

# Perceived 21st-century competencies as capabilities of secondary school teachers in a South African context



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**Orientation:** The *capability for work* framework led to a shift in thinking about occupational health psychology. The value of work can only be preserved if decision-makers recognise that employees value their work and the competencies needed to excel at work.

**Research purpose:** This study aimed to develop a list of capabilities from 21st-century competencies found in literature and to quantitatively measure the resulting 21st-century competency (21CC) capabilities of secondary school teachers (SSTs) – valued knowledge and skill dimensions that are enabled and can be realised.

**Motivation for study:** This framework is an appropriate outline for studying the functioning of employees but lacks specificity regarding the specific competencies (knowledge and skills) needed to function well.

**Research approach/design and method:** A convenience sample of SSTs ( $N = 144$ ) in the Gauteng province completed the 21st-century competencies as capabilities questionnaire.

**Main findings:** The results indicated that the 21CC capabilities are most likely to form part of SSTs' capability set (i.e. the competencies that they value, are enabled in and achieve) were collaboration, constructive relationships and educational literacy. The 21CC capabilities least likely to form part of the teachers' capability set included cognitive and digital literacy, processing and personal and professional development.

**Practical/managerial implications:** Managers and practitioners should consider the concept of capability (value, empowerment and achievement) in management interventions and conceptualise occupation-specific competencies for use and development of knowledge and skills capabilities.

**Contribution/value-add:** This study contributes to scientific knowledge regarding the integration of specific competencies using the capability approach.

**Keywords:** 21st century; competency; capabilities approach; secondary school teacher; value; enablement; achievement; South Africa.

## Introduction

The education sector in South Africa is one of the most challenging work spheres (Ramdass, 2009) and a critical societal development pillar (Cilliers, 2020; Markle & Cilliers, 2020). Despite centralised education governance in South Africa, staggering inequality is found in different school contexts, affecting learners and teachers alike through hurdles to achieving quality education (Spaull, 2019). The global environment is increasingly becoming more dynamic and organisations (such as schools) must deal with discontinuity in work processes and fast-paced changes caused by technological development (Schwab, 2016), disruptive innovations, influential global competition, changes in governmental regulations and alterations in industry structures (Du & Chen, 2018). Furthermore, the lack of information and communication technology has exacerbated the paralysing effects of the COVID-19 pandemic on education in the majority of schools in South Africa (South African Department of Basic Education, 2020). Research has indicated that the South African education sector is not flourishing as it should, despite high investment in education (McWilliam, 2017; Pretorius, 2013; Van der Berg, 2008; Venter & Viljoen, 2020).

The unprecedented pace of change, coupled with the high rate of digitalisation and interlinking of the technological and biological spheres (Gallup, 2019; Schwab, 2016), requires different competencies from employees than was the case in the past. These competencies (which can be

referred to as 21st-century competencies) entail contemporary knowledge, skills and attributes needed to support individuals' learning and flourishing (McWilliam, 2017; Xu, David, & Kim, 2018). Therefore, it is essential to develop teachers' 21st-century competencies (Gordon et al., 2010; Lonka, 2018; Pellegrino & Hilton, 2013). Studies in sub-Saharan Africa (e.g. Tao, 2013) and specifically in South Africa (e.g. Van der Berg, Spaull, Wills, Gustafsson, & Kotzé, 2016) have attributed poor education quality to teacher-related factors. The Action Plan for 2030 (South African Department of Basic Education, 2020) outlines the improvement of teachers' professionalism, teaching skills, subject knowledge and computer literacy as an ongoing priority. Research has indicated that schools and teachers do not possess adequately rich teaching tools to make learning effective, they do not seem to be sufficiently self-confident in using these tools (Gordon et al., 2010) and every aspect of educational transformation depends on competent teachers' achievement (Eyre, 2016; Pretorius, 2013).

Recently, the capability approach applied to work led to a shift in thinking about occupational health psychology (Van der Klink et al., 2016). It considers the freedom and opportunity that employees have to exercise choice in matters relating to their jobs. Van der Klink (2019) maintained that the value of work can only be preserved if managers and leaders recognise that employees value their work (and specifically the use of knowledge and skills) and the development of new knowledge and skills) and are enabled to mine the value and achieve the unlocking of such value, therefore searching for work that fits their preferences and allows them to flourish (Abma et al., 2016). Therefore, this study deals with conceived 21st-century competencies that should best be transformed into employees' capabilities.

## Twenty-first-century competencies

The concepts of competence and competency have acquired importance in human resource management worldwide (Lozano, Boni, Peris, & Hueso, 2012). The term *competence* refers to the ability to successfully meet complex performance requirements and develop skill proficiency in a particular context through the mobilisation of psychosocial prerequisites (including both cognitive and noncognitive processes) (Rychen & Salganik, 2001; Stephenson & Yorke, 2012). A *competency* is defined as a collection of related knowledge, attitudes and skills that affects a job. Hence, it is a capacity or ability of related, but different, sets of behaviours that are organised around an underlying construct and reflect a person's maturity to perform in this area (Succar, Sher, & Williams, 2013). Competencies intend to afford the individual the needed knowledge, skills and attributes to solve problems that arise externally from other persons or establishments in society.

*Twenty-first-century competencies* is a concept that refers to an array of knowledge, skills and attributes needed for people to function and contribute to current and future society in a radically different work environment. The

notion of competency suggests more than just the attainment of needed knowledge and skills; it involves the application of the knowledge, skills, attitudes and values to meet multifarious demands (Organisation for Economic Co-operation and Development, 2018). Therefore, the competency approach has a significant bearing on ensuring a close correlation between the development of learners and potential work opportunities (Kyrychok, 2017). Various 21st-century competency frameworks have been conceptualised (Care, 2018), ranging from high-level to detailed analysis and focusing on different 21st-century competencies, including core, technology and digital and broader supporting competencies.

Table 1 summarises the results of 23 framework publications regarding 21st-century competencies applicable to secondary school teachers (SSTs). The information in the frameworks could not easily be compared because of differences in emphasis and lines of reasoning, but it was broadly groupable (Voogt & Roblin, 2012).

However, much controversy exists over the sufficiency of competency modelling to portray the full capacity needed to perform a job, even when attempts are made to use other methods (e.g. job analysis) to supplement competency thinking (Bromley, 2019). This study thus applied the *capability approach* (CA) (Sen, 1980, 1985, 1993) and, more specifically, the sustainable employability (SE) model dimensions of value, enablement and achievement that are measured in this model (Abma et al., 2016; Van der Klink et al., 2016) to transform competencies into capabilities. While acknowledging the significance of resources, the CA also indicates the significance of applied use-value and internal resources that affect the capabilities of individuals in terms of their abilities and opportunities to execute the behaviours that relate to a life they have reason to value (Bromley, 2019).

## From 21st-century competencies to capabilities

The CA outlines people's internal and external capacity to access and use afforded opportunities and resources (i.e. capabilities). Moreover, the CA focuses on making valued choices and having agency (Walker & Unterhalter, 2007; Wilson-Strydom & Walker, 2015) to action their choices effectively.

A key principle in the CA is the value attached to work and the tasks involved to support sustainable employability (SE) (Van der Klink et al., 2016). In SE literature, the reasoning for capability development is the creation of conditions that enable job incumbents to use their agency for various opportunities to create value for themselves and their employer, while maintaining well-being and attitudinal and motivational aspects (Fleuren, De Grip, Jansen, Kant, & Zijlstra, 2016) in order for them to remain sustainably employed in their organisation, to the benefit of both the organisation and the job incumbent.

**TABLE 1:** Synthesis of potential 21st-century competencies.

Competency	Description	Conceptual capability-functioning (CF) category
Identity (self-awareness) <sup>†</sup> 1,2,3,4,5,9,12,13,14,23	Awareness of self; impact of own thinking, feeling and behaviour values on self and others	<b>AUTONOMY</b> (enables the individual to effectively gauge value in own being and decide and act accordingly)
Decision-making and judgement or discernment <sup>†</sup> 1,2,4,5,6,10,13,15,16,17,20,22,23	Interpreting information; taking a view to action using reasonability and best practice principles	
Self-driven, initiating, regulating and motivating <sup>†</sup> 3,4,6,7,9,12,13,16,17,19,21,23	Mobilising and regulating the self towards a specific aim or purpose	
Critical thinking (analysis) <sup>†</sup> 3,4,6,9,11,12,13,16,17,21,23	Mentally processing information; reasoning; analysing, sifting and filtering	<b>COGNITIVE LITERACY</b> (enables the individual to apply mental energy effectively and use cognitive tools interactively)
Foundational literacy (reading, writing and numeracy) <sup>†</sup> 1,3,6,11,12,13,15,16,17,19,21,23	Proficiency in home language and other languages and numbers to interact in society	
Metacognitive literacy (understanding) <sup>†</sup> 4,5,6,9,12,13,14,15,17,21	Learning how to learn; thinking about thinking; and understanding being human	
Self-efficacy (self-enablement) <sup>†</sup> 2,3,4,5,6,9,12,13,14,17,23	Belief in own ability to deliver the needed, in spite of obstacles or hindrances; having the attitude of 'can-do, successfulness, effectiveness'	<b>COLLABORATION</b> (enables the individual to interact and work with others in heterogeneous groups)
Adaptability and flexibility <sup>†</sup> 3,4,6,9,10,12,13,14,15,17,21,23	Responding and adjusting to the context required with as little as possible negative effect for all stakeholders	
Communication <sup>†</sup> 1,2,3,4,6,9,13,14,15,16,17,20,21,22,23	Utilising verbal, written and other methods to transfer (cyclically sending, receiving and interpreting) necessary messages between stakeholders with a specific aim or purpose.	
Networking <sup>†</sup> 6,9,12,14,17,20,22	Seeking out, and engaging with, external stakeholders to widen knowledge and social platforms and tap potential for collaboration	<b>CONSTRUCTIVE RELATIONSHIPS</b> (enable the individual to live with and relate to others)
Influencing and participating <sup>†</sup> 1,3,4,6,7,9,10,12,13,14,15,16,17,18,20,21,23	Willingly persuading and mobilising others, while being part of initiatives and actions with a specific aim	
Engagement with stakeholders at diverse levels (self, learners, colleagues and peers, school leadership team, parents, broader community) <sup>†</sup> 1,2,3,4,5,6,7,9,13,14,15,16,18,21,22,23	Intentional, inclusive and interactive engagement with other stakeholders at diverse levels of the system or organisation	
Emotional maturity (functionality) <sup>†</sup> 4,6,7,9,10,12,13,14,16,18,19,23	Resilience, emotional intelligence and ability to feel emotion and understand emotion in others, responding appropriately to a stimulus	<b>CONTEXTUALISATION</b> (enables the individual to be aware of and include the local and broader system context)
Presence (being present and responsive) <sup>†</sup> 5,6,10,12,13,15,19,23	Psychologically available, not absent at any level (physical, mental, emotional and other) Engaged in the task and relationships required in the moment	
Civic or societal structure <sup>†</sup> 1,3,4,5,6,9,10,11,13,22,23	Understanding the different ways society organises itself at local, provincial, national, international and global levels	
Awareness, appreciation and incorporation of cultural context (history) <sup>†</sup> 1,3,4,5,6,7,9,10,11,12,13,14,15,17,20,21,23	Considering the impact of different ways of thinking, feeling and behaviours on culture and other historical constructs	<b>DIGITAL LITERACY</b> (enables the individual to effectively use digital tools interactively)
Awareness, appreciation and incorporation of economic context (finance) <sup>†</sup> 3,9,10,11,12,13,14,17	Considering the impact of different ways of thinking, feeling, and behaviours on the economy and other financial constructs	
Awareness, appreciation and incorporation of environmental context (nature) <sup>†</sup> 1,2,5,9,10,11,12,13,14,16	Considering the impact of different ways of thinking, feeling and behaviours on the environment and other natural constructs	
Awareness, appreciation and incorporation of time as a continuum (past-present-future) <sup>†</sup> 6,9,10,12,22	Considering the past, present and future in any thinking, feeling or behaviours	
Awareness, appreciation and incorporation of social context (relations) <sup>†</sup> 1,3,4,5,6,9,10,11,12,13,14,15,17,20,21,23	Considering the impact of different ways of thinking, feeling and behaviours on relationships and other social constructs	
Information technology literacy <sup>†</sup> 3,4,5,6,7,9,13,15,16,17,19,23	Proficiency in IT concepts, principles, processes and application	<b>EDUCATION LITERACY (TEACHING)</b> (enables the individual to effectively use teaching and learning tools interactively)
Application of information and communication technology (ICT) <sup>†</sup> 3,4,5,6,7,9,15,16,17,19,21,23	Incorporating ICT into everyday practices	
Digital self-regulation and management <sup>†</sup> 3,4,6,7,15,16,17,19	Working with digital technology and platforms in a way that enhances the well-being of the self and others	
Field literacy (discipline-specific) <sup>†</sup> 3,4,6,9,10,11,12,13,14,15,17,18,19,21,23	Competence in a specific field, incorporating science, technology, engineering, artistic innovation and mathematics (STEAM) into thinking and practice	<b>MINDFULNESS</b> (enables the individual to effectively take responsibility)
Assessment literacy (monitoring and evaluating) <sup>†</sup> 3,6,7,9,11,13,14,15,17,18,19,20	Identifying and using the best methods for the evaluation and monitoring of progress towards a specific goal(s)	
Resource management (stewardship), including individualised approaches and variety in methods <sup>†</sup> 4,5,6,7,9,15,17,18,19	Organising, managing and using different resources and capital (human, material, methodological, intellectual and other).	
Epistemic and procedural literacy (pedagogical content knowledge) <sup>†</sup> 3,5,6,7,9,12,13,14,15,17,18,19	Identifying and using the best methods to transfer learning to others	<b>PERSONAL AND PROFESSIONAL DEVELOPMENT</b> (enables the individual to effectively develop and grow sustainably on a personal and professional level)
Capability conversion <sup>†</sup> 3,5,6,9,14	Bring about development that translates into valued behaviours and competence	
Evaluation and reflection <sup>†</sup> 1,6,7,9,14,13,15,16,17	Monitoring and evaluating the value of tasks and intervention in order to improve on or source best practice. Includes action research	
Sustainability focus <sup>†</sup> 1,2,3,4,6,9,12,15,17,22	Incorporating thinking and practices that lead to long-term well-being and benefit for all stakeholders	<b>PERSONAL AND PROFESSIONAL DEVELOPMENT</b> (enables the individual to effectively develop and grow sustainably on a personal and professional level)
Well-being (physical, mental, spiritual and emotional) <sup>†</sup> 1,2,3,4,6,7,9,12,14,15,16,17,19	Functioning in a way that intentionally focuses on the well-being of self and others at all levels	
Values, virtues, ethics, morals and maturity <sup>†</sup> 2,3,4,6,7,9,10,11,12,13,14,15,22	Considering consequences of endeavours in terms of their impact on all the different stakeholders and acting for the greater good	
Work-life balance <sup>†</sup> 4,9	Constructing an effective equilibrium between personal and professional aspects of life	<b>PERSONAL AND PROFESSIONAL DEVELOPMENT</b> (enables the individual to effectively develop and grow sustainably on a personal and professional level)
Lifelong learning and education <sup>†</sup> 1,2,3,5,6,7,12,15,17,18,19,20,23	Keeping on learning and growing professionally and personally in order to function effectively	
Mentorship and guidance <sup>†</sup> 3,6,7,9,15,20	Growing professionally and personally by learning from certain relevant others (e.g. experts and peers) and modelling to others	

Table 1 continues on the next page →

**TABLE 1 (Continues...):** Synthesis of potential 21st-century competencies.

Competency	Description	Conceptual capability-functioning (CF) category	
Managing change <sup>†9,10,14,17,20</sup>	Implementing and responding to changes in an effective way	<b>PRODUCTIVITY</b> (enables the individual to effectively create new value)	
Entrepreneurial inclination or mindset <sup>†2,3,6,7,9,17,21</sup>	Constructively initiating new ventures, being willing to take risks and experimenting in order to progress and develop		
Innovative or creative thinking <sup>†2,3,4,6,7,9,10,12,13,15,16,20,21,23</sup>	Thinking beyond the existing practices to develop new ways of functioning effectively		
Learning-centred approach <sup>†1,7,9,13,15,17,18,22</sup>	Curiosity, agile learning and embedding learning through deep learning practice		
Relevance (contextual, quality, and standards) <sup>†3,6,9,15</sup>	Ensuring that an endeavour is relevant at all levels to the context at hand		
Producing results <sup>†1,3,6,7,9,10,13,14,15,16,17,20,21</sup>	Delivering on and achieving specific aims or goals		
Design thinking <sup>†6,7,9,15,16,17,20,21,22</sup>	Incorporating essential planning elements into any endeavour		
Interdisciplinary transference (holistic perspective) <sup>†2,6,9,10,12,13,15,16,21,22</sup>	Transferring learning in one area of learning or teaching to another as appropriate		
Balancing competing or contrasting demands <sup>†4,5,6,9,12,13,15,21</sup>	Identifying tensions between aspects in different spheres of life and dealing constructively with these to create a functional equilibrium		<b>PROCESS(ING)</b> (enables the individual to effectively use processes and structures)
Integrative or systemic thinking (recognising connections) <sup>†6,7,9,10,13,14,16,20,22</sup>	Recognising connections between different fields and understanding how inputs in one part of the system affect other parts of the system		
Problem-solving <sup>†1,3,4,5,6,7,9,11,12,13,16,17,21,22,23</sup>	Identifying, grappling with and implementing solutions to obstacles in order to function effectively		
Project or enquiry-based learning <sup>†6,9,13,22</sup>	Working with a focus to investigate and respond to a complex question, problem or challenge		

†, Numbers given as listed in Appendix 1.

Both the *competence approach* and *CA* recognise the significance of addressing the individual's rational, emotional and social dimensions. Therefore, both assist in understanding how employees' performance could be improved. The *capability for work* framework (Van der Klink, 2019) is an appropriate outline for studying the functioning of employees, but it lacks specificity regarding the specific competencies (knowledge and skills) needed to feel good and function well, rendering employees more capable of performing well. For example, the Capability for Work Questionnaire (Abma et al., 2016) measures using and developing knowledge, skills and attitudes without being specific about which knowledge, skills and attitudes are relevant. Therefore, the information contained in, for instance, 21st-century competency frameworks could serve as the foundation for understanding capabilities in learning and teaching.

## Current study

According to previous research reports, there are differences between how teachers and policymakers interpret teachers' work and what is valued and considered to be good-quality teaching from the policymakers' and teachers' perspectives, respectively (Buckler, 2012). Hence, it is vital to gauge teachers' perspectives of their capability in terms of 21st-century competencies that contribute to their functioning, especially in the sub-Saharan African region that experiences poor educational outcomes (Cilliers, 2020). Being faced with competing demands between the contextualised education needed for the African context and the 21st-century competencies developed in Western context, researchers are tasked to find the best alternative for Africa to create the necessary capabilities, if they intend to develop and realise contextually valued capabilities and explore educational options for emancipation and achievement of true African identity (Woolman, 2001).

Although the competency approach is essential for conceptualising, measuring and developing SSTs to fulfil

their roles, this study goes one step further and translates competencies into capabilities; showing how competencies are valued, applied and achieved by SSTs. Abma et al. (2016) found that using and developing knowledge and skills were pertinent capabilities of employees, but their research did not go as far as to conceptualise the specific knowledge and skills that employees might value. Different jobs may require different knowledge and skills. From a CA perspective, individuals will become more capable when their competencies are valued, when they are enabled to use them and when they achieve success in using the competencies. It is essential to create the conditions for employees to feel valued and believe that they are adding value (Prillientensky & Prillientensky, 2021).

In the broader context of sub-Saharan African developing countries, studies have roughly positioned teachers as either being the reason for poor education quality, as evidenced in citations of absenteeism, rote teaching and keeping back content or of being the sufferers of a defective system, which is revealed through expositions of teachers' impoverished working and living conditions (Tao, 2013, 2014). What seems to be missing from research is an explicit connection between what teachers value, their conditions of service and their criticised behaviours (Tao, 2013). Tao (2013) mentioned that many of these actions are explained as acts predominantly governed by 'culture' or 'opportunism'. However, these actions diminish teachers' behaviours to either products of cultural edifices (thereby overlooking teachers' capacity for deliberation and agency) or the outcome of voluntarist action only (which does not pay enough attention to social arrangements in society). Technocratic fixes that rely on technology and technical expertise to bring solutions rarely work because they are unsuccessful in considering the challenging working and living conditions that teachers must bear (Tao, 2013) or teachers' value to various parts of their job (Buckler, 2012).

This study aimed to investigate 21st-century competencies as capabilities of SSTs in a South African context.

## Research design

This study entailed a quantitative, cross-sectional design.

### Research approach

A survey design was used by developing and implementing a survey. Cross-sectional surveys suit descriptive and predictive functions of correlational research and are efficient when resources are scarce (Creswell & Creswell, 2018).

### Research method

This study applied the 21st-century Competency – Capabilities Questionnaire (21CCQ) to SSTs.

### Participants

The population for this study included all SSTs in three districts of Tshwane, Gauteng (North, South and West). Table 2 indicates the demographic variables of the participants. A total of 36 (17.9%) of the participants were employed in the Tshwane North district, while 160 (79.6%) were employed in Tshwane South and five (2.5%) in Tshwane West. For those who indicated what language English was for them, 17 (16.7%) indicated English as their home language. Unfortunately, the voluntary nature of participation in the study and the demands on teachers because of the COVID-19 pandemic made it exceedingly difficult to obtain participants. In addition, the sample was small because school principals and teachers were under pressure to cover the curriculum in a brief period when data collection took place. Furthermore, the social distancing

**TABLE 2:** Characteristics of participants ( $N = 144$ ).

Demographic	Grouping	<i>N</i>	%
Gender ( $N = 99$ )	Male	31	31.3
	Female	68	68.7
Age group ( $N = 101$ )	18–24 years old	8	7.9
	25–34 years old	40	39.6
	35–44 years old	16	15.8
	45–54 years old	28	27.7
	55–64 years old	9	8.9
	65+ years old	0	0.0
Years teaching (experience) ( $N = 100$ )	Less than 1 year	10	10.0
	1 to 3 years	24	24.0
	4 to 13 years	36	36.0
	14 to 24 years	17	17.0
	25 or more years	13	13.0
Ethnicity ( $N = 101$ )	Black people	74	73.3
	Asian people	0	0.0
	Mixed race people	2	2.0
	Indian people	0	0.0
	White people	23	22.8
	Other	2	2.0
Highest teaching qualification ( $N = 103$ )	Certificate (1 year)	4	1.9
	Diploma	15	7.2
	Graduate degree	49	23.7
	Honour's-level degree	29	14.0
	Master's-level degree	3	1.4
	Doctoral-level degree	0	0.0
	Other	3	1.4

protocols prescribed during the COVID-19 pandemic lockdown made it challenging to obtain more participants. According to the South Africa Department of Basic Education Electronic Management Information System (SADBE EMIS, 2018), there are 8797 SSTs in the Tshwane districts, clustered in 218 secondary schools. The response rate equated to 1.64%.

### Measuring instruments

The 21st-century *Competency – Capabilities Questionnaire* (21CCQ) comprised thirteen 21st-century competency (21CC) categories, with three questions relating to capacity in respect of each competency, namely, a value component (e.g. 'Personally, how important is it to you to be effective in this aspect?'), an enablement component (e.g. 'Does your work offer you enough opportunity to use this aspect?') and an achievement component (e.g. 'Do you feel confident about your ability to be competent in this aspect?'). The items were measured on a scale varying from 1 (*not at all*) to 5 (*very much so*). Each of the 13 dimensions consisted of three to seven items: autonomy (AU; five items, e.g. 'Make your own decisions'); processing (PR; five items, e.g. 'Use provided structures and processes in your job'); cognitive literacy (CL; five items, e.g. 'Read and write in another world language'); digital literacy (DL; five items, e.g. 'Understand how digital technology and platforms work'); education literacy (EL; six items, e.g. 'Be competent in a specific field or discipline in your work'); constructive relationships – general (CR1; four items, e.g. 'Engage with others in an emotionally mature manner'); constructive relationships – levels (CR2; four items, e.g. 'Engage with people who have authority over you'); collaboration – drive (CO1; four items, e.g. 'Meet and network with many different people as part of your work'); collaboration – other-focus (CO2; three items, e.g. 'Adapt according to the needs of other people'); contextualisation (CX; five items, e.g. 'Be aware of and incorporate the culture and history of the people with whom you work'); productivity (PD; seven items, e.g. 'Produce noticeable results as part of your work'); mindfulness (MI; seven items, e.g. 'Consider values, virtues, ethics and morals as part of your job'); and personal and professional development (PP; four items, e.g. 'Engage in constant learning and education to develop yourself').

### Research procedure

Teachers from both public (state-controlled) and independent (privately governed) secondary schools were included, but teachers from schools that cater for Learners with Special Education Needs (LSEN) were excluded. The data collection phase coincided with the start of the ongoing COVID-19 pandemic lockdown period in South Africa, necessitating remote communication and data gathering. Introductory materials (an introductory presentation to principals, a video explaining the study and e-posters for the teachers) were developed and made accessible electronically. The questionnaires were administered on both an electronic platform and in paper format between June 2020 and July 2021. As a result of restrictions placed on physical proximity

by the COVID-19 pandemic, school principals as gatekeepers were contacted telephonically and via e-mail to introduce the study and request participation.

All schools in the districts that were contactable were included for potential participation. In total, 117 (53.9%) school principals were reached for participation. A letter of goodwill and a school questionnaire were submitted to the principal. The survey was made available to school principals to distribute to their teaching staff. In addition, the school principals mediated contact with SSTs. Finally, the data were captured electronically on Microsoft Excel. In the case where respondents left out answers, the missing data was dealt with using complete case (or available case) analysis (listwise deletion) by omitting the cases with missing data, while analysing the remaining data.

### Data analysis

Mplus 8.6 (Muthén & Muthén, 1998–2021) and SPSS 27 (IBM Corp., 2021) were used to analyse the results. The measurement models were evaluated using the weighted least square mean and variance adjusted (WLSMV) estimator in Mplus 8.6 (Muthén & Muthén, 1998–2021). The following indices were used to assess the fit of the models: chi-square ( $\chi^2$ ), the standardised root mean square residual (SRMR), the root mean square error of approximation (RMSEA), the Tucker–Lewis index (TLI) and the comparative fit index (CFI). Lower values indicate a better fit on all the indices, except for the CFI and TLI, where higher values indicate better fit (Wang & Wang, 2020).

Abma et al. (2016) suggested a procedure where a summary score was calculated for each capability aspect to assess whether it formed part of the teacher's capability set. A capability aspect (range 1 to 5) was included in a teacher's capability set if the teacher regarded and scored the aspect as important ( $A = 4$  to  $5$ ) was enabled to achieve it ( $B = 4$  to  $5$ ) and succeeded in achieving it ( $C = 4$  to  $5$ ). Teachers who found an aspect important but lacked the opportunity to realise it or failed to realise it might demonstrate ineffective functioning, while teachers who regarded a capability aspect as important, were enabled to realise it and succeeded in achieving it might function

well. In cases where teachers responded as follows, a capability aspect was not considered part of the capability set: (1) the capability was important ( $A = 4$  to  $5$ ), but the workplace was not providing enough opportunities ( $B \leq 3$ ); (2) the capability aspect was important ( $A = 4$  to  $5$ ), but the person could not achieve it ( $C \leq 3$ ); or (3) the workplace offered sufficient opportunities ( $B = 4$  to  $5$ ), but the person could not achieve the aspect ( $C \leq 3$ ).

### Ethical considerations

Before the commencement of the study, ethical clearance was obtained from a higher education institution. Ethical approval was granted by the Health Research Ethics Committee (HREC) at North-West University (reference number: NWU- 00430-19-A1). Permission for the study was obtained from the research division of the Gauteng Department of Education (GDE).

## Results

Results were statistically analysed using confirmatory factor analysis (CFA), phi coefficients and mean scores.

### Confirmatory factor analysis, reliability and correlations

Confirmatory factor analysis was undertaken to assess the fit of the measurement model of the different 21CCs identified, based on the value component of each. Items that excessively weakened the value component of each dimension in the model were removed. Two dimensions showed loadings onto more than one factor and were processed as such: the constructive relationships capability indicated a 'general' component (items that had to do with relationships in general) and a 'levels' component (items that had to do with relationships at different levels of authority in relation to the person), and the collaboration capability indicated a 'drive' component (where the individual collaborated for the sake of the energy the person got from collaboration) and an 'other focus' component (where the focus of collaboration was on capacitating other people). Table 3 provides the CFA statistics.

**TABLE 3:** Confirmatory factor analysis characteristics of the value component of each 21CC dimension.

Value component	$\chi^2$	df	P	CFI	TLI	RMSEA	SRMR	$\beta$ -values
Autonomy	2.600	2	0.27	0.99	0.99	0.06	0.02	0.72 to 0.88
Processing	2.97	2	0.23	0.99	0.98	0.07	0.02	0.66 to 0.81
Cognitive literacy	16.74	2	0.00	0.92	0.77	0.28	0.07	0.15 to 0.94
Digital literacy	6.23	2	0.04	0.99	0.97	0.15	0.03	0.67 to 0.95
Education literacy	8.63	8	0.37	0.99	0.99	0.03	0.03	0.72 to 0.89
Constructive relationships – general	6.23	2	0.04	0.99	0.97	0.15	0.03	0.63 to 0.90
Constructive relationships – authority	6.23	2	0.04	0.99	0.97	0.15	0.03	0.75 to 0.81
Collaboration – drive	24.71	13	0.03	0.99	0.98	0.10	0.05	0.75 to 0.93
Collaboration – other focus	24.71	13	0.03	0.99	0.98	0.10	0.05	0.70 to 0.95
Contextualisation	3.848	4	0.43	1.00	1.00	0.00	0.03	0.77 to 0.91
Productivity	3.81	2	0.15	0.99	0.99	0.11	0.02	0.78 to 0.93
Mindfulness	9.06	5	0.11	0.99	0.99	0.10	0.03	0.70 to 0.89
Personal and professional development	2.89	2	0.24	0.99	0.99	0.07	0.02	0.69 to 0.89

$\chi^2$ , chi-square; CFI, comparative fit index; TLI, Tucker–Lewis index; RMSEA, root mean square error of approximation; SRMR, standardised root mean square residual.

**TABLE 4:** Factor loadings and reliabilities for the 21st-century competencies as capability dimensions.

21CC dimension	Dimension items	Value (NB)		Enablement (OP)		Achievement (IM)	
		Factor loading	$\omega$	Factor loading	$\omega$	Factor loading	$\omega$
Autonomy† (AU)	(TC) Think critically and analytically	0.83	0.83	0.67	0.84	0.60	0.76
	(SD) Be self-driven and motivated	0.72		0.68		0.68	
	(OD) Make your own decisions	0.64		0.80		0.67	
	(JD) Use your own judgement and discernment	0.76		0.86		0.69	
Processing‡ (PR)	(SP) Solve problems in your job	0.76	0.78	0.80	0.86	0.73	0.77
	(IC) Integrate and make connections between varying aspects of the job	0.71		0.87		0.68	
	(WP) Work on a specific project or theme in your job	0.63		0.67		0.62	
	(ST) Use provided structures and processes in your job	0.64		0.75		0.68	
Cognitive literacy§ (CL)	(WL) Read and write in a world language	0.05	0.56	0.41	0.73	0.28	0.63
	(MA) Use maths concepts as part of the job	0.23		0.37		0.34	
	(UL) Understand how learning works	0.84		0.80		0.98	
	(UT) Understand how thinking works	0.81		0.90		0.50	
Digital literacy¶ (DL)	(DT) Understand how digital technology and platforms work	0.62	0.81	0.87	0.85	0.93	0.82
	(IT) Use ICT as part of your job	0.74		0.71		0.75	
	(RI) Manage and regulate the use of digital information as part of your job	0.90		0.81		0.65	
	(TT) Keep up to date with new teaching technology	0.59		0.68		0.60	
Education literacy†† (EL)	(CD) Be competent in a specific field or discipline	0.77	0.87	0.65	0.80	0.59	0.85
	(TK) Transfer knowledge, skills and abilities to other people	0.85		0.73		0.58	
	(MT) Use different methods to teach concepts	0.69		0.69		0.88	
	(ME) Monitor, assess and evaluate progress or performance	0.77		0.70		0.85	
	(FL) Facilitate learning in others	0.70		0.58		0.73	
Constructive relationships – general‡‡ (CR1)	(EE) Engage with others in an emotionally mature manner	0.61	0.71	0.56	0.77	0.70	0.75
	(BR) Be intentional about building and maintaining relationships as part of your work	0.61		0.91		0.76	
	(DI) Have interactions with diverse types of people as part of your work	0.79		0.69		0.65	
Constructive relationships – levels§§ (CR2)	(SA) Engage with people who are at the same level of authority as you	0.77	0.77	0.76	0.78	0.66	0.75
	(LA) Engage with people over whom you have authority	0.74		0.78		0.80	
	(HA) Engage with people who have authority over you	0.67		0.68		0.65	
Collaboration – drive (CO1)	(NW) Meet and network with many different people as part of your work	0.72	0.84	0.72	0.86	0.68	0.81
	(IP) Influence or persuade other people as part of your work	0.73		0.92		0.86	
	(GP) Be part of, and play a role in, group projects	0.77		0.78		0.71	
	(EX) Engage with content and people that fall outside your field of expertise	0.77		0.70		0.64	
Collaboration – other-focus (CO2)	(AN) Adapt according to the needs of other people	0.63	0.80	0.75	0.85	0.69	0.81
	(TW) Work in a team with other people as part of your work	0.89		0.81		0.80	
	(CO) Communicate in many ways (such as verbally, written, digitally and others) as part of your work	0.74		0.85		0.80	
Contextualisation¶¶ (CX)	(SS) Be aware of and incorporate the social structures of the people with whom you work	0.76	0.82	0.85	0.85	0.74	0.85
	(CH) Be aware of and incorporate the culture and history of the people with whom you work	0.78		0.80		0.89	
	(EN) Be aware of and incorporate environmental and natural factors in your work	0.78		0.78		0.81	
	(PF) Be aware of and understand the past, present and future of the context in which you work						
Productivity††† (PD)	(IN) Incorporate innovative or creative thinking as part of your job	0.72	0.86	0.66	0.84	0.78	0.86
	(SY) Include thinking about the entire system in which you work as part of your job	0.83		0.81		0.86	
	(RL) Ensure that results or performance is relevant to the context in which it is produced	0.84		0.84		0.81	
	(CM) Be aware of and manage change in ways of doing as part of your job	0.71		0.68		0.65	
Mindfulness‡‡‡ (MI)	(VE) Consider values, virtues, ethics and morals as part of your job	0.69	0.85	0.44	0.89	0.63	0.87
	(PW) Intentionally focus on your physical well-being and that of others	0.60		0.80		0.74	
	(MW) Intentionally focus on your mental well-being and that of others	0.73		0.86		0.83	
	(SW) Intentionally focus on your spiritual well-being and that of others	0.79		0.86		0.69	
	(EW) Intentionally focus on your emotional well-being and that of others	0.82		0.87		0.86	
Personal and professional development (PPD)	(LD) Engage in constant learning and education to develop yourself	0.65	0.80	0.88	0.87	0.74	0.83
	(MG) Receive mentorship and guidance from superiors and experts	0.86		0.81		0.79	
	(VO) Be able to convert your own and others' abilities into valued outcomes	0.56		0.69		0.67	
	(BA) Have a reasonable balance between work and other areas of your life	0.72		0.78		0.78	

†, One item removed = (ID) Know and develop your own identity.

‡, One item removed = (BD) Balance competing or contrasting demands in your job.

§, One item removed = (HL) Read and write in your home language.

¶, One item removed = (PD) Programme and design on digital platforms (such as doing macro-functions or running programming script) as part of your work.

††, One item removed = (MR) Manage inventories, materials, stock and other resources as part of your work.

‡‡, One item removed = (PR) Be present (e.g. not being absent or distracted or preoccupied) as part of your work.

§§, One item removed = (CO) Engage with people in the broader community outside your direct work.

¶¶, Two items removed = (EC) Be aware of and incorporate the economic (financial) context in which you work and (PF) Be aware of and understand the past, present and future of the context in which you work.

†††, Three items removed = (LL) Have a learn-as-you-work approach as part of your work; (RS) Produce noticeable results as part of your work; and (EN) Use entrepreneurial skills and an entrepreneurial mindset as part of your job.

‡‡‡, Two items removed = (EP) Reflect on and evaluate practices that form part of your job; and (LW) Incorporate thinking and practices that lead to long-term well-being and benefit for all stakeholders.

These values indicated a just acceptable fit between the dimension models and the observed data (Shevlin & Miles, 1998).

Table 4 demonstrates that the factor loadings on items were all indicated to be within the acceptable range of 0.45 to 0.80 (Field, 2016). Concerning the cognitive literacy dimension, two items showed lower loadings, but they were kept in because of their criticality to education, namely being able to converse in a world language and using mathematical concepts as part of one's job. Most capability dimensions showed acceptable reliability coefficients against the cut-off value of 0.70 (Nunnally & Bernstein, 1994).

Phi coefficients correlations were used to indicate correlations between the variables at a nominal level (i.e. the competency capabilities). Point-biserial correlations were computed to show the associations between competency capabilities and the capability set. Table 5 indicates that correlations between the different capability dimensions ranged between 0.24 and 0.57, with all correlations being indicated as statistically significant.

### Descriptive statistics of the 21st-century competency capabilities

The participants rated each capability on three dimensions: value (importance), opportunity (enablement) and achievement (succeeding). The mean ratings as provided by the respondents are provided in Table 6.

Table 6 reveals that, in terms of 21CC capabilities, the following percentages of SSTs reported placing a high *value* on the different 21CC capability components (from the highest to the lowest percentage): educational literacy (85.7%), collaboration – other focus (84.3%), constructive relationships – general (84.3%), constructive relationships – levels (82.9%), autonomy (81.4%), mindfulness (81.4%), personal and professional development (81.4%), productivity (78.6%), digital literacy (72.9%), contextualisation (71.4%),

processing competency (70.0%), cognitive literacy (67.1%) and collaboration – drive (58.6%).

Regarding *opportunity* (enablement of values), the following percentages (from the highest to the lowest percentage) show the SSTs who reported being enabled in the different 21CC capability components: collaboration – other focus (77.1%), constructive relationships – levels (75.7%), contextualisation (65.7%), educational literacy (72.9%), constructive relationships – general (67.1%), productivity (65.7%), autonomy (64.3%), digital literacy (61.4%), processing competency (57.1%), collaboration – drive (57.1%), cognitive literacy (55.7%), personal and professional development (55.7%) and mindfulness (54.3%).

Finally, concerning *achievement*, the following percentages (from the highest to the lowest percentage) of SSTs reported being able to succeed in achieving each of the 21CC capability components: constructive relationships – general (82.9%), autonomy (77.1%), collaboration – other focus (75.7%), mindfulness (72.9%), personal and professional development (71.4%), educational literacy (71.4%), constructive relationships – levels (70.0%), processing competency (67.1%), collaboration – drive (65.7%), contextualisation (65.7%), productivity (65.7%), cognitive literacy (58.6%) and digital literacy (51.4%).

Table 6 indicates that when all three elements (value, opportunity and achievement) were considered in combination, the percentages of teachers from whom 21CC capabilities were included in each of the measured capabilities were as follows: collaboration – other focus (67.1%), constructive relationships – levels (64.3%), educational literacy (62.9%), constructive relationships – general (60.0%), productivity (58.6%), autonomy (57.1%), collaboration – drive (51.4%), contextualisation (54.3%), mindfulness (50.0%), processing competency (48.6%), personal and professional development (48.6%), cognitive literacy (47.1%) and digital literacy (47.1%).

**TABLE 5:** 21CC capabilities phi coefficients and point-biserial correlations.

Variable	AU	PR	CL	DL	EL	CR1	CR2	CO1	CO2	CX	PD	MI	PP
PR	0.57**	-	-	-	-	-	-	-	-	-	-	-	-
CL	0.39**	0.35**	-	-	-	-	-	-	-	-	-	-	-
DL	0.30**	0.22*	0.30**	-	-	-	-	-	-	-	-	-	-
EL	0.32**	0.37**	0.26*	0.53**	-	-	-	-	-	-	-	-	-
CR1	0.34**	0.26*	0.33**	0.25*	0.38**	-	-	-	-	-	-	-	-
CR2	0.34**	0.29**	0.43**	0.36**	0.51**	0.54**	-	-	-	-	-	-	-
CO1	0.37**	0.37**	0.35**	0.32**	0.29**	0.57**	0.51**	-	-	-	-	-	-
CO2	0.30**	0.35**	0.42**	0.47**	0.43**	0.47**	0.45**	0.57**	-	-	-	-	-
CX	0.55**	0.44**	0.37**	0.40**	0.34**	0.38**	0.39**	0.47**	0.51**	-	-	-	-
PD	0.25*	0.40**	0.49**	0.24*	0.48**	0.38**	0.42**	0.33**	0.48**	0.47**	-	-	-
MI	0.46**	0.33**	0.52**	0.39**	0.40**	0.29*	0.47**	0.40**	0.55**	0.50**	0.50**	-	-
PP	0.42**	0.38**	0.31**	0.32**	0.29*	0.35**	0.29*	0.43**	0.36**	0.50**	0.32**	0.57**	-
CAPSET	0.32**	0.38**	0.39**	0.38**	0.30**	0.30**	0.29**	0.37**	0.29**	0.35**	0.34**	0.41**	0.41**

AU, autonomy; PR, processing; CL, cognitive literacy; DL, digital literacy; EL, education literacy; CR1, constructive relationships – general; CR2, constructive relationships – levels; CO1, collaboration – drive; CO2, collaboration – other-focus; CX, contextualisation; PD, productivity; MI, mindfulness; PP, personal and professional development.

\*,  $p \leq 0.05$  level (two-tailed).

\*\*,  $p \leq 0.01$  level (two-tailed).

**TABLE 6:** Mean ratings and capability by dimension and combined total.

21CC capability	Capability means (maximum = 5)						Capability percentages (scored)				
	N	Value mean	Enable mean	Achieve mean	Combined mean	s.d.	Report	Value	Enable	Achieve	Com
AU	110	4.39	3.89	4.15	4.15	0.52	Capable	81.4	64.3	77.1	57.1
							Not capable	18.6	35.7	22.9	42.9
PR	105	4.08	3.78	3.92	3.92	0.62	Capable	70.0	57.1	67.1	48.6
							Not capable	30.0	42.9	32.9	51.4
CL	107	4.04	3.81	3.87	3.90	0.67	Capable	67.1	55.7	58.6	47.1
							Not capable	32.9	44.3	41.4	52.9
DL	102	4.24	3.89	3.79	3.97	0.70	Capable	72.9	61.4	51.4	47.1
							Not capable	27.1	38.6	48.6	52.9
EL	104	4.41	4.11	4.07	4.19	0.58	Capable	85.7	72.9	71.4	62.9
							Not capable	14.3	27.1	28.6	37.1
CR1	97	4.37	4.10	4.24	4.24	0.52	Capable	84.3	67.1	82.9	60.0
							Not capable	15.7	32.9	17.1	40.0
CR2	97	4.22	4.08	4.02	4.09	0.64	Capable	82.9	75.7	70.0	64.3
							Not capable	17.1	24.3	30.0	35.7
CO1	94	4.03	3.79	3.85	3.89	0.70	Capable	58.6	57.1	65.7	51.4
							Not capable	41.4	42.9	34.3	48.6
CO2	94	4.36	4.06	4.16	4.18	0.62	Capable	84.3	77.1	75.7	67.1
							Not capable	15.7	22.9	24.3	32.9
CX	93	4.05	3.93	3.92	3.99	0.74	Capable	71.4	65.7	65.7	54.3
							Not capable	28.6	34.3	34.3	45.7
PD	86	4.22	4.05	4.09	4.14	0.62	Capable	78.6	65.7	65.7	58.6
							Not capable	21.4	34.3	34.3	41.4
MI	86	4.26	3.82	4.12	4.06	0.58	Capable	81.4	54.3	72.9	50.0
							Not capable	18.6	45.7	27.1	50.0
PP	88	4.25	3.83	4.11	4.05	0.59	Capable	81.4	55.7	71.4	48.6
							Not capable	18.6	44.3	28.6	51.4

AU, autonomy; PR, processing; CL, cognitive literacy; DL, digital literacy; EL, education literacy; CR1, constructive relationships – general; CR2, constructive relationships – levels; CO1, collaboration – drive; CO2, collaboration – other-focus; CX, contextualisation; PD, productivity; MI, mindfulness; PP, personal and professional development.

## Discussion

This study aimed to identify and measure the 21CC capabilities of SSTs – valued aspects of work that were enabled and could be achieved. Confirmatory factor analysis confirmed 13 21CC capability dimensions.

The results indicated that 70.0% to 85.7% of the SSTs valued each of the 13 21CC capabilities. Education literacy was valued by most of the teachers. However, the smallest number of teachers valued processing. The enablement responses indicated that 54.3% to 77.1% of SSTs perceived themselves as enabled in each of the 13 capabilities. Most of the teachers indicated enablement concerning collaboration – other focus. However, the lowest enablement was reported for mindfulness. From 51.4% to 82.9% of the teachers reported successfully achieving the 13 capabilities. Constructive relationships – general was a capability for most teachers, while digital literacy was achieved by the lowest number of SSTs. When the three elements (value, opportunity and achievement) were combined in capabilities, 64.3% of the respondents reported overall capability in constructive relationships – levels (most reported) and 47.1% in cognitive literacy and digital literacy (least reported).

The given discussion indicates that most teachers reported all 13 of the 21CC values as being important to them. They valued autonomy, constructive relationships – general and collaboration – other focus as most important, although

education literacy, constructive relationships – levels, collaboration – other focus, mindfulness and personal and professional development were also important to more than 80% of the teachers. The enablement and opportunities to realise their value were considerably lower for all thirteen 21CC dimensions but even more so for mindfulness, cognitive literacy, personal and professional development, processing and collaboration – drive. Achievement of capabilities showed the same pattern as enablement: the achievement was considerably lower than the importance for all seven 21CC dimensions but specifically for digital literacy and cognitive literacy. The discrepancy in value, enablement and achievement supports other capability approach findings in the SSA secondary (Chigona & Chigona, 2010) and primary school (Buckler, 2012) spheres where the official capability factors differ from the list of teacher-generated capability factors, showing possible misalignments between what teachers value and what the system supports them to achieve and discrepancies between the quality of teaching that teachers feel they are providing versus what those who employ them think they achieve (Buckler, 2016).

The participants perceived their capabilities to be in the range of just below average to high average in all the 21CC capabilities. However, less capability was indicated regarding cognitive literacy, digital literacy, processing and personal and professional development. Overall, the value attached to capabilities was generally higher than the opportunity and achievement of these capabilities. These

results concur with findings in previous studies (Abma et al., 2016; Buckler, 2012; Chigona & Chigona, 2010; Eyre, 2016). The findings also indicate that SSTs reported more success than enablement in 8 of the 13 capabilities (autonomy, processing, cognitive literacy, constructive relationships – general, collaboration – drive, collaboration – other focus, mindfulness and personal and professional development), which differed from the findings in the previous study of Abma et al. (2016).

## Limitations and recommendations for future research

In terms of the limitations of this study, firstly, the cognitive literacy 21CC capability dimension held weak psychometric properties, although it contained critical content in terms of SSTs' functionality (Otto & Ziegler, 2006). It is worth exploring how to conceptualise this dimension further to improve its power in the model. Secondly, the small sample size obtained as an effect of the COVID-19 pandemic (Sastry, McGonagle, & Fomby, 2020) and the missing data in the surveys did not allow for broader exploratory factor analysis between different subgroups (such as independent and public school SSTs), which could have assisted in further unpacking and understanding the various dimensions identified and its impact on different educational contexts (Walker & Unterhalter, 2007). Thirdly, although cross-sectional data sufficed for exploratory research, the study could also be supplemented by longitudinal measurement of 21CC capabilities. Lastly, the timing of the collection of data was not ideal. Data collection commenced and ended while the COVID-19 pandemic was at its height: teachers were in flux and education in South Africa was destabilised. This could have resulted in a positively biased sample of only the very committed principals and teachers who opted to participate in the research and completed the lengthy survey, thereby inferring nonresponse bias that could positively skew the results obtained (National Research Council, 2013).

Research on the effects of the context of schooling in South Africa is also necessary, as it has been indicated that teachers operating in different circumstances (e.g. school sector, type and socio-economic status of learners) may have different 21CC capability needs in different school contexts (Mushayikwa, 2013; Tsanwani, Harding, Engelbrecht, & Maree, 2014).

## Conclusion

This study developed a model of 21st-century competency capabilities for SSTs based on the CA (Sen, 1980). These 21CC capabilities were measured in accordance with the value, enablement and achievement that teachers perceived in applying the 21st-century competencies. Further research is needed to ascertain how changes in capability affect the performance of teachers, as well as learners' performance, specifically in different teaching contexts.

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### Authors' contributions

T.d.W. conducted the statistical analyses and wrote the article. S.R. assisted with the statistical analyses and with interpreting the results and editing the article.

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### Data availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

### Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

## References

- Abma, F.I., Brouwer, S., De Vries, H.J., Arends, I., Robroek, S.J.W., Cuijpers, M.P.J., ... Van der Klink, J.J.L. (2016). The capability set for work: Development and validation of a new questionnaire. *Scandinavian Journal Work, Environment and Health*, 42(1), 34–42. <https://doi.org/10.5271/sjweh.3532>
- Buckler, A. (2012). Understanding the professional lives of female teachers in rural sub-Saharan African schools: A capability perspective. Doctoral thesis, The Open University. <https://doi.org/10.21954/ou.ro.0000993c>
- Buckler, A. (2016). Teachers' professional capabilities and the pursuit of quality in Sub-Saharan African education systems: Demonstrating and debating a method of capability selection and analysis. *Journal of Human Development and Capabilities*, 17(2), 161–177. <https://doi.org/10.1080/19452829.2014.991706>
- Bromley, P. (2019). A paradigm shift from competence to Capability in neonatal nursing. *Journal of Neonatal Nursing*, 25(6), 268–271. <https://doi.org/10.1016/j.jnn.2019.04.003>
- Care, E. (2018). Twenty-first-century skills: From theory to action. In E. Care, P. Griffin, & M. Wilson (Eds.), *Assessment and teaching of 21st-century skills: Research and applications* (pp. 3–17). Dordrecht: Springer International Publishing. <https://doi.org/10.1007/978-94-017-9395-7>
- Chigona, A., & Chigona, W. (2010). Capability approach on pedagogical use of ICT in schools. *The Journal for Transdisciplinary Research in Southern Africa*, 6(1), 209–224. <https://doi.org/10.4102/td.v6i1.117>
- Cilliers, J. (2020). *Africa first! Igniting a growth revolution*. Johannesburg: Jonathan Ball Publishers. Retrieved from <https://www.jakkiecilliers.org/africa-first>
- Creswell, J.W., & Creswell, J.D. (2018). *Research design: Qualitative, quantitative, and mixed method approaches* (5th ed.). London: Sage.
- Du, J., & Chen, Z. (2018). Applying organizational ambidexterity in strategic management under a "VUCA" environment: Evidence from high tech companies in China. *International Journal of Innovation Studies*, 2(1), 42–52. <https://doi.org/10.1016/j.ijis.2018.03.003>
- Eyre, D. (2016). *High-performance learning: How to become a world-class school*. Oxon: Routledge. <https://doi.org/10.4324/9781315674476>
- Field, A. (2016). *An adventure in statistics: The reality enigma*. London: Sage.
- Fleuren, B., De Grip, A., Jansen, N., Kant, I.J., & Zijlstra, F. (2016). Critical reflections on the currently leading definition of sustainable employability. *Scandinavian Journal of Work and Environmental Health*, 42(6), 557–560. <https://doi.org/10.5271/sjweh.3585>
- Gallup. (2019). *The real future of work*. Issue 4: Disruption. Retrieved from <https://www.gallup.com/workplace/265934/future-work-issue-disruption.aspx>
- Gordon, J. (2010). *Key competences for a changing world: Draft 2010 joint progress report of the council and the commission on the implementation of the education & training 2010 work programme*. Commission of the European Communities. Retrieved from <http://aei.pitt.edu/42899/>

- IBM Corp. (2021). *IBM SPSS statistics: Version 27*. Armonk, NY: IBM Corporation.
- Kyrychok, A. (2017). The main determinants of improvement of model of educational training of specialists in the field of PR based on competency approach. *Future Human Image*, 7, 71–85. Retrieved from <https://cyberleninka.ru/article/n/the-main-determinants-of-improvement-of-model-of-educational-training-of-specialists-in-the-field-of-pr-based-on-competency-approach/viewer>
- Lonka, K. (2018). *Phenomenal learning from Finland*. Helsinki: Edita.
- Lozano, J.F., Boni, A., Peris, J., & Hueso, A. (2012). Competencies in higher education: A critical analysis from the capabilities approach. *Journal of Philosophy of Education*, 46(1), 132–147. <https://doi.org/10.1111/j.1467-9752.2011.00839.x>
- Markle, A., & Cilliers, J. (2020). *South Africa first! Getting to Thuma Mina*. Southern African Report, 36. Institute for Security Studies. Retrieved from <https://issafrica.org/research/southern-africa-report/south-africa-first-getting-to-thuma-mina>
- McWilliam, E. (2017). Today's children, tomorrow's creatives: Living, learning and earning in the conceptual age. In S. Choo, D. Sawch, A. Villanueva, & R. Vinz (Eds.), *Educating for the 21st century: Perspectives, policies and practices from around the world*. Singapore: Springer. [https://doi.org/10.1007/978-981-10-1673-8\\_1](https://doi.org/10.1007/978-981-10-1673-8_1)
- Mushayikwa, E. (2013). Teachers' self-directed professional development: Science and Mathematics teachers' adoption of ICT as a professional development strategy. *African Journal of Research in Mathematics, Science and Technology Education*, 17(3), 275–286. <https://doi.org/10.1080/10288457.2013.848540>
- Muthén, L.K., & Muthén, B.O. (1998–2021). *Mplus users' guide* (8th ed.). Los Angeles, CA: Muthén & Muthén.
- National Research Council. (2013). *Nonresponse in social science surveys: A research agenda*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/18293>
- Nunnally, J.C., & Bernstein, I.H. (1994). *Psychometric theory* (3rd ed.). New York, NY: McGraw-Hill.
- Organisation for Economic Co-operation and Development. (2018). *The future of education and skills: Education 2030*. Paris: Organisation for Economic Co-operation and Development. Retrieved from [https://www.oecd.org/education/2030/E2030%20Position%20Paper%20\(05.04.2018\).pdf](https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf)
- Otto, H., & Ziegler, H. (2006). Capabilities and education. *Social Work & Society*, 4(2), 269–287. Retrieved from <https://ejournals.bib.uni-wuppertal.de/index.php/sws/article/view/158/218>
- Pellegrino, J.W., & Hilton, M.L. (2013). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. Washington, DC: National Academies Press, National Research Council.
- Pretorius, S.G. (2013). Teacher effectiveness in the South African context: first steps towards a comprehensive definition. *Journal of Social Science*, 36(3), 235–246. <https://doi.org/10.1080/09718923.2013.11893191>
- Prillentensky, I., & Prillentensky, O. (2021). *How people matter: Why it affects health, happiness, love, work, and society*. London: Cambridge University Press.
- Ramdass, K. (2009). *The challenges facing education in South Africa*. University of Johannesburg. Retrieved from <http://hdl.handle.net/10210/5397>
- Rychen, D.S., & Saganik, L.H. (2001). *Definition and selection of competencies theoretical and conceptual foundations*. Seattle, WA: Hogrefe & Huber Publishers.
- Sastry, N., McGonagle, K., & Fomby, P. (2020). Effects of the COVID-19 crisis on survey fieldwork: Experience and lessons from two major supplements to the U. S. Panel Study of Income Dynamics. *Survey Research Methods*, 14(2), 241–245. <https://doi.org/10.18148/srm/2020.v14i2.7752>
- Schwab, K. (2016). *The 4th industrial revolution*. New York, NY: World Economic Forum.
- Sen, A.K. (1980). Equality of what? In S.M. MacMurrin (Ed.), *The Tanner lectures on human values* (2nd ed., pp. 7–23). London: Cambridge University Press.
- Sen, A.K. (1985). Well-being, agency and freedom: The Dewey lectures 1984. *The Journal of Philosophy*, 82(4), 169–221. <https://doi.org/10.2307/2026184>
- Sen, A.K. (1993). Capability and well-being. In M. Nussbaum, & A.K. Sen (Eds.), *The quality of life* (pp. 30–53). Oxford: Clarendon Press. <https://doi.org/10.1093/0198287976.003.0003>
- Shevlin, M., & Miles, J.N.V. (1998). Effects of sample size, model specification and factor loadings on the GFI in confirmatory factor analysis. *Personality and Individual Differences*, 25(1), 85–90. [https://doi.org/10.1016/S0191-8869\(98\)00055-5](https://doi.org/10.1016/S0191-8869(98)00055-5)
- South Africa Department of Basic Education (2018). *Electronic Management Information System (EMIS)*. Retrieved June 24, 2019 from <https://www.education.gov.za/Programmes/EMIS/EMISDownloads.aspx>
- South African Department of Basic Education. (2020). *Action plan to 2024: Towards the realisation of schooling 2030*. Retrieved from <https://www.education.gov.za/Portals/0/Documents/Publications/Sector%20plan%202019%2015%20Sep%202020.pdf?ver=2020-09-16-130709-860>
- Spaull, N. (2019). Equity: A price too high to pay? In N. Spaull & J.D. Jansen (Eds.), *South African schooling: The enigma of inequality. A study of the present situation and future possibilities* (pp. 1–22). Cham: Springer. <https://doi.org/10.1007/978-3-030-18811-5>
- Stephenson, J., & Yorke, M. (2012). *Capability and quality in higher education*. London: Routledge.
- Succar, B., Sher, W., & Williams, A. (2013). An integrated approach to BIM competency assessment, acquisition and application. *Automation in Construction*, 35, 174–189. <https://doi.org/10.1016/j.autcon.2013.05.016>
- Tao, S. (2013). Why are teachers absent? Utilising the capability approach and critical realism to explain teacher performance in Tanzania. *International Journal of Educational Development*, 33(1), 2–14. <https://doi.org/10.1016/j.ijedudev.2012.01.003>
- Tao, S. (2014). Using the capability approach to improve female teacher deployment to rural schools in Nigeria. *International Journal of Educational Development*, 39, 92–99. <https://doi.org/10.1016/j.ijedudev.2014.08.011>
- Tsanwani, A., Harding, A., Engelbrecht, J., & Maree, K. (2014). Perceptions of teachers and learners about factors that facilitate learners' performance in Mathematics in South Africa. *African Journal of Research in Mathematics, Science and Technology Education*, 18(1), 40–51. <https://doi.org/10.1080/10288457.2014.884262>
- Van Der Berg, S. (2008). How effective are poor schools? Poverty and educational outcomes in South Africa. *Studies in Educational Evaluation*, 34(3), 145–154. <https://doi.org/10.1016/j.stueduc.2008.07.005>
- Van der Berg, S., Spaull, N., Wills, G., Gustafsson, M.A., & Kotzé, J. (2016). *Identifying binding constraints in education: Synthesis report for the Programme to Support Pro-Poor Policy Development (PsPPd)*. Cape Town: Research on Socio-economic Policy. Department of Economics, University of Stellenbosch. <https://doi.org/10.2139/ssrn.2906945>
- Van der Klink, J.J.L. (2019). *Cutting stone or building a cathedral*. Valedictory address. Tilburg: Tilburg University.
- Van der Klink, J.J.L., Bültmann, U., Burdorf, A., Schaufeli, W.B., Zijlstra, F.R.H., Abma, F.I., ... Van der Wilt, G.J. (2016). Sustainable employability – Definition, conceptualisation, and implications: A perspective based on the capability approach. *Scandinavian Journal of Work, Environment and Health*, 42(1), 71–79. <https://doi.org/10.5271/sjweh.3531>
- Venter, L., & Viljoen, T. (2020). A systems perspective on school improvement with a focus on teachers. *Systemic Practice and Action Research*, 33(3), 265–293. <https://doi.org/10.1007/s11213-019-09508-6>
- Voogt, J., & Roblin, N.P. (2012). A comparative analysis of international frameworks for 21st-century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, 44(3), 299–321. <https://doi.org/10.1080/00220272.2012.668938>
- Walker, M., & Unterhalter, E. (2007). *Amartya Sen's capability approach and social justice in education*. New York, NY: Palgrave Macmillan. <https://doi.org/10.1057/9780230604810>
- Wang, J., & Wang, X. (2020). *Structural equation modeling: Applications using Mplus*. Chichester: Wiley.
- Wilson-Strydom, M., & Walker, M. (2015). A capabilities-friendly conceptualisation of flourishing in and through education. *Journal of Moral Education*, 44(3), 310–324. <https://doi.org/10.1080/03057240.2015.1043878>
- Woolman, D.C. (2001). Educational reconstruction and post-colonial curriculum development: A comparative study of four African countries. *International Education Journal*, 2(5), 27–46. <https://doi.org/10.1.1.491.5399&rep=rep1&type=pdf>
- Xu, M., David, J.M., & Kim, S.H. (2018). The Fourth Industrial Revolution: Opportunities and challenges. *International Journal of Financial Research*, 9(2), 90–95. <https://doi.org/10.5430/ijfr.v9n2p90>

Appendix starts on the next page→

## Appendix 1

**TABLE 1-A1:** List of supplementary documents mentioned in Table 1.

Number	Supplementary documents
*1	Association for the Development of Education in Africa. (2018). ADEA 2017 Triennale general synthesis: Revitalizing education towards the 2030 global agenda and Africa's Agenda 2063. <a href="https://www.adeanet.org/en/publications/adea-2017-triennale-general-synthesis-revitalizing-education-towards-the-2030-global">https://www.adeanet.org/en/publications/adea-2017-triennale-general-synthesis-revitalizing-education-towards-the-2030-global</a>
*2	African Development Bank Group (2016). <i>Continental Education Strategy for Africa 2016 – 2025</i> . <a href="https://www.adeanet.org/en/system/files/resources/cesa_16-25_english_v9.pdf">https://www.adeanet.org/en/system/files/resources/cesa_16-25_english_v9.pdf</a>
*3	BattelleForKids. (2019). <i>Partnership for 21st-century learning: Framework for 21st-century learning definitions</i> . Retrieved from <a href="https://battelleforkids.org/networks/p21/frameworks-resources">https://battelleforkids.org/networks/p21/frameworks-resources</a> on 13 May 2020.
*4	Binkley, M., Erstad, O., Herman, J., Raizen, S., & Ripley, M. (2012). Defining 21st century skills. In P. Griffin, B. McGaw, & E. Care (Eds.), <i>The assessment and teaching of 21st century skills</i> . Dordrecht: Springer.
*5	Delors, J. (2013). The treasure within: Learning to know, learning to do, learning to live together and learning to be. What is the value of that treasure 15 years after its publication? <i>International Review of Education</i> , 59(3), 319–330. <a href="https://doi.org/10.1007/s11159-013-9350-8">https://doi.org/10.1007/s11159-013-9350-8</a>
*6	Gordon, J., Halasz, G., Krawczyk M., Leney, T., Michel, A., Pepper, D., Putkiewicz, E., & Wiśniewski, J. (2009). <i>Key competencies in Europe: opening doors for lifelong learners across the school curriculum and teacher education</i> . CASE Network Reports, No. 87, ISBN 978-83-7178-497-2, Center for Social and Economic Research (CASE), Warsaw. <a href="http://hdl.handle.net/10419/87621">http://hdl.handle.net/10419/87621</a>
*7	International Society for Technology in Education. (2017). ISTE Standards for Educators. <a href="https://cdn.iste.org/www-root/Libraries/Images/Standards/Download/ISTE%20Standards%20for%20Educators%20(Permitted%20Educational%20Use).pdf">https://cdn.iste.org/www-root/Libraries/Images/Standards/Download/ISTE%20Standards%20for%20Educators%20(Permitted%20Educational%20Use).pdf</a>
*8	Lemke, C. (2003). <i>EnGauge 21st-century skills: Literacy in the digital age</i> . North Central Regional Educational Laboratory and the Metiri Group. <a href="https://eric.ed.gov/?id=ED463753">https://eric.ed.gov/?id=ED463753</a>
*9	Lonka, K. (2018). <i>Phenomenal learning from Finland</i> . Helsinki, Finland: Edita.
*10	Millican, R., & Vare, P. (2020). A rounder sense of purpose: Educator competences for sustainability and resilience. In A. A. Shafi, T. Middleton, R. Millican, & S. Templeton (Eds.) <i>Reconsidering Resilience in Education</i> (pp. 199–212). Cham: Springer. <a href="https://doi.org/10.1007/978-3-030-49236-6_13">https://doi.org/10.1007/978-3-030-49236-6_13</a>
*11	National Assessment of Educational Progress (2021, October 14). <i>Assessment frameworks</i> . Institute of Education Sciences (IES): National Centre for Education Statistics (NCES). <a href="https://nces.ed.gov/nationsreportcard/assessments/frameworks.aspx">https://nces.ed.gov/nationsreportcard/assessments/frameworks.aspx</a>
*12	Organization for Economic Cooperation and Development (2018). The future of education skills: Education 2030. OECD: Paris. <a href="https://www.oecd.org/education/2030-project/contact/E2030%20Position%20Paper%20(05.04.2018).pdf">https://www.oecd.org/education/2030-project/contact/E2030%20Position%20Paper%20(05.04.2018).pdf</a>
*13	Pellegrino, & Hilton, (2013). <i>Education for life and work: Developing transferable knowledge and skills in the 21st century</i> . National Academies Press, National, Research Council. <a href="http://www.nap.edu/catalog.php?record_id=13398">http://www.nap.edu/catalog.php?record_id=13398</a>
*14	Sleurs, W. (2008). Competencies for ESD (Education for Sustainable Development) teachers: A framework to integrate ESD in the curriculum of teacher training institutes. <a href="https://unece.org/fileadmin/DAM/env/esd/inf.meeting.docs/EGonInd/8mtg/CSCT%20Handbook_Extract.pdf">https://unece.org/fileadmin/DAM/env/esd/inf.meeting.docs/EGonInd/8mtg/CSCT%20Handbook_Extract.pdf</a>
*15	South African Council of Educators (undated). <i>Professional teaching standards</i> . South African Council of Educators. <a href="https://www.sace.org.za/assets/documents/uploads/sace_36738-2019-03-06-SACE%20Draft%20PTS%20for%20Gazette%2028082018%20(00000003).pdf">https://www.sace.org.za/assets/documents/uploads/sace_36738-2019-03-06-SACE%20Draft%20PTS%20for%20Gazette%2028082018%20(00000003).pdf</a>
*16	South African Department of Basic Education. (undated). National Curriculum Statements Grade R-12. <a href="https://www.education.gov.za/Curriculum/NationalCurriculumStatementsGradesR-12.aspx?gclid=Cj0KCQjw8eOLBhC1ARIsAOzX5cF1jhtw3d5AE4utYOq6-ibgPSFt07K-T8_LOml0tnkDKA7h6F5oB2kaAlr3EALw_wcB">https://www.education.gov.za/Curriculum/NationalCurriculumStatementsGradesR-12.aspx?gclid=Cj0KCQjw8eOLBhC1ARIsAOzX5cF1jhtw3d5AE4utYOq6-ibgPSFt07K-T8_LOml0tnkDKA7h6F5oB2kaAlr3EALw_wcB</a>
*17	South African Department of Basic Education. (undated). Professional Development Framework for Digital Learning. <a href="https://www.education.gov.za/DigitalLearningFrameworkJuly18.aspx">https://www.education.gov.za/DigitalLearningFrameworkJuly18.aspx</a>
*18	South African Department of Higher Education and Training. (2015). Revised policy on the minimum requirements for teacher education qualifications. <a href="https://www.dhet.gov.za/Teacher%20Education/National%20Qualifications%20Framework%20Act%202067_2008%20Revised%20Policy%20for%20Teacher%20Education%20Qualifications.pdf">https://www.dhet.gov.za/Teacher%20Education/National%20Qualifications%20Framework%20Act%202067_2008%20Revised%20Policy%20for%20Teacher%20Education%20Qualifications.pdf</a>
*19	South African Department of Basic Education. (2020). <i>Action plan to 2024: Towards the realisation of schooling 2030</i> . <a href="https://www.education.gov.za/Portals/0/Documents/Publications/Sector%20plan%202019%2015%20Sep%202020.pdf?ver=2020-09-16-130709-860">https://www.education.gov.za/Portals/0/Documents/Publications/Sector%20plan%202019%2015%20Sep%202020.pdf?ver=2020-09-16-130709-860</a>
*20	United Nations Educational, Scientific and Cultural Organization. (2015). UNESCO Competency Framework. <a href="https://en.unesco.org/sites/default/files/competency_framework_e.pdf">https://en.unesco.org/sites/default/files/competency_framework_e.pdf</a>
*21	Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st-century competences: Implications for national curriculum policies. <i>Journal of Curriculum Studies</i> , 44(3), 299–321. <a href="https://doi.org/10.1080/00220272.2012.668938">https://doi.org/10.1080/00220272.2012.668938</a>
*22	Wiek, A., Withycombe, L., & Redman, C. I. (2011). Key competencies in sustainability: A reference framework for academic program development. <i>Sustainability Science</i> , 6(2), 203–218. <a href="https://doi.org/10.1007/s11625-011-0132-6">https://doi.org/10.1007/s11625-011-0132-6</a>
*23	World Economic Forum. (2015). <i>New vision for education: Unlocking the potential of technology</i> . Geneva: Author. <a href="https://www3.weforum.org/docs/WEFUSA_NewVisionforEducation_Report2015.pdf">https://www3.weforum.org/docs/WEFUSA_NewVisionforEducation_Report2015.pdf</a>