Chapter 2
Teacher Education in the Digital Age: Opportunities and Challenges

Mmabaledi K. Seeletso

Abstract This chapter considers some possibilities that may result from improved digital skills and competencies of teachers in the digital age. The chapter, conceptual in nature, also considers challenges that teachers face in the digital age. Available literature has been used to inform this conceptual chapter which looks through the lens of Gibson (1979) affordance theory. Bates (2016) argues that teachers must use ICTs for teaching to remain relevant. Digital technologies have proved that they can allow teaching and learning to continue during pandemics and crisis situations. This calls for stakeholders to engage and interact meaningfully through ICTs. Teachers, as key stakeholders in the education space, need to master technology use to enhance and improve their pedagogy and andragogy. However, research shows that digital technologies also present some challenges when used. Change in teacher education is key and needs to be prioritised. Teachers need to be nurtured into accepting and embracing technology, though some may resist (Fullan 2006). Citizens of Southern Africa continue to be frustrated by the digital gap in their countries. Therefore, it remains a challenge for their governments to support and give teacher education in the digital age the urgency it needs.

Keywords Affordance theory · COVID-19 pandemic · Digital age · Resistance to change · Teacher education

2.1 Introduction

Teachers across the world are faced with an unprecedented change characterised by a number of factors, including diverse students as well as having to cope with ever-changing technology. To effectively face and overcome these challenges, teachers need solid grounding and training in technology-enhanced teaching for them to acquire the necessary skills and competencies. This will make them not only conversant with teaching in the digital era but also in dealing with the technological delivery

M. K. Seeletso (✉)
SADC Centre for Distance Education, Botswana Open University, Gaborone, Botswana
e-mail: mmaba.see@gmail.com

J. Olivier et al. (eds.), *Perspectives on Teacher Education in the Digital Age*,
Future Education and Learning Spaces,
https://doi.org/10.1007/978-981-19-4226-6_2

that characterises the Fourth Industrial Revolution (4IR). The digital age is characterised by the use of technology. Even in the past, technology has always been used to support face-to-face teaching for improved delivery. Srinivasan (2017) observes that the digital revolution has and continues to change and impact peoples' lives, including how information is shared. Sharma (2017, p. 10) contends that "the digital revolution has transformed almost everything from our work at our organisations to our daily routines".

Teacher education needs to be geared towards promoting growth for knowledge creation. In most educational institutions in Africa, teachers lack basic training to match the world of rapidly changing technologies used for teaching and learning. This requires teacher training and development strategies that would expose them to new methodologies and strategies for technology-mediated or enhanced learning (Serafino 2019).

Over the years, institutions have made great investments to add technologies to support teaching (Elliot 2018; Glushkova et al. 2019), and it is now increasingly common for students to be encouraged to bring their gadgets, such as phones, to schools. In the past, in developing countries such as Botswana, gadgets were confiscated when students were caught with them. This does not happen anymore, as these once-forbidden gadgets are now used as teaching tools by teachers and as learning tools by students. Sharma (2017, p. 10) postulates that technology "is transforming the way children and young people play, access information, communicate with each other, learn, relearn and unlearn". Children are now playing active roles in their learning due to the classroom transformation brought about by technology. Teachers need to be trained on how to develop interactive, online content, and this increases teachers' knowledge, as they can collaborate on content design and development to produce high-quality content which will be a team product. As observed by Sharma (2017, p. 10), "teachers in this ever-changing digital era need a good balance of theoretical and practical knowledge to provide a solid foundation for their teaching". Leu et al. (2004) also appreciate the changing roles of teachers due to technology use. They note that teachers should be familiar with twenty-first-century students and understand their way of thinking for them to cope with the digital age (Leu et al., 2004).

This chapter is divided into four sections. In the first section, the introduction provides the background, and the definitions of the keywords used in the chapter are provided. The latter are affordance theory, COVID-19 pandemic, digital age, resistance to change, and teacher education. The second section foregrounds and argues the topic through the lens of Gibson, using his affordance theory. The third section discusses key issues that can be addressed by appropriate teacher education in the digital era. In the third section, the possibilities and challenges of teacher education in the digital era are also discussed. The section acknowledges that teacher education remains key to what the education system always turns out to be, including throughput in terms of students' academic performance. The section appreciates that most teachers may have been trained before technology was emphasised and adopted to facilitate teaching and learning and that to fit well in this digital era and in the 4IR, teachers need to be skilled in teaching through technology. The section further

emphasises that teachers should be exposed to accessible technology resources so that they can teach through the available technology methodologies by using the platforms for teaching at hand. In addition, the section appreciates the possibilities and challenges that come with digitising teacher education. The fourth and last section concludes the chapter, and salient recommendations are made to develop teachers who can effectively use technology to enhance teaching and content delivery.

Definitions of keywords

In this section, the keywords used in the context of the chapter are defined. Some of the definitions have been used as coined by the authorities. However, some of the definitions are provided by the author to suit the context in which they are used in the chapter.

Affordance theory has its origins linked to what the environment can afford or give its inhabitants. In this context, affordance theory refers to the available technology and how students and teachers can use these for their own benefit and advantage. This, in other words, refers to possibilities that one can derive from one's environment.

Zu et al. (2020, p. 15) define the ***COVID-19 pandemic*** as "pneumonia associated with a novel coronavirus, severe acute respiratory syndrome (SARS) coronavirus 2". This definition has been corroborated by Zheng et al. (2020). COVID-19 became a global pandemic at the beginning of 2020, disturbing most sectors from doing their usual businesses. The education sector was not spared, as students across all levels around the world had to stay home to observe the health protocols of social distancing.

The ***digital age*** refers to a time when machines dominate jobs that were in the past done by human beings. This is an era characterised by high technology use. We are currently living in the digital age, also known as the industrial revolution or the digital era. The use of machines to improve delivery and production has heightened during the digital age.

Resistance to change refers to an act where an individual opposes change or is not ready to accept new measures, especially those proposed by leadership. Whenever change is introduced in an institution or organisation, accepting it will differ among the stakeholders, especially employees where the change is being introduced. Some people will embrace and accept the envisaged change immediately, while others will take some time to accept it. Some people may also completely reject the envisaged change without even giving it a chance. The latter group comprises people who will resist change, making it their duty to oppose whatever change is proposed.

Teacher education involves teacher development and training strategies and methodologies. This is usually informed and guided by policies and procedures that must be implemented to ensure effective teacher education. Teacher education remains the main issue in the effective delivery of the curriculum in the entire learning process.

Technology and *digitisation* are used interchangeably to mean the same concept in this chapter.

Research Question

The following research question guides the discussion in this chapter.
What are the main opportunities and challenges teachers experience due to the digitisation of education?

2.2 Affordance Theory

Gibson (1979) explains affordance theory as an environment that offers several opportunities to the different animal species that live in the environment. In his view, these different animal species have different ways of life, and they use the environment in different ways. Gibson (1979, p. 129) contends as follows:

There are all kinds of nutrients in the world and all sorts of ways of getting food; all sorts of shelters or hiding places, such as holes, crevices, and caves; all sorts of materials for *making* shelters, nests, mounds, huts; all kinds of locomotion that the environment makes possible, such as swimming, crawling, walking, climbing, and flying. These offerings have been taken advantage of; the niches have been occupied. But for all we know, there may be many offerings of the environment that have *not* been taken advantage of, that is, niches not yet occupied.

2.2.1 The Affordances Theory Applied

Technology, by its very nature, involves several aspects. It must be appropriate for use by a group of people and should be easy to use for them to accept and embrace. Appropriate, user-friendly technology needs to have an Internet connection available, gadgets that are affordable and easy to use, and technical support readily available, among others. All these are needed to equip a twenty-first-century teacher who is faced with teaching millennials, also known as the "computer generation". Bates (2016) contends that technology should be about tools that may be used to solve real-world problems and not some assortment of tools that would create even more problems (of use) for users. Technology should also have relevance to the people's culture for them to be able to embrace it.

Technology for teaching should be useful, with affordances for different types of learning to increase participation (Kaplan and Haenlein 2016). Media used for a particular level, for instance, should be able to bring out desired learning outcomes, especially understanding of content by students. As such, the media used must package and present content in a way that allows users to access and use it with ease. The technology adopted for use should facilitate easy understanding of instruction and should accommodate all that is necessary to support text. Technology also needs to be able to fully engage students with a wide range of activities for them to be actively involved, even in the absence of their teacher.

Furthermore, the identified technology should have the ability to facilitate the different forms of interaction that characterise digital learning. This includes interaction between students; interaction between students and their teachers; and interaction between students and their content, among others. The cost of technology and the demographics of users must also be considered. It is also important to establish the reliability of technology before it can be adopted for use. The adopted technology must be easy for users or their institutions to maintain and upgrade, especially for teachers who are not technology specialists, as is common in most institutions. If the technology adopted for use requires advanced expertise, it is important for the institution to have the necessary support readily available for the technology to remain effective.

Change is never easy, and different people adopt and accept technology at different times. As such, some teachers may be slow adopters and thus take time to embrace the change that comes with technology. They may feel uncomfortable embracing something they feel is not from their "world". In developing countries, it is even worse, since teachers, just like most of their students, experience the digital gap, which makes teacher development difficult to achieve (Adnan and Anwar 2020; Serafino 2019).

2.3 Key Issues on Teacher Education in the Digital Age

The digital age can present numerous issues in the education sector. This section discusses opportunities and challenges that teachers can expect to face with the introduction of technology in learning institutions in the digital age.

2.3.1 Opportunities for Improved Teacher Education in the Digital Age

Srinivasan (2017) contends that digital learning promotes growth. Teachers need to receive effective training to be able to teach using technology. They need to be helped to acquire the necessary skills and competencies needed to teach in the digital age. Teacher education needs to use methods and strategies that can help develop and transfer the necessary skills for a knowledge-based society.

2.3.1.1 Knowledge Creation

Through digital teaching, teachers are able to help their institutions to promote, create, and use online resources to facilitate a more conducive teaching and learning environment (OECD 2017). Resources pulled together can further facilitate and

encourage active learning and collaboration. To fit into the envisaged knowledge-based economy, teachers, as knowledge creators, must be exposed to the necessary training to enable them to achieve this. Teachers need to move away from traditional teacher-centred instructional practices where they view themselves as more knowledgeable.

Technology-enhanced teaching promotes teamwork. Teamwork allows teachers to complement each other and thus deliver high-quality content which can be updated as and when necessary and used by other institutions. Digitisation also brings with it the ability to create, not just to be users of open educational resources (OERs), which is a form of open education (Bates 2016). OERs are "digital educational materials freely available over the Internet that can be downloaded … without charge, and if necessary adapted or amended" (Bates 2016, p. 34). OERs facilitate expanded access to knowledge through quality materials developed by teachers and educators in general. Digitisation does not only encourage the development and sharing of resources by teachers, it also facilitates active learning and sharing of resources by students. Bates (2016) notes that teachers can give students assessments on which they can work together to capitalise on the interaction they have to access the digital information at any time they so wish. Digital teaching helps both teachers and students work as a team. This helps them solve problems collaboratively, as a collective. The available social tools enhance teaching that always keeps students active. Digitisation can help computer-assisted teaching which facilitates computer-marked assessment. The computer-marked assessment can be programmed such that it guides students on the questions they get wrong and may even provide correct answers for students to appreciate where they have gone wrong. The feedback assessment in the computer-marked assessment can then help explain to students where they went wrong and help improve their performance.

2.3.1.2 Increased Interaction and Support

Following the interest in online teaching, traditional instructors continue to add more online components to their classroom teaching, including the use of PDFs with their notes. Most learning institutions are now going fully online for their delivery and support. In the words of Bates (2016, p. 33), "[f]ully online learning is now a key component of many schools and post-secondary education systems". The digital world facilitates interactive learning through webinars, video conferencing, and discussion forums, among the many possible means. Digitisation allows for the use of audio, which is important for language teaching, as it requires a lot of technical proficiency. It also allows for the use of videos. Digitisation allows teachers to use videos to capture experiments that cannot be done or explained by other media. Hence, Bates (2016:245) argues that "digitised teaching can create and present original teaching content in a rich and varied way". He further contends that digitisation allows for "[c]omputer-based animations and simulations" (Bates 2016, p. 246), which helps bring technology-mediated teaching as close to reality as possible.

Teachers are responsible for both their teaching and students' learning. Therefore, they need to support and motivate all students they teach—both the highflyers and the slow learners in the digital environment. Teachers are also expected to monitor how students manage their time. Flipped classrooms are gradually getting common with the advent of digitisation, especially in tertiary institutions. This allows for lecturers to pre-record the session, and students can then watch it later on their own. There are usually discussions and assessments based on the recorded content to check students' comprehension. All of these are vital to creating an inventive and interactive educational establishment (European Commission 2017; Khireddine 2020).

Institutions use a learning management system (LMS) to work in the learning environment. Both teachers and students should be knowledgeable about both the LMS and the different learning environments for them to participate meaningfully in the teaching and learning processes. Teachers must be a step or two ahead to be able to guide their students. Active learning takes place in an LMS when various groups interact with one another: students and teachers interact; students interact among themselves; and students interact with their course content. Such interaction can also be a response to other learning forums, such as discussions, chats, or responding to quizzes or other activities meant to check the students' comprehension levels. Online discussions can be asynchronous, where they are delayed, or they can be synchronous, where they are instant and done in real time. All these are possible in digitised teaching and learning. The main advantage is that students can always revisit sites if they missed something or if they wish to go through some content once more. More teachers and instructors have over time embraced online learning and now use online systems such as LMS to store content (Bates 2016). In the past, there has always been paper all over in some schools, with high possibilities of information either getting lost or confidential documents getting misplaced or ending up in the wrong hands due to poor record keeping. With digitisation came more reforms that brought with them improved filing systems which can be created in the LMS for electronic record filing. However, digitisation development is not without its downside. The machines and other gadgets need frequent maintenance to remain fully operational. These machines and gadgets may crash, leading to the loss of critical information if not backed up safely elsewhere.

2.3.1.3 Teacher Training and Development

From the literature on teacher training in the digital age, teacher training and development remain critical for the education sector to effectively address the changes brought about by technology. Students that remain physically apart are brought closer to each other and even closer to their teachers by technology. However, it is important to know that, for this to happen, teachers need to acquire the necessary skills to use technology tools. Developing and empowering teachers will help them become skilled and competent enough to deliver content in the digital era. This will help promote social presence, even when the teacher and their students are physically apart. Teachers need to get the necessary training to facilitate technology-mediated

delivery. This can help them become innovative in their teaching, compared to the traditional teaching and learning system where there were no resources that enabled a technology-enabled teaching environment. Primarily, teaching with technology will facilitate knowledge creation among teachers. Labbas and El Shaban (2018, p. 53) observed that "it is vital that educators are familiar with new educational changes, mainly those changes which are connected to technology". Digital teachers will, therefore, need to be great innovators to remain relevant in the digital era. They need skills to facilitate the design and development of highly interactive content. Technology further creates lifelong learners. This is because every day presents something new to learn and allows teachers to keep abreast of new developments and emerging trends as well as changing technologies related to teaching as they collaborate with both their peers and students. Digitisation allows for skills- and knowledge sharing. Teachers can connect anywhere through social media to exchange ideas and knowledge as necessary. They can search for knowledge, and they can also disseminate the acquired knowledge as they see fit.

Teacher education in the digital era should be done such that it allows for collaboration to be able to create a pool of content developers and knowledge creators. Teacher education should also be designed such that it imparts competencies for the twenty-first-century teacher for them to be change makers in the education sector. Rossikhina et al. (2019, p. 741) argue that "[t]he world is digital today. In order to have the necessary competencies of the 21st century, children should receive them at school". The same argument goes for teachers: they need to acquire the necessary training to impart the right content and competencies to children. Digital technology will help equip teachers and educators with the necessary skills to access various sources of information and allows for creativity and innovation. In essence, this makes it clear that teacher training remains crucial to prepare teachers to use the different technologies for teaching. The education sector cannot be doing things the way they did them a decade ago. They need to be relevant to the needs and demands of the twenty-first century. Digitised teaching facilitates personalise learner support. Teachers have the platform to provide unique solutions as demanded by diverse learners rather than applying "one size fits all" strategies to support learners. They can nurture their students and have discussions related to issues students may raise. As such, teacher training and development remains a priority in Southern Africa and other developing countries globally.

2.3.2 Challenges Teachers Face in the Digital Era

Digitised teaching has proven beyond a doubt that it can be both effective and efficient. This is because it has allowed teaching and learning to continue during the COVID-19 pandemic when the face-to-face delivery mode could not continue in all educational institutions due to health protocols of social distancing (OECD 2017). It

was necessary to adopt social distancing to curb the spread of the coronavirus globally. However, it has also become clear that, though digitisation facilitated the much-needed interaction and was no match for face-to-face delivery during the COVID-19 pandemic, digital exclusion was obvious in Africa. This exclusion did not only affect students but also teachers. As it were, students' technological skills exceeded those of their teachers (Warlick 2001). Therefore, some teachers fear the use of technology (Serafino 2019), as they see themselves as digital immigrants who cannot work with their students, whom they view as digital natives. Labbas and El Shaban (2018) and Prensky (2001) explain that digital natives are people born after 1980, while digital immigrants are those born before the digital revolution. So, teachers' lack of skills excluded them from being role players in technology-supported delivery which became the "in-thing" during the COVID-19 pandemic.

2.3.2.1 Lack of Resources and Skills

Research has brought to the attention of many unequal access to much-needed technology for digital teaching and learning to take place. This continues to impact negatively on effective teaching and content delivery. During the COVID-19 pandemic, digitisation made it possible for teaching and learning to continue with minimal disturbances. This is because schools that adopted online learning strategies to continue with their teaching progressed well. However, it became apparent that the schools that benefitted were private schools in most countries in Southern Africa, while government or public schools lagged behind due to a lack of resources. Most students and teachers in public schools also lagged behind, as they lacked the necessary expertise to facilitate online teaching and learning (O'Malley 2020; Serafino 2019). As such, the availability of learning gadgets to facilitate digitised learning remained the main challenge. Teachers who did not have the technology to facilitate teaching were the most affected, especially in developing countries of Southern Africa. It was evident during the COVID-19 pandemic that most institutions and, by extension, most teachers, were not ready for the digital revolution. It was clear that the calibre of teachers in most schools in Southern Africa still had a fear of and reservations about digital teaching and using technology for teaching. Many teachers, of course, had something to blame. As observed by Adnan and Anwar (2020), this included a lack of access to Internet facilities, lack of proper interaction, and ineffective technology. In Southern Africa, most of the teachers in government-owned or public schools lack the necessary technological skills and expertise to facilitate digitised education (Adnan and Anwar 2020). Other than the lacking skills among teachers and other workers in the education sector, Africa as a continent still experiences a serious shortage of resources, such as the Internet and gadgets necessary to facilitate digital learning. The cost of the Internet remains unaffordable for many citizens of developing countries, and the price of gadgets remains prohibitive, even among teachers. This corroborates Serafino's (2019:2) claim, who said that "[t]his is leading to a digital divide between those who have access to information

and communication technology and those who do not, giving rise to inequalities to access opportunities, knowledge, services and goods".

Most people from the working class in Africa own smartphones, with some using top-of-the-range models that they only use for calling and texting their friends and family members. Few teachers belong to this group. However, if, during their training, teachers are not exposed to digitised teaching, gadgets remain obsolete and under-utilised. Most teachers in Southern Africa have not appreciated that the same gadget they use for calling and texting their contacts could be a teaching device. This can only happen when teacher education, training, and development strategies and methodologies are revamped to embrace digitisation. In some African countries, bandwidth across households remains a serious challenge, even for those with gadgets and skills. Other parts of the continent struggle with fast, affordable, and reliable Internet connections due to a lack of the necessary infrastructure.

Lack of technological skills and expertise among educators, teachers in particular, hinders digitisation in most of the schools in Africa (Serafino 2019). Kaplan (2021) claims that digitisation comes at a cost, as it needs devices and Internet, as well as skills. As such, people need to be convinced to adopt technology. Teachers need to be able to access the Internet and search for whatever they wish to find to use to inform and improve their teaching. However, if they do not have these necessary skills, they may lose it all in the digital world, unless and until they are skilled through in-service training to remain effective in twenty-first-century teaching. Serafino (2019:2) contends that "[u]sers of the Internet can still be digitally excluded because they lack the skills to be able to confidently and safely navigate the digital world".

2.3.2.2 Technophobia and Resistance Among Teachers

There are teachers who fear technology because they have never used it before. They lack both the skill and knowledge to work through the platforms available for their use. Due to their lack of the necessary skills, expertise, and knowledge, most teachers tend to resist any new digital initiatives the leadership may wish to bring to their institutions. Technophobia, therefore, needs to be handled with caution for teachers to buy in and agree to the necessary training. Teachers, especially older ones, need to be engaged about what technology can do so that they can trust the envisaged change. If the change is not well communicated to the teachers, they may resist it, thinking that it is an initiative only introduced to replace them in their workspaces. Some teachers are still holding on to the traditional teaching strategies and methodologies due to their fear of change and fearing the unknown. Sudden digital transformation is not healthy and cannot be embraced if not well communicated to the teachers whom it is meant to benefit. As such, introducing new teacher training strategies and methodologies needs to be communicated with caution and handled with great care. It must be treated as a project that will involve all stakeholders for them to equally appreciate and embrace it.

Teachers also resist embracing change to digital teaching, as they think that there is no need. They would wonder why they should change something that has always worked so well for everyone. They fear that introducing technology and skills in developing countries might just destroy their teaching which has been going on well without technology.

2.4 Conclusion

Teacher training systems need to sufficiently train teachers. There is a need to change some social practices for technologies to be fully implemented and adopted to transform teaching in most African institutions. The African Union Agenda 2063 encourages countries and respective institutions to invest in teacher training to produce quality teachers that can compete globally. The absence of a robust teacher training and development plan for the digital age will render technology adoption in most schools in Southern Africa just a dream that can never be realised. A transformed teacher education system creates new learning environments, which are integral for twenty-first-century skills. Reforms in teacher training institutions need to be continuous to follow development trends lest teachers are left behind, yet they teach children who are advanced in the use of technology. Teachers need to be eager, like the children they teach, to try anything related to technology and its use.

Today, students grow up with technology all around them—from play stations and other gadgets at home, and this directly influences their learning in a positive way. Some children have access to extensive knowledge via the Internet. As such, they can be a challenge to their teachers if teachers remain inadequately trained. Teachers need to be adequately trained to match their students, who are more inquisitive, more interrogative, and always demanding answers their teachers at times struggle to answer. Research in most education establishments has confirmed that there are policies in support of integrating technology in teaching. What remains the challenge is the continued resistance by teachers in some circles who still want to be seen as the authority in the teaching field. In other cases, the challenge is expensive gadgets and Internet connection. Some teachers may be willing and ready for this development. However, the challenge will then be a lack of the needed skills to facilitate this.

Traditionally, teachers have always felt powerful and comfortable teaching content they know best and that they know is unknown to students. This makes them feel powerful, in authority, and in control. Digital teaching exposes them to the authorities that their students are, where students are now in control. In the digital era, teachers are facilitators as opposed to fountains of knowledge. This allows students to also contribute to knowledge creation and remain active in the learning process. However, this is one of the elements that leads to teachers' resistance to embracing technology-enhanced teaching in school.

References

Adnan M, Anwar K (2020) Online learning amid the COVID-19 pandemic: students' perspectives. JPSP 2(1). https://doi.org/10.33902/JPSP.2020261309

Bates AW (2016) Teaching in a digital age: guidelines for teaching and learning

Elliot M (2018) Out of the Maze—Building digitally inclusive communities (Report). The Workshop, Wellington, New Zealand

European Commission (2017) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a Renewed EU Agenda for Higher Education, Brussels. COM, 247 Final. https://ec.europa.eu/education/sites/education/files/he-com-2017-247_en.pdf

Fullan M (2006) The future of educational change: system thinkers in action. J Educ Change 7:113–122

Gibson JJ (1979) The theory of affordances. In: The ecological approach to visual perception. Boston, Houghton, Mifflin

Glushkova S, Belotserkovich D, Morgunova N, Yuzhakova Y (2019) The role of smart phones and the internet in developing countries. ESPACIOS 40(27)

Kaplan AM, Haenlein M (2016) Higher education and the digital revolution: about MOOCs, SPOCs, social media, and the Cookie Monster. Bus Horiz 59:441–450

Kaplan A (2021) Higher education at the crossroads of disruption: the ubiversity of the 21st century, Great debates in higher education. Emeral Publishers Limited: United Kingdom

Khireddine A (2020) An innovative higher education institution through digital revolution. Exprofesso 4(2):137–147

Labbas R, El Shaban A (2018) Teacher development in the digital age. Teach Engl Technol 13(3):53–64

Leu Jr DJ, Kinzer CK, Coiro J, Cammack DW (2004) Toward a theory of new literacies emerging from the internet and other information and communication technologies. In: Ruddell RB, Unrau NJ (eds) Theoretical models and processes of reading. International Reading Association, Newark, DE, pp 1570–1613

O'Malley B (2020) Digital divide "catastrophic" for many students. World University News

OECD (2017) Key issues for digital transformation in the G20. https://www.oecd.org/internet/key-issues-for-digital-transformation-in-the-g20-pdf

Prensky M (2001) Digital natives, digital immigrants. Horizon 9(5)

Rossikhina H, Rossikhin V, Kaganovska T (2019) Problems of education digitalisation in Ukraine. Adv Econ Bus Manag Res 105 (Atlantis)

Serafino P (2019) Exploring the UK's digital divide. Office for National Statistics, UK

Sharma M (2017) Teacher in a digital era. Glob J Comput Sci Technol: Glob Interdiscip 17(3):10–14

Srinivasan J (2017) Teaching and learning in a digital era. Scope Int J Sci Human Manag Technol 3(3):10–17

Warlick DF (2001) Redefining literacy for the 21st century. Linworth Publishing Co, Worthington, Ohio

Zheng Y, Ma Y, Zheng J, Xie X (2020) Cardio-vascular system. Nat Rev Cardiol 17(259)

Zu ZY, Di Jiang M, Xu PP, Ni QQ, Lu GM, Jiang L (2020) Coronavirus disease 2019 (COVID-2019): a perspective from China. Radiology 296(2)

Mmabaledi Kefilwe Seeletso is currently the Director of the SADC Centre for Distance Education, based at Botswana Open University. Dr. Seeletso specialises in issues of Open and Distance Learning content planning, design, and development, as well as assessment of tertiary programmes. She has been the Head of Department for Educational Management and Leadership from January 2014 until October 2021. She has worked in an open and distance learning environment for over 20 years. Dr. Seeletso read for her Degree in Humanities and Post Graduate Diploma

in Education at the University of Botswana in 1996 and 1997, respectively. She then read for her MA in Educational Management which she obtained in 2004, from the University of Bath, in the United Kingdom. Seeletso acquired her Ph.D. from the University of Pretoria in 2016. She was a recipient of the Fulbright Scholarship, during which she served at the University of Denver as a visiting scholar from 2017 to 2018. She is also the University of Bath Ambassador in Botswana and a member of the UKRI International Peer Review College. Dr. Seeletso was a Post-Doctoral Fellow at the University of South Africa, Pretoria, based at the UNESCO Chair on ODL from April 2019 to March 2020.