduates.

Technological and Educational Frameworks

The absence of robust technological and educational frameworks is a critical constraint to the effective integration of technology in education. Frameworks like the Technological Pedagogical Content Knowledge (TPACK) are essential for guiding educators in the meaningful adoption of technology. These frameworks emphasise the interplay between technology, pedagogy, and subject matter knowledge, ensuring that technological tools are used to enhance rather than disrupt the educational process. Without such frameworks, the integration of technology remains fragmented and ineffective, failing to connect technological tools with pedagogical practices and subject content. This disconnect leads to inconsistent and suboptimal use of technology in classrooms, undermining its potential to improve learning outcomes.

Resource Management and Efficiency

Inefficient resource management and budget constraints are significant limitations in basic education. Schools often face limited funding, making it challenging to invest in essential infrastructure, teaching materials, and professional development for educators. This inefficiency hinders the implementation of necessary educational reforms and improvements, directly affecting the quality of education provided. Resource allocation is seen as frequently short-term and reactive, falling short when addressing long-term educational needs and sustainability. This results in inadequate infrastructure, outdated teaching materials, and insufficient support for teachers, all of which contribute to suboptimal educational outcomes. Efficient resource management requires strategic planning and investment, focusing on solutions that offer long-term benefits and improvements in teaching and learning processes.



Ethical and Effective Use of Technology

Limited policies and training that emphasise the ethical and effective use of technology in education is a critical constraint. Educators and learners need to understand responsible technology use, including data privacy, digital citizenship, and the potential risks associated with technology. Without a robust framework guiding ethical technology use, the potential benefits of educational technology are undermined, and risks such as increased inequality and privacy breaches arise. This constraint prevents the creation of a safe and effective digital learning environment, where technology enhances education without compromising ethical standards. Policies and training programs that focus on these aspects are essential to ensure that technology is used to its full potential in an ethical and responsible manner.

Specialist Versus Generalist Education

The ongoing debate between specialist and generalist education presents a significant constraint to adequately preparing learners for the future. A lack of balance between developing specialised skills in high-demand areas and fostering generalist skills such as critical thinking and adaptability can lead to skill gaps. This imbalance affects learners' ability to thrive in diverse career paths and rapidly changing environments. Specialist education focuses on in-depth expertise in specific fields, while generalist education provides a broad knowledge base and versatile skills. Both approaches have their merits, but an imbalance can result in learners being ill-prepared for the complexities of the future job market.

Key stakeholders

Collaboration with diverse stakeholders, including educational institutions, private sector partners, and international experts, is crucial for driving innovation and addressing educational challenges. These partnerships foster resource sharing and strategic planning, ensuring comprehensive and forward-looking educational reforms. Key collaborators are detailed in **Table 4**, though this list is not exhaustive.

Table 4: *Potential collaborative partners and stakeholders*

Entity/Organisation	Core Deliverable	Motivation for Supporting Futures Integration in Basic Education
Adopt-a-School Foundation	Implements Whole School Development in rural and township communities	Enhances academic, infrastructural, social, and security environments in schools to improve educational outcomes
African Venture Alliance	Leverages technology to improve education outcomes in Africa	Develops and implements educational technologies tailored to local needs and barriers
Artificial Intelligence Institute of South Africa (AIISA)	Promotes AI research and application, focusing on digital transformation	Provides knowledge and applications to integrate AI in education, supporting digital skills and technological advancements
Centre for the Future of Work (University of Pretoria)	Specialises in future work skills and education futures	Provides strategic insights into integrating futures thinking at a policy level
Ceed Learning	Provides high-impact blended learning solutions and on-demand eLearning solutions	Facilitates just-in-time learning and keeps pace with technological changes to enhance education outcomes
Click Learning	Enhances literacy through digital platforms and technology	Shares successful technology integration models and helps scale effective programs
Department of Basic Education (DBE)	Develops and implements national education policies	Ensures alignment with national policies, fostering environments for technological advancements
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Implements international cooperation projects for sustainable development	Supports education projects with a focus on technology integration and capacity building
EIDU	Provides early childhood education through digital learning tools	Introduces effective early childhood educational technologies suitable for South African schools

Entity/Organisation	Core Deliverable	Motivation for Supporting Futures Integration in Basic Education
eTraverse	Offers innovative Learning Management System (LMS) solutions like the Bokamoso LMS	Supports interactive and engaging e-learning environments, crucial for modern education needs
Future Fund for Education	Supports African entrepreneurs transforming education	Provides funding, technical assistance, and mentorship to innovative education projects across Africa
Future SA	Works on bridging the digital divide in education in South Africa	Supports initiatives for digital literacy and inclusion, vital for preparing learners for the future
LearnWare	Develops e-learning solutions tailored to organisational needs	Utilises industry experience to create engaging, interactive content aligned with organisational training requirements
National Education Collaboration Trust (NECT)	Facilitates collaboration between government, business, and civil society for educational improvement	Mobilises support for educational innovations through public-private partnerships
South African Institute of International Affairs (SAIIA)	Conducts research and policy analysis on international affairs and development	Develops policy recommendations to integrate futures thinking in education
Spark Schools	Operates private schools with a focus on blended learning and future readiness	Offers models and frameworks for successful blended learning strategies adaptable to public schools
Teachers and Educational Leaders (South African Democratic Teachers Union - SADTU, National Professional Teachers' Organisation of South Africa - NAPTOSA)	Deliver and manage educational content and strategies in schools	Provide continuous professional development and feedback processes crucial for integrating futures thinking and technology
United Nations Educational, Scientific and Cultural Organization (UNESCO) International Institute for Capacity Building in Africa (IICBA)	Provides capacity building and educational support across Africa	Offers strategic insights and support for integrating futures thinking into policy and practice

Table 5 lists notable international academic collaborators whose expertise spans various critical areas in education, from curriculum design and digital literacy to teacher training and global competence. Their contributions could support the strategic integration of futures in educational systems. This list is not exhaustive.

Table 5: *Key international collaborators*

Name/Organisation	Expertise/Area of Contribution
Philip Tomporowski (The University of Georgia, United States)	Interdisciplinary knowledge, physical activity and cognitive function
Joke Voogt (University of Amsterdam, Netherlands)	Curriculum redesign, digital literacy
Nancy Walt (British Columbia Ministry of Education, Canada)	Educational policy, curriculum development
Conrad Wolfram (Computer-Based Math, United Kingdom)	Math education, technology in learning
Michael Young (UCL Institute of Education, United Kingdom)	Curriculum theory, educational reform
Kiyomi Akita (The University of Tokyo, Japan)	Teacher education, classroom practices
Ilayda Bilgin (MEF High School Istanbul, Turkey)	Innovative school networks, learner perspectives
Veronica Boix Mansilla (Harvard Graduate School of Education, United States)	Interdisciplinary studies, global competence
Alexander Browman (Boston College, United States)	Psychological aspects of education, learner motivation
Darryl Buchanan (Association of Independent Schools of NSW, Australia)	School leadership, educational improvement
Jeppe Bundsgaard (Aarhus University, Denmark)	ICT in education, digital learning resources
Claudia Costin (CEIPE - Fundação Getulio Vargas, Brasil)	Global education policies, innovation in education
Graham Donaldson (University of Glasgow, United Kingdom)	Educational assessment, curriculum design
Michael Fullan (New Pedagogies for Deep Learning, Canada)	Whole system educational change, innovation
Howard Gardner (Harvard Graduate School of Education, United States)	Multiple intelligences, education reform
Andreas Schleicher (OECD Director for Education and Skills)	Global education analysis, PISA studies
Yuri Belfali (OECD Head of Division)	Early childhood education and skills development
Miho Taguma (OECD Senior Analyst)	Child well-being and educational outcomes

Data Sources

To develop critical insights, and make proactive and scientifically based suggestions, reliable data is required. To this end, several data sources are suggested in **Table 6**.

Table 6: *Data sources*

Data Source	Description	Utilisation
SA-SAMS (School Administration Management System)	Provides data on learner performance, attendance, and resource allocation	Enhances capabilities for detailed data analytics and tailors interventions more effectively
Digital Ethnography	Captures and analyses experiences and perspectives of learners and educators	Identifies barriers to technology adoption and areas for additional support or training
UNESCO Institute for Statistics (UIS)	UIS Statistics provides a range of international educational data	Supports comparative analysis and benchmarking, informing international educational standards
World Bank Education Data	Offers comprehensive statistics on global educational environments and outcomes	Aids in evaluating and adjusting educational programs, supporting funding decisions and assessments
OECD Education Statistics	Includes data on educational systems and achievements across member and non-member countries	Facilitates international comparisons, guides policy development, and curriculum redesign efforts
Spatial Tax Data	Provides spatially detailed tax data and other economic metrics for South Africa	Supports research and analysis on economic disparities, informs educational funding and resource allocation decisions

Summary

This section explored the alignment of future fit educational programs in South Africa with the NDP, highlighting the need for significant youth employment to drive economic growth. Government initiatives focus on improving educational quality and aligning outcomes with community and economic needs, despite challenges such as insufficient funding and inadequate teacher training. Emphasis is placed on integrating 4IR technologies and adopting the STEAME approach to enhance creativity and critical thinking. Addressing GBV and mental health issues within schools is crucial for creating a safe and inclusive learning environment. The erosion of trust between public and private sectors post-COVID-19 hinders educational reforms, necessitating transparency and accountability. To this end, the DBE is essential for driving innovation, providing guidance on digital infrastructure investment, and fostering public-private partnerships. Furthermore, they can advise on inclusive education, incorporation of indigenous knowledge systems and develop insights around the impact of the informal economy. To this end, sector-specific strategies tailored to various economic clusters are considered essential for preparing learners for future opportunities.

Overall, systemic change, strategic technology integration, and proactive futures thinking are vital for building a resilient and progressive educational system in South Africa.

Section 4

Theory of Change (ToC)

The implications for educational policy and practice include the need for adaptive education systems that address the changing dynamics of work and family life by integrating skills that enhance adaptability, resilience, and well-being. Policies need to reflect the diversity of family and work arrangements, ensuring equitable access to education and support for lifelong learning. Additionally, educators and policymakers must remain vigilant to technological and societal shifts to ensure education remains responsive and relevant to future needs.

To this end the report offers a Theory of Change (ToC). The ToC encapsulates the evolution of understanding and strategic thinking, articulated through diagrams and narratives. These elements are not static; they are revised and refined at regular intervals to reflect new learnings and changes in context, ensuring that the theory of change remains relevant and effective in guiding programmatic efforts and achieving desired outcomes.

Theory of Change (ToC) Framework

The Theory of Change (ToC) for Ed-Futures for the South African education system aims to establish a resilient and innovative framework capable of preparing learners for future challenges and opportunities.

Table 7 outlines the key components of the ToC, detailing the resources, activities, outputs, outcomes, and contextual factors necessary for achieving the desired impact in the education system. Each element provides insights into how the initiative will unfold and the expected changes at various stages. This culminates in the ToC shown in **Fig. 11**.

Table 7: *TOC components*

Inputs	Resources necessary to initiate and support the change process.	
Insight	**Sufficient government and private sector funding:** Sustainable financial support and mechanisms for building and maintaining required infrastructure towards more digital inclusion. Also, necessary resources to training the trainer on how to leverage futures and associated tools. For example, partnerships between the government and technology centric organisations such as Microsoft that have enabled developing economies can provide necessary resources and expertise. Education outsourcing could be integrated to save costs. For instance, e-Learning platforms that enable 24/7 schooling. Also, conducive learning environments, where there is running water and no sewage in all school facilities as this was noted by learners to be a major concern. **Allocate sufficient human resources to futures initiatives by recruiting experts such as futurists, data analysts, and educational specialists:** By ensuring sufficient expertise and capacity, comprehensive monitoring of global educational trends, technological advancements, and the integration of these findings into policy and curriculum updates can realise. **Educational policies supporting a futures-oriented curriculum:** Policies should encourage the integration of futures thinking, AI, digital literacy, and sustainability into the curriculum. An example is the National Education Policy Act in South Africa, which supports inclusive education reforms. **Access to ICT technology, digital resources, and high-speed internet:** Providing schools with key ICT tools and reliable internet access can support several facets of futures. For instance, Google's Loon project aimed at providing internet in rural Kenya can serve as a model. **Update training programs for teachers:** Focus on equipping teachers with the skills needed to utilise new technologies effectively, where it does not burden their load but lightens it. For instance, automate marking areas, help lesson planning, or develop videos to supplement key topics. Programs like Finland's teacher training, which emphasises digital competence and innovation, can serve as a benchmark as it enables efficiencies.	
Activities	Actions taken to utilise inputs and achieve the desired change.	
Insight	**Establish a dedicated futures team:** With several silos and potential areas of duplication, a dedicated futures team could lead key projects that align DBE initiatives and positive futures. Moreover, the team can ensure initiatives are well implemented to address the complexities and dynamic nature of futures education, leading to more adaptive and innovative educational systems. The team can also advise to priority areas. **Integrate futures thinking into the curriculum:** This involves creating a curriculum that includes AI, digital literacy, critical thinking, and problem-solving skills. For example, Singapore's education system integrates coding and computational thinking from primary levels. The CAPS programme was noted as a good program that has flexibility for this kind of thinking. **Professional development and ongoing training for educators:** Regular workshops and courses to keep teachers updated on technological advancements and teaching methodologies. The Global Learning Network offers extensive professional development resources. **Establish partnerships with technology providers, universities, and educational content creators:** Collaboration with these entities can enhance resource availability and curriculum quality. For instance, partnerships with platforms like Coursera or Khan Academy can provide supplementary learning resources. This can also serve learn-as-you-go. **Engage communities and stakeholders:** Building community support through workshops and seminars ensures that all stakeholders understand and back the educational initiatives. South Africa's community-based education initiatives can serve as an example. Moreover, it supports schooling extended programmes, towards inclusive learning.	

Outputs

The immediate results generated from the activities.

Insight

Updated curriculum: Incorporating futures-oriented elements and digital competencies, updating elements of the CAPS curriculum in South Africa to enable future ready skills for youth.

Teachers trained in advanced teaching practices and futures: Equipping teachers with the skills to use AI and digital tools effectively for themselves and learner benefit. Finland's model of continuous professional development for teachers can be referenced.

Increased access to digital learning materials and associated skills enablement: Ensuring that both learners and teachers have access to necessary digital resources. An example is the widespread distribution of computers and e-books in South Korea.

Reports and feedback: Collecting and analysing feedback from stakeholders to assess the initiative's effectiveness and areas for improvement.

Short-term Outcomes

Early effects felt by the program's direct beneficiaries.

Insight

Improved teacher readiness: Majority of educators have enhanced skills, knowledge, and confidence to deliver futures-oriented education using advanced technologies. Success in this area is indicated by increased teacher participation in professional development activities, positive feedback regarding their preparedness and confidence levels, and the observable use of advanced technologies in their teaching practices.

Enhanced learner engagement and performance: Increased interest and active participation in learning activities, which align with future job prospects or further educational journeys. This approach boosts learner motivation and academic performance but also prepares them for real-world applications and career opportunities.

Initial improvements in digital literacy: Increased number of learners, especially those in rural communities, who can effectively use digital tools and access skill development opportunities, increasing their access to 24/7 schooling. Overall, learners who are more adept at navigating and utilising futures learning. A part of this could be usage of mobile interfaces.

Increased community and stakeholder support: Will be achieved through engagement initiatives that involve parents, community members, and stakeholders in the educational process. Sharing success stories and positive outcomes from pilot schools will demonstrate the effectiveness of new practices and build broader acceptance.

Intermediate Outcomes

Changes that occur following the short-term outcomes, leading to the goal.

Insight

Sustained improvement in teaching quality: Evidenced by the continuous enhancement of teaching methods and the resultant positive impact on learner learning outcomes, in both rural and metropolitan areas. Accomplished through ongoing professional development for teachers, ensuring they utilise pedagogical techniques and technological tools to their and their learners advantage.

Integration of futures thinking in the curriculum: Marked by the successful embedding of key skills such as futures, usage of AI, digital literacy, and problem-solving into the broader educational curriculum. This approach ensures that learners are well-prepared for the challenges and opportunities of the future workforce.

Stronger collaboration: Improved partnerships between schools, communities, the private sector, and educational institutions. These partnerships foster a supportive network that enhances educational practices and outcomes. By working together, these stakeholders share resources, expertise, and innovative solutions to common challenges.

Enhanced capacity to adapt: Schools' increased ability to respond to technological advancements and educational improvements. This adaptability is crucial in a rapidly changing educational landscape, ensuring that schools remain relevant and effective. An example of this success is collaboration between Google for Education and various school districts, which has provided schools with access to the latest educational technologies and training.

Long-term Outcomes

The ultimate impact of the initiative, showing the change in the initial condition.

Description

Insight

Workforce prepared for the future: Learners equipped with strong digital literacy, critical thinking, and other futures skills where they are employable in new roles, can integrate into further learning or start their own entrepreneurial ventures.

Responsive education system: An education system that meets the changing needs of the economy and society, while bringing along all learners.

Improved national competitiveness: Enhanced national capacity for innovation and socio-economic equity of the strong youth cohort and a globally relevant Gen Alpha.

Digitally inclusive society: Reduced educational disparities and increased opportunities for all learners. For example, the tech-driven economy Singapore.

Assumptions

Beliefs about how the initiative will bring about change.

Description

Insight

Access to resources and funding: Continuous support from the government, private sector, and community is essential. This includes consistent funding and policy backing. Moreover, access to key skills and talent that enables futures.

Teacher adaptability: Teachers will embrace and effectively utilise new technologies in their teaching practices, given proper training and resources.

Community engagement: Engaging communities and stakeholders that create a supportive environment for education initiatives.

Technology adoption: Effective adoption of ICT and 4IR technology into the curriculum that can enhance learning outcomes and teacher effectiveness.

Addressing the digital divide: Providing equitable access to technology and internet will reduce educational disparities.

Continuous improvement: Regular review and adaptation of educational practices that ensure the system remains relevant and futures ready.

Ethical and inclusive practices: Ethical considerations in AI and digital learning addressed to ensure fair distribution of benefits.

Resilience and innovation: A culture of innovation and continuous learning that develops among educators and learners.

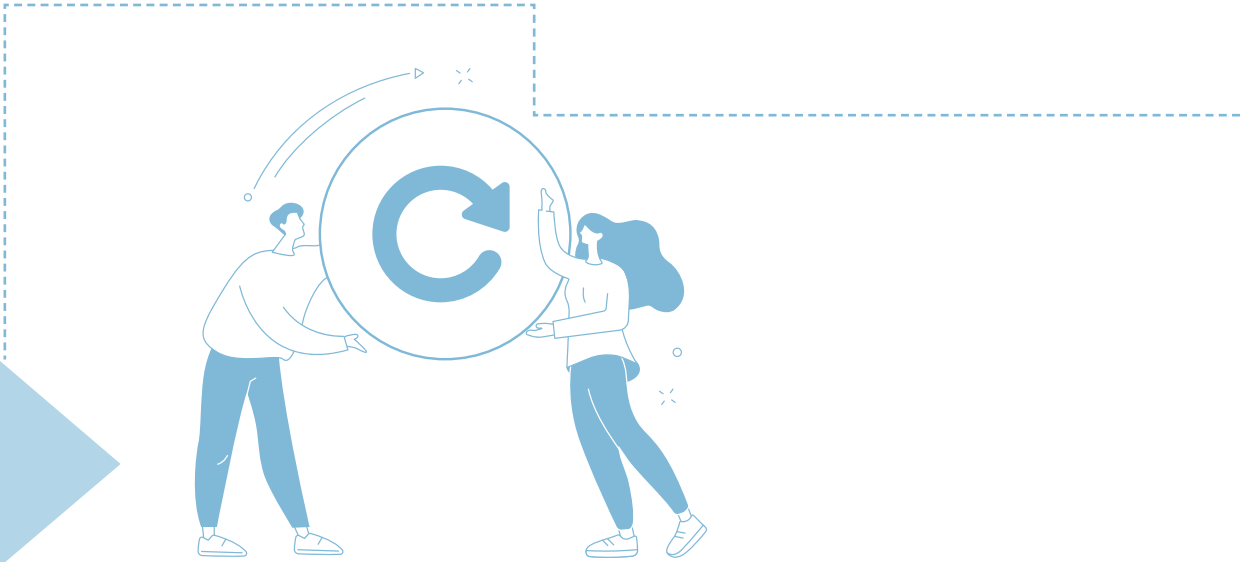
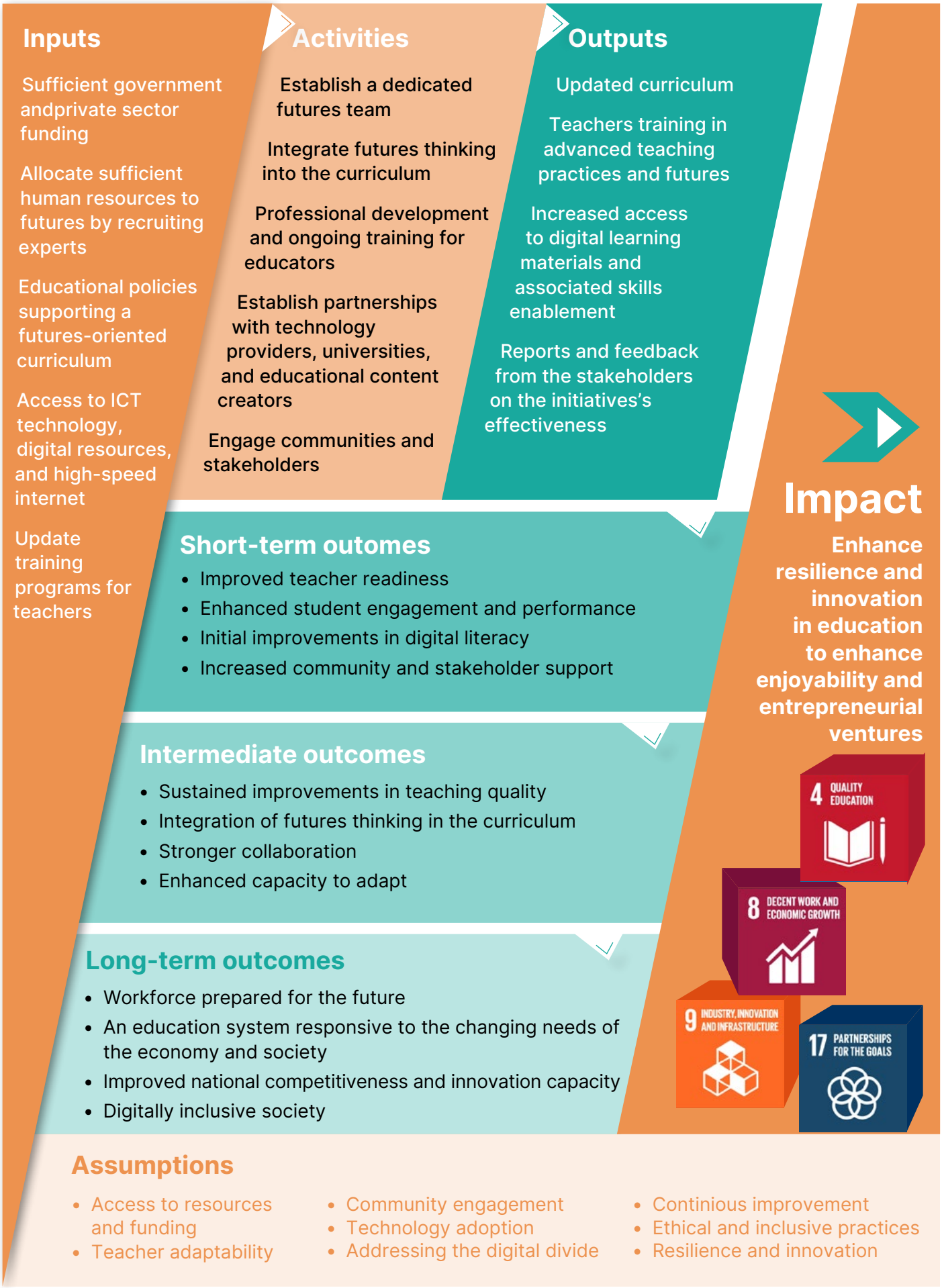


Figure 11: Theory of Change for Ed-Futures



Policy and Strategic Considerations with Associated Operational Recommendations

Determining the best approach for futures in South Africa's education system requires a nuanced strategy. While nation-wide research offers a broad overview and aligns with national goals, customised approaches for specific provinces or districts can address local needs more effectively. A blended approach might be the most beneficial, combining nation-wide studies to ensure overarching strategic alignment with needed policies. This method allows for a comprehensive understanding of both national objectives and local nuances, facilitating targeted and impactful educational interventions. To this end, policy recommendations, strategic actions and operational considerations are shown in **Table 8**, underpinned by the ToC in **Fig. 11**.

Table 8: *Policy & strategic considerations with associated operational recommendations for basic education*

Key Area	Policy Recommendations	Strategic Actions	Operational Considerations
Develop a Comprehensive AI Policy Framework	Establish national standards for AI usage in education, including ethical guidelines and data privacy protections. Mandate periodic reviews of AI applications.	The DBE should prioritise developing a comprehensive policy framework for AI usage in education.	Form a task force of AI experts, educators, and policymakers. Conduct pilot projects in selected schools. Establish partnerships with tech companies and research institutions.
Foster Interdisciplinary Collaboration within the DBE	Implement policies to encourage regular inter-departmental communication and collaboration. Develop a formal structure for interdisciplinary committees.	Break down silos within the DBE through improved communication, collaboration, and shared decision-making.	Implement regular inter-departmental meetings and workshops. Use digital platforms for centralised knowledge-sharing. Encourage joint projects and cross-functional teams.
Establish a Futures Research Unit	Allocate dedicated funding for futures research and mandate regular reporting on global trends. Integrate futures research findings into national curriculum standards.	Develop a curriculum that anticipates future trends by establishing a futures research unit within educational departments.	Recruit futurists, data analysts, and educational experts. Monitor global educational trends and technological advancements. Integrate findings into policy and curriculum updates.
Bridge the Gap between Current Practices and Future Requirements	Launch national awareness campaigns highlighting the benefits of technology in education. Provide grants and incentives for schools to pilot innovative technologies.	Overcome resistance to technology integration by addressing fears and misconceptions.	Conduct awareness campaigns. Implement pilot programs and share success stories. Organise professional development workshops.
Enhance Teacher Training and Competency	Develop and enforce national standards for teacher training programs, including digital literacy. Require ongoing professional development for teachers.	Implement comprehensive teacher training programs using the TPACK framework.	Develop detailed training sessions on lesson planning with digital tools. Use real-life classroom scenarios in training. Provide ongoing professional development perhaps through MOOCs.

Key Area	Policy Recommendations	Strategic Actions	Operational Considerations
Empower and Equip Learners for the Future	Update national curriculum standards to include mandatory courses on AI, automation, and sustainability. Provide funding for schools to implement STEAME-based curricula.	Integrate future-focused subjects like AI, automation, and sustainability into the core curriculum.	Design a CAPS and STEAME-integrated curricula. Regularly update the curriculum. Use real-world problem-solving exercises.
Foster Resilience and Adaptability	Implement policies prioritising funding for digital infrastructure, especially in underserved areas. Encourage public-private partnerships for technological innovation.	Allocate resources strategically to maximise technological investments.	Conduct comprehensive cost-benefit analyses. Develop public-private partnerships. Focus on providing robust internet connectivity and high-quality digital tools.
Address Barriers to Technology Integration	Establish national programs to enhance digital literacy among educators and learners. Provide funding and support for upgrading technological infrastructure.	Address the digital divide and infrastructural deficiencies for effective technology adoption.	Implement targeted training programs. Upgrade technological infrastructure. Develop user-friendly technological tools.
Leverage AI and Automation in Education	Develop national guidelines for the ethical use of AI and automation in education. Encourage adoption of novel technologies such as AI tools through funding and support for pilot projects.	Use AI and automation to personalise learning experiences and improve operational efficiency.	Use algorithms to analyse learner performance data. Implement automation for repetitive tasks. Ensure equitable access and address ethical considerations.
Promote a Cultural Shift Towards Technology Adoption	Implement policies supporting continuous professional development in technology. Foster a culture of innovation by recognising and rewarding successful technology integration.	Encourage a cultural shift towards continuous learning and openness to new technologies among educational leaders and teachers.	Create a supportive environment for experimentation. Foster a culture of continuous learning and adaptability.
Utilise Digital Ethnography for Inclusive Education	Mandate the use of digital ethnography in educational research. Use insights from digital ethnography to inform policy changes aimed at improving inclusivity and engagement.	Use digital ethnography to develop more inclusive and effective teaching strategies.	Capture and analyse learner and educator experiences. Incorporate insights into educational practices. Promote a user-centred approach to educational innovation.

Limitations of Futures Integration in South Africa

Recognising key constraints in existing futures research within the education sector is vital for enhancing its effectiveness. These constraints often include limited access to relevant and timely data, a lack of integration between research findings and practical application, insufficient funding for comprehensive futures research, and the absence of a collaborative approach that encompasses various stakeholders.

Limited Data Access

One of the most significant constraints is the challenge of accessing relevant and up-to-date data. To overcome this, establishing partnerships with governmental and non-governmental organisations can ensure a steady flow of current and comprehensive data. Additionally, leveraging technology to implement advanced data collection and analysis methods, such as big data analytics and artificial intelligence, can enhance the quality and scope of research findings.

Integration of Research and Application

Another constraint is the gap between futures research and its practical implementation in educational settings. Feasible solutions include developing clear mechanisms for translating research insights into actionable policies and practices. This can be achieved through regular workshops and seminars that connect researchers, policymakers, and practitioners, ensuring that futures research is effectively integrated into educational planning and decision-making processes.

Insufficient Funding

The lack of funding often limits the scope and depth of futures research. To address this, advocacy for increased investment in educational research from both public and private sectors is essential. Demonstrating the long-term benefits of futures research in shaping a resilient and forward-thinking education system can help attract necessary funding.

Collaborative Approach

The absence of a collaborative and multidisciplinary approach to futures research can hinder its effectiveness. Encouraging collaboration across different sectors and disciplines can lead to more comprehensive and inclusive research outcomes. Establishing multi-stakeholder consortia that include educators, policymakers, industry leaders, and community representatives can foster a holistic approach to futures research in education.

Inequality in Teacher Training and Education Reform

A constraint identified from the focus groups is the inequality throughout the education system. Certain schools, educators, and communities are often excluded from the futures conversation due to disparities in access and resources. This exclusion must be addressed to ensure a more equitable and inclusive approach to teacher training and education reform.

Section 5

References

Adamba, C., 2023. Trends in financing of basic education in Ghana – a political economy analysis. International Journal of Educational Management, 37, 337–349. https://doi.org/10.1108/IJEM-01-2022-0036

Adu, K.K., Dube, L., Adjei, E., 2016. Digital preservation: The conduit through which open data, electronic government and the right to information are implemented. Library Hi Tech, 34, 733–747. https://doi.org/10.1108/LHT-07-2016-0078

AFRICARENA, 2024. The State of Tech in Africa.

Airaksinen, T., Halinen, I. and Linturi, H., 2017. Futuribles of learning 2030 - Delphi supports the reform of the core curricula in Finland. European Journal of Futures Research, 5(1), p. 2. https://doi.org/10.1007/s40309-016-0096-y

Alsan, A., 2008. Corporate foresight in emerging markets: Action research at a multinational company in Turkey. Futures, 40, 47–55. https://doi.org/10.1016/j.futures.2007.06.009

Aznar-Díaz, I., Hinojo-Lucena, F.-J., Cáceres-Reche, M.-P., Trujillo-Torres, J.-M., Romero-Rodríguez, J.-M., 2019. Environmental attitudes in trainee teachers in primary education. The future of biodiversity preservation and environmental pollution. International Journal of Environmental Research and Public Health, 16. https://doi.org/10.3390/ijerph16030362

Bakhshi, H., Downing, J., Osborne, M., Schneider, P., 2017. The Future of Skills Employment in 2030. Pearson and Nesta, London.

Barbosa, C.E., de Lima, Y.O., Costa, L.F.C., dos Santos, H.S., Lyra, A., Argôlo, M., da Silva, J.A., de Souza, J.M., 2022. Future of work in 2050: thinking beyond the COVID-19 pandemic. European Journal of Futures Research, 10. https://doi.org/10.1186/s40309-022-00210-w

Benavides Rincón, G., Díaz-Domínguez, A., 2022. Assessing futures literacy as an academic competence for the deployment of foresight competencies. Futures, 135. https://doi.org/10.1016/j.futures.2021.102872

Bowden, M., 2021. Deepening futures methods to face the civilisational crisis. Futures, 132. https://doi.org/10.1016/j.futures.2021.102783

Bugallo-Rodríguez, A., Vega-Marcote, P., 2020. Circular economy, sustainability and teacher training in a higher education institution. International Journal of Sustainability in Higher Education, 21, 1351–1366. https://doi.org/10.1108/IJSHE-02-2020-0049

Castañeda-Garza, G., Valerio-Ureña, G., 2023. Energy literacy in elementary school textbooks in Mexico. Environmental Education Research, 29, 410–422. https://doi.org/10.1080/13504622.2022.2135687

Chiang, F., Liang, X., Xiao, X., Jiang, Z., Zhou, Y., 2023. Design-Based Research on the Development and Implementation of AI Courses from the Perspective of University-Enterprise Cooperation. Frontiers of Education in China, 18, 400–418. https://doi.org/10.3868/s110-008-023-0031-5

Chigova, L., 2021. The National Development Plan 2030: A Focus on Innovation Issues. Journal of Public Administration.

Cunningham, J.A., Audretsch, D., Kuratko, D.F., Lehmann, E.E., Menter, M., 2019. Entrepreneurial ecosystems: economic, technological, and societal impacts. Journal of Technology Transfer, 44, 313–325. https://doi.org/10.1007/s10961-018-9690-4

de Melo, A.A.S., 2016. Brazilian curricular policy: Challenges for the future. Turkish Online Journal of Educational Technology, 2016, 392–397.

Deloitte, 2020. The heart of resilient leadership: Responding to COVID-19.

Department of Basic Education, 2023a. General Household Survey (GHS): Focus on Schooling 2020-2021.

Department of Basic Education, 2023b. Primary Mathematics LTSM and Assessments Review: Summative Report.

Department of Basic Education, 2022. 2022 Basic Education Sector Report Lekgotla Report.

Department of Basic Education, 2019. Professional Development Framework for Digital Learning.

Edoho, F.M., 2015. Entrepreneurship and socioeconomic development: Catalyzing African transformation in the 21st century. African Journal of Economic and Management Studies, 6, 127–147. https://doi.org/10.1108/AJEMS-03-2013-0030

Égert, B., Botev, J., Turner, D., 2020. The contribution of human capital and its policies to per capita income in Europe and the OECD. European Economic Review, 129. https://doi.org/10.1016/j.euroecorev.2020.103560

El Hilali, W., El Manouar, A., 2019. Towards a sustainable world through a SMART digital transformation, in: ACM International Conference Proceeding Series. Association for Computing Machinery. https://doi.org/10.1145/3320326.3320364

European Commission, 2020a. European Digital Innovation Hubs in Digital Europe Programme - Draft working document.

European Commission, 2020b. LifeComp: The European Framework for Personal, Social and Learning to Learn Key Competence.

European Commission, 2019. EntreComp: the European Entrepreneurship Competence Framework.

European Commission, 2017. European Framework for the Digital Competence of Educators: DigCompEdu.

Falloon, G., 2020. From digital literacy to digital competence: the teacher digital competency (TDC) framework. Educational Technology Research and Development, 68, 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Fourie, W., 2018. Aligning South Africa's National Development Plan with the 2030 Agenda's Sustainable Development Goals: Guidelines from the Policy Coherence for Development movement. Sustainable Development, 26, 765–771. https://doi.org/10.1002/sd.1745

Gómez-García, G., Hinojo-Lucena, F.-J., Fernández-Martín, F.-D., Romero-Rodríguez, J.-M., 2022. Educational Challenges of Higher Education: Validation of the Information Competence Scale for Future Teachers (ICS-FT). Education Sciences, 12. https://doi.org/10.3390/educsci12010014

Holmes, W., 2024. AIED—Coming of Age? International Journal of Artificial Intelligence in Education. https://doi.org/10.1007/s40593-023-00352-3

Honorato-Errázuriz, J., Ramírez-Montoya, M.S., 2020. Intervention model to promote reading in basic education: Contributions to public policies, in: Garcia-Penalvo, F.J. (Ed.), ACM International Conference Proceeding Series. Association for Computing Machinery, pp. 299–303. https://doi.org/10.1145/3434780.3436553

Hwang, G.-J., Lee, H.-Y., Chen, C.-H., 2019. Lessons learned from integrating concept mapping and gaming approaches into learning scenarios using mobile devices: Analysis of an activity for a geology course. International Journal of Mobile Learning and Organisation, 13, 286–308. https://doi.org/10.1504/IJMLO.2019.10020119

International Monetary Fund (IMF), 2023. Unemployment rate. URL https://www.imf.org/external/datamapper/LUR@WEO/OEMDC/ADVEC/WEOWORLD (accessed 1.23.23).

Kamaruzaman, F.M., Hamid, R., Mutalib, A.A., Rasul, M.S., 2021. Determination of Leadership Attributes for 4IR Engineering Graduates, in: Proceedings - 2nd SEA-STEM International Conference, SEA-STEM 2021. Institute of Electrical and Electronics Engineers Inc., pp. 168–173. https://doi.org/10.1109/SEA-STEM53614.2021.9668169

Kamilaris, A., Kartakoullis, A., Prenafeta-Boldú, F.X., 2017. A review on the practice of big data analysis in agriculture. Computers and Electronics in Agriculture, 143, 23–37. https://doi.org/10.1016/j.compag.2017.09.037

Kindei, L., Nikitina, O., Baraniuk, I., Kotelianets, Y., Kotelianets, N., 2022. The Problem of Methodological Training of Future Teachers in the Digital Environment. Journal of Curriculum and Teaching, 11, 146–154. https://doi.org/10.5430/jct.v11n5p146

KnowledgeWorks, 2018. Navigating the Future of Learning: Forecast 5.0.

Kruger, S., Steyn, A., 2020. A conceptual model of entrepreneurial competencies needed to utilise technologies of Industry 4.0. International Journal of Entrepreneurship and Innovation, 22, 56–67. https://doi.org/10.1177/1465750320927359

Kruger, S., Steyn, A.A., 2022. Innovation Environment's Role in Supporting Industry 4.0 Technology Adoption to Address Effects of COVID-19. International Journal of Innovation and Technology Management, 19. https://doi.org/10.1142/S0219877022420019

Kulikov, S.B., Shirokova, A.V., 2020. Artificial intelligence, culture and education. AI & Society, 36, 305–318. https://doi.org/10.1007/s00146-020-01026-7

Liu, G., 2022. Research on Educational Informatization Platform Based on Cloud Computing, in: Liu, Q., Liu, X., Chen, B., Zhang, Y., Peng, J. (Eds.), Lecture Notes in Electrical Engineering. Springer Science and Business Media Deutschland GmbH, pp. 1140–1153. https://doi.org/10.1007/978-981-16-6554-7_126

Magwentshu, N., Rajagopaul, A., Chui, M., Singh, A., 2019. The future of work in South Africa: Digitisation, productivity and job creation, Mckinsey Global Institute.

Mangnus, A.C., Oomen, J., Vervoort, J.M., Hajer, M.A., 2021. Futures literacy and the diversity of the future. Futures, 132. https://doi.org/10.1016/j.futures.2021.102793

Manyika, J., Chui, M., Joshi, R., 2018. Modeling the global economic impact of AI | McKinsey, McKinsey.

Manyika, J., Chui, M., Miremadi, M., Bughin, J., George, K., Willmott, P., Dewhurst, M., 2017. A future that works: Automation, employment, and productivity, Mckinsey Global Institute.

Martins, R., Paulo, E., Noronha-Sousa, D., Costa, E., Pascoinho, J., 2023. Professional Skills Developed in a E@D Practicum, in: Abreu, A., Carvalho, J.V., Liberato, D., Galdames, I.S. (Eds.), Smart Innovation, Systems and Technologies. Springer Science and Business Media Deutschland GmbH, pp. 1–10. https://doi.org/10.1007/978-981-19-9960-4_1

Mbanda, V., Fourie, W., 2020. The 2030 Agenda and coherent national development policy: In dialogue with South African policymakers on Policy Coherence for Sustainable Development. Sustainable Development, 28, 751–758. https://doi.org/10.1002/sd.2025

Min, M., 2023. School culture, self-efficacy, outcome expectation, and teacher agency toward reform with curricular autonomy in South Korea: a social cognitive approach. Asia Pacific Journal of Education, 43, 951–967. https://doi.org/10.1080/02188791.2019.1626218

Mkansi, M., Landman, N., 2021. The future of work in Africa in the era of 4IR–The South African perspective. Africa Journal of Management, 7, 17–30. https://doi.org/10.1080/23322373.2021.1930750

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2009. Academia and Clinic Annals of Internal Medicine Preferred Reporting Items for Systematic Reviews and Meta-Analyses: Annals of Internal Medicine, 151, 264–269.

Murphy, R., Wang, S., Bienkowski, M., Bhanot, R., 2023. Digital learning solutions for improving adults' basic skills. Interactive Learning Environments. https://doi.org/10.1080/10494820.2023.2253860

Nasiri, M., Saunila, M., Ukko, J., Rantala, T., Rantanen, H., 2020. Shaping Digital Innovation Via Digital-related Capabilities. Information Systems Frontiers. https://doi.org/10.1007/s10796-020-10089-2

National Planning Commission, 2022. NDP Implementation Pathways Towards 2030 and Critical Actions.

National Planning Commission, 2020. Digital Futures: South Africa's Digital Readiness for the Fourth Industrial Revolution.

National Planning Commission, 2019. 2050 Vision and Pathways for a Just Transition to a Low Carbon, Climate Resilient Economy and Society.

National Planning Commission, 2012. National Development Plan 2030: Our future-make it work.

National Science and Technology Forum, 2022. Featured SET Policy: The National Development Plan (NDP).

Niemi, K., 2021. 'The best guess for the future?' Teachers' adaptation to open and flexible learning environments in Finland. Education Inquiry, 12, 282–300. https://doi.org/10.1080/20004508.2020.1816371

Nieto-Márquez, N.L., Sillaots, M., Martínez, A.C., Nieto, M.Á.P., 2020. Assessing impact of self-regulated learning using educational games on intelligent platform, in: Fotaris, P. (Ed.), Proceedings of the European Conference on Games-Based Learning. Dechema e.V., pp. 408–416. https://doi.org/10.34190/GBL.20.102

Nkrumah, R.B., Sinha, V., 2020. Context and Implications Document for: Revisiting global development frameworks and research on basic education access in Ghana and Sub-Saharan Africa: A review of evidence and gaps for future research. Review of Education, 8, 765–767. https://doi.org/10.1002/rev3.3224

OECD, 2022. Trends Shaping Education 2022, Trends Shaping Education. OECD. https://doi.org/10.1787/6ae8771a-en

OECD, 2018. The Future of Education and Skills: Education 2030.

Papadakis, S., 2016. Creativity and innovation in European education. Ten years ePast, present and the future. International Journal of Technology Enhanced Learning, 8, 279–296. https://doi.org/10.1504/IJTEL.2016.082315

Park, S., 2017. The Fourth Industrial Revolution and implications for innovative cluster policies. AI & Society, 33, 1–13. https://doi.org/10.1007/s00146-017-0777-5

Patokorpi, E., Ahvenainen, M., 2009. Developing an abduction-based method for futures research. Futures, 41, 126–139. https://doi.org/10.1016/j.futures.2008.09.019

Pereira, L.M., Hichert, T., Hamann, M., Preiser, R., Biggs, R., 2018. Using futures methods to create transformative spaces: Visions of a good anthropocene in Southern Africa. Ecology and Society, 23. https://doi.org/10.5751/ES-09907-230119

Piamsa-nga, P., Poovarawan, Y., 2020. Design a Curriculum with User-Experience Analysis: Case Study Computing Science Curriculum, in: Cheung, S.K.S., Li, R., Phusavat, K., Paoprasert, N., L.-F., K. (Eds.), Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). Springer, pp. 25–36. https://doi.org/10.1007/978-3-030-51968-1_3

Plozer-Ngwato, T., Shilakoe, L., Morse, K., Huston, K., 2023. National Reading Survey 2023 Findings Report.

Poli, R., 2021. The challenges of futures

literacy. Futures, 132. https://doi.org/10.1016/j.futures.2021.102800

Porter, A., 2004. Technology futures analysis: Toward integration of the field and new methods. Technological Forecasting and Social Change, 71, 287–303. https://doi.org/10.1016/j.techfore.2003.11.004

Qiu, S., Natarajarathinam, M., Johnson, M.D., Roumell, E.A., 2021. The Future of Work: Identifying Future-ready Capabilities for the Industrial Distribution Workforce, in: ASEE Annual Conference and Exposition, Conference Proceedings. American Society for Engineering Education.

Safonov, Y., Borshch, V., Shulzhenko, I., Zahrebelna, I., Bolshakova, I., 2022. Digital Transformation in Developing Economies Under the COVID-19 Pandemic. IEEE Engineering Management Review, 50, 46–57. https://doi.org/10.1109/EMR.2022.3195873

Sahlberg, P., 2015. Finnish Lessons 2.0, 2nd ed. Teachers College Press.

Saunders, M.N.K., Lewis, P., Thornhill, A., 2019. Research Methods for Business Learners, 8th ed. Pearson, London.

Schalk, A.E., McAvinia, C., Rooney, P., 2022. Exploring the concept of the digital educator during COVID-19. Australasian Journal of Educational Technology, 38, 129–141. https://doi.org/10.14742/ajet.7316

Schlange, L.E., 1995. Linking futures research methodologies. Futures, 27, 823–838. https://doi.org/10.1016/0016-3287(95)00047-Z

Shay, S., 2017. Educational investment towards the ideal future: South Africa's strategic choices. South African Journal of Science. https://doi.org/10.17159/sajs.2017/20160227

Slaughter, R.A., 2012. Sense making, futures work and the global emergency. Foresight, 14, 418–431. https://doi.org/10.1108/14636681211269897

South African National Energy Association, 2023. Energy Skills Roadmap South Africa 2023.

Statistics South Africa, 2021. Stats SA. URL http://www.statssa.gov.za/ (accessed 10.28.18).

Stats SA, 2023. Sustainable Development Goals: Country Report 2023.

Tay, L.Y., Nair, S.S., Lim, C.P., 2017. A regression analysis of elementary learners' ICT usage vis-à-vis access to technology in Singapore. Educational Media International, 54, 34–47. https://doi.org/10.1080/09523987.2017.1324362

The Guardian, 2017. Inequality index: where are the world's most unequal countries? The Guardian. URL https://www.theguardian.com/inequality/datablog/2017/apr/26/inequality-index-where-are-the-worlds-most-unequal-countries (accessed 3.6.24).

The World Bank, 2020. Labour Market Dynamics in South Africa 2020. URL https://microdata.worldbank.org/index.php/catalog/4540 (accessed 8.2.23).

Thomas, C.G., 2021. Research Methodology and Scientific Writing, 2nd ed. Springer Nature.

Tranfield, D., Denyer, D., Smart, P., 2003. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. British Journal of Management. https://doi.org/10.1111/1467-8551.00375

Treasury, Schwab, K., 2018. Economic transformation, inclusive growth, and competitiveness: Towards an Economic Strategy for South Africa Prepared by Economic Policy, National Treasury. World Economic Forum, 1–62.

UNESCO, 2023. SDG 4 South Africa: Country Profile.

UNESCO, 2021. Future of Education.

Uotila, T., Melkas, H., Harmaakorpi, V., 2005. Incorporating futures research into regional knowledge creation and management. Futures, 37, 849–866. https://doi.org/10.1016/j.futures.2005.01.001

Užule, K., Kuzmina-Merlino, I., Merlino, M., 2021. Modern Managers in Gig Economies: Competencies, Personality and their Effect on Manager Education in the Digital Era, in: Kabashkin, I., Yatskiv, I., Prentkovskis, O. (Eds.), Lecture Notes in Networks and Systems. Springer Science and Business Media Deutschland GmbH, pp. 613–622. https://doi.org/10.1007/978-3-030-68476-1_57

van Laar, E., van Deursen, A.J.A.M., van Dijk, J.A.G.M., de Haan, J., 2017. The relation between 21st-century skills and digital skills: A systematic literature review. Computers in Human Behavior, 72, 577–588. https://doi.org/10.1016/j.chb.2017.03.010

Vossen, T.E., Land-Zandstra, A.M., Russo, P., Schut, A., Van Vulpen, I.B., Watts, A.L., Booij, C., Tupan-Wenno, M., 2023. Effects of a STEM-oriented lesson series aimed at inclusive and diverse education on primary school children's perceptions of and sense of belonging in space science. International Journal of Science Education, 45, 689–708. https://doi.org/10.1080/09500693.2023.2172693

Walter, A., Finger, R., Huber, R., Buchmann, N., 2017. Smart farming is key to developing sustainable agriculture. Proceedings of the National Academy of Sciences, 114, 6148–6150. https://doi.org/10.1073/pnas.1707462114

Wang, F., Wang, Q., Du, C., 2021. WeChat-Based Interactive Translation Mobile Teaching Model. Mobile Information Systems, 2021. https://doi.org/10.1155/2021/7054016

World Economic Forum, 2023. The Future of Jobs Report.

Annexures

For access to the research tools, click on the Annexures below.

Annexure A
Research Methodology

Annexure B
Instruments For Think-Tank Focus Group Session

Annexure C
Bibliometrics Analysis

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