Article

Digital Literacy Skills as Prerequisite for Teaching and Learning in Higher Education Institutions

Tlou Maggie Masenya
https://orcid.org/0000-0001-5400-0549
Durban University of Technology
maggst124@gmail.com

Abstract

The advent of digital technologies has brought about new opportunities and challenges to the education system globally. The use of digital technologies by educators in Higher Education Institutions (HEIs) is a portal for innovative teaching and learning. While there is a gradual increase in the use of these innovative technologies by HEIs in South Africa, there is still a long way to transform the educational system fully. Effective use of digital technologies in teaching and learning needs a certain level of digital literacy. Digital literacy enhances teaching and learning by helping educators integrate and use digital technologies, while equipping students with skills to access the internet effectively. The impact of digital technology has beaconed the need of educators to acquire 21st-century skills. Digital literacy skills are critical in realising the potential and benefits of digital technologies. This paper investigates the importance of digital technologies in education and the impact of digital literacy skills on the effective use of these technologies in HEIs in South Africa. Data collection was primarily based on a critical review of literature relating to the application of mobile technologies in HEIs in South Africa. The results revealed various barriers inhibiting educators from adopting mobile technologies in teaching and learning, including lack of digital literacy skills, time constraints, unwillingness to change, lack of educator confidence, poor technological infrastructure, and lack of digital or mobile devices. The study provides recommendations to enable and inspire educators in HEIs to use mobile digital technologies effectively.

Keywords: digital technology; mobile technology; digital literacy skills; higher education institutions; educators

UNISA university of south africa PRESS

Mousaion: South African Journal of Information Studies
https://upjournals.co.za/index.php/LIS
Volume 39 | Number 2 | 2021 | #8428 | 20 pages

https://doi.org/10.25159/2663-659X/8428
ISSN2663-659X(Online) ISSN0027-2639(Print)

Introduction

Today's world is in a burgeoning digital age in which a digital form of information and communication dominates in virtually every aspect of society, including education (Hague and Payton 2010). Increasing opportunities for digital learning are now available, and the education sector is embracing the idea of electronic-learning (e-learning) and mobile-learning (m-learning), aiming at open and lifelong education (Beetham and Sharpe 2013). Educators in Higher Education Institutions (HEIs) are under immense pressure of using digital technologies to enhance teaching and learning, which requires unceasing and constant e-learning. Educators are tapping into the digital revolution and adopting new technologies within their classrooms, and they work towards improving their teaching practices in a way that benefits their students and the learning environment in which they work. Digital technologies that are used for e-learning include social media, online games, multimedia and mobile technologies. Examples of mobile technologies are laptops, tablets, mobile phones and netbook computers. These technological developments are transforming the way educational institutions operate (Maphosa and Bhebhe 2019), and the education sector thus has to adapt and phase out historical didactic methods of transmitting academic knowledge from the educator to the learner. However, this transition requires members of the education society to possess skills and abilities related to technological tools, and also to have knowledge regarding the norms and practices of the appropriate use of digital devices (Meyers, Erickson, and Small 2013).

Therefore, to take full advantage of the benefits that digital technologies offer, educators must have the skills and knowledge to do so. Acquiring digital literacy skills through educator training is thus seen as a significant initiative for improvement. Digital literacy entails using tablets, smartphones, computers, navigating the web, sharing images and videos on social media, and doing a Google search to find information (Common Sense Media 2018). It is the ability to use Information and Communication Technologies (ICTs) to find, evaluate, utilise, share, create and communicate information (Heitin 2016). Similarly, Burns (2017) refers to digital literacy as an individual's ability to find, evaluate, produce and communicate information clearly through writing and other forms of communication on various digital platforms. Digital literacy means having the required skills to live, learn and work in a society where communication and access to information are increasingly through digital technologies like internet platforms, social media and mobile devices (Study Smart Zone 2018). Digitally literate teachers can use digital devices like a video player, CD player, and computers in their classrooms where they let learners watch videos and listen to audios for learning, as stated by Common Sense Media (2018). Digital literacy skills are essential in digital learning as they support informal learning in emerging online communities and bridge the digital competencies and electronic skills gap. Educators thus need to be empowered with the resources and knowledge to implant digital learning and problem-solving in teaching and learning. However, according to Sutton (2011), the question of better-preparing educators to use digital technologies effectively and productively in schools is an

enduring issue. The global education and telecommunications sectors play a significant role in addressing the challenges of acquiring digital literacy skills in the backdrop of a digitally divided environment (UNESCO 2011). The South African government presented a system that allowed all South African learners to receive the same education in 2004, as a way to enhance the education system. This system was reinforced and implemented by the White Paper on e-Education (2004), which states that for the incorporation of ICT in all schools, educators should be trained to possess the knowledge and skills to be capable of using digital technologies for teaching and learning. Aktaruzzaman, Shamim, and Clement (2011) also view educators' professional development and digital literacy skills as another crucial factor that ensures the integration and use of digital technology in the pedagogic environment. Digital literacy training and formal education in ICT literacy occupy the centre stage in augmenting the introduction to digital technologies in teaching and learning.

The introduction and integration of digital technologies in the schooling system and social community would also develop crucial awareness of the significance of the use of ICTs. However, to embrace these innovative technologies, it is essential for institutions of learning to focus their attention on digital literacy skills training and incorporate such technologies into the classroom's actual pedagogical processes. As observed by Ala-Mutka, Punie, and Redecker (2008), this may not happen without challenges involved, as the rate of technological change may not be proportionate to the availability of resources to cope with the demands of such changes. The studies by Makgato (2012) and Tedla (2012) have shown that the successful implementation of digital technologies in schools is essentially dependent on the availability of technological infrastructure, adoption by the educators and acceptance of these technologies in education. The aim of this paper is, therefore, to investigate the use of mobile technologies in teaching and learning and the role of digital literacy skills in ensuring the effective use and integration of these technologies in teaching and learning.

Problem Statement

The teaching professions now face rapidly changing demands, which require a new set of competencies. The major challenges faced by HEIs today are integrating digital technologies into the educational system and establishing adequate professional development workshops and courses for educators (UNESCO 2011). The current delivery of ICT in HEIs is highly unsatisfactory and uninspiring for the learners. Educators are only developing basic skills while excluding the more advanced knowledge and digital skills that could be gained through digital literacy training. UNESCO's (2011) policy brief articulates and emphasises how the responsibility lies with the educators to be digitally literate and be able to transfer their digital capabilities to high school learners. To develop adequate 21st-century skills among students, educators should be authentic ICT users and integrate digital literacy with other core competencies in their professional and private lives.

Although many educators understand the value and importance of digital literacy for the ICT classroom, they have rarely executed it effectively in other subject areas for successful teaching and learning. Educators should develop sufficient 21st-century skills, be capable users of mobile technologies, and should implement digital literacy and other essential competencies in their teaching and learning. There is very little guidance on technology for new teachers, taking their first tentative steps into the complex arena of educational practice. In addition to this, trainee teachers are likely to have a patchy digital technology experience in the school context because of variations in resources, access and classroom practice (Burnett 2009). The paper thus discusses the role of digital literacy skills in ensuring the effective integration and use of mobile technologies in teaching and learning by educators in HEIs in South Africa. The objectives formulated to address the research problem were to:

- Determine the benefits of using mobile technologies in teaching and learning by educators in HEIs.
- Establish the educators' barriers to the effective use of mobile technologies in teaching and learning.
- Establish the initiatives available for improving digital literacy skills to meet the educators' needs.

Theories, Models and Frameworks for Digital Capability Development

Technological Pedagogical Content Knowledge (TPACK), Substitution, Augmentation, Modification and Redefinition (SAMR) and Replacement, Amplification and Transformations (RAT) were adopted in this study as digital learning theories and frameworks to guide the development of digital capability programmes in HEIs. Digital learning theories help teachers develop curricula that allow students to use technology to research, create, innovate, collaborate and promote problem-solving and critical thinking (Terrell 2018).

Technological Pedagogical Content Knowledge Framework

Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) framework offers a productive approach to many of the dilemmas that teachers face in implementing educational technology in the classrooms. It focuses on technological knowledge, pedagogical knowledge and content knowledge. The TPACK framework presents a holistic model that theorises the relationship between technological, pedagogical and content knowledge to effective curriculum learning-focused technology use (Falloon 2020). This framework thus outlines how the course content and pedagogy must form the foundation for any effective technology integration (Falloon 2020). It provides a framework for identifying the teacher knowledge required to integrate technology effectively within the complexities of the larger context of teaching. The content knowledge and pedagogical knowledge are primarily understood to be at the heart of effective teaching, however, adding technological knowledge into the mix provides an effective filter for teachers to examine the way that they think about

technology integration (Kirkland 2014). This model merges each element into a central core that blends deep and robust discipline conceptual knowledge to understand the potential of and capacity to use technology to enhance learning through supportive pedagogies that acknowledge students' prior understandings and learning needs.

Technological tools such as hardware, software, applications and associated information literacy practices are best used to instruct and guide students towards a better, more robust understanding of the subject matter (Mishra and Koehler 2006). TPACK thus builds on the earlier work of Shulman (1986), explaining how teachers' understanding of educational technologies and pedagogical content knowledge interact with one another to produce effective teaching with technology, as noted by Koehler, Mishra, and Cain (2013). Teachers need to understand that instructional practices are best shaped by content-driven, pedagogically-sound and technologically-forward thinking knowledge. However, the success of TPACK relies on the capabilities of teachers within each domain and their capacity for flexibility, willingness to update and readiness to explore how the domains interrelate to support effective technology use in a range of different situations (Harris and Hofer 2009). TPACK acknowledges the integrative relationship between conceptual content knowledge and pedagogy and technology within teacher education programmes. However, Ndongfack (2015) observes that this relationship is seldom reflected in course design and teaching practices.

Substitution, Augmentation, Modification and Redefinition (SAMR) model

Substitution, Augmentation, Modification and Redefinition (SAMR) is a descriptive model that maps different educational uses of technology hierarchically against levels or stages progressing from substitution ("doing digitally" what has been carried out traditionally) through to redefinition (curriculum, pedagogy and practice reconceptualised through digital technologies) (Falloon 2020). The SAMR model enables teachers to design, develop and infuse digital learning experiences that utilise technology in teaching and learning (Puentedura 2006). Educators in HEIs have widely adopted this model as a pragmatic guide for signposting ICT development progress, and as a result, they work towards what is seen as the ideological position of curriculum redefinition through technology (Geer et al. 2017; Hilton 2016). This model focuses solely on describing levels of subject-based technology integration, reflecting a narrow interpretation of the understandings teacher education students need for the more holistic and comprehensive capability set required by an expanded view of digital competence. The goal of including this model into the teaching and learning is to transform learning experiences to higher levels of achievement for students, and it is thus apparent for teachers to create tasks that target the higher-order cognitive skills as well as design tasks that have a significant impact on student outcomes in teaching and learning (Kirkland 2014). Puentedura (2006) summarised SAMR stages as follows:

- In the substitution stage, technology acts as a direct tool substitute with no functional change.

- Augmentation and modification stages represent intermediate steps between substitution and redefinition, describing increasing complexity in using technology to facilitate changes to learning design, pedagogy and curriculum innovation.
- In the redefinition stage, technology allows for the creation of new tasks that align with the exercise of higher-order thinking capabilities such as analysing, evaluating, and creating.

Replacement, Amplification and Transformations Framework

Replacement, Amplification and Transformations (RAT) was initially developed for PK-12 education, as an assessment framework for understanding technology's role in teaching, learning and curricular practices (Hughes, Thomas, and Scharber 2006). This model has been applied in higher education, especially in pre-service teacher education. The RAT framework's original purpose was to introduce it as a self-assessment for pre-service and in-service teachers to increase critical technological decision-making (Falloon 2020). Teachers can also use this framework to develop lesson plans that they will use in their classrooms, and it helps in understanding how digital technology is functioning as replacement, amplification, or transformation in educational practice, as summarised by Hughes et al. (2006):

- ***Technology replacement*** refers to the technology used to replace established instructional practices, student learning processes or content goals. The technology serves merely as a different (digital) means to the same instructional end.
- ***Amplification of technology*** refers to increased efficiency, effectiveness and productivity of instructional practices, student learning processes, or content goals. The tasks stay fundamentally the same while the technology extends our capabilities ineffectiveness or streamlining.
- ***Transformation of technology*** refers to technology that reinvents aspects of instruction, learning, or curriculum in new and original ways. For example, new cognitive forms could emerge, new people could be involved, or new content may be accessible.

Methodology

This study adopted a qualitative research approach, namely desktop-based research. A literature search on the use and integration of mobile digital technologies in teaching and learning in HEIs in South Africa—and the importance of digital literacy skills in ensuring the effective use of these technologies—was conducted using Google scholar and the Scopus database. The search terms and phrases included "digital literacy skills"; "digital skills and digital capabilities"; "use of mobile technologies in teaching and learning"; "integration of mobile technologies in teaching and learning"; "use of digital technologies in teaching and learning"; "role of digital literacy skills in teaching and learning"; "barriers to effective use of mobile technologies in teaching and learning";

and “digital literacy initiatives.” Conducting a literature review can also assist in developing a conceptual definition of a construct on the basis of shared meaning and describe what theories were used to explain relationships among concepts, as stated by Ngulube (2017). Digital learning theories and frameworks to guide the development of digital capability programmes in HEIs were also reviewed in this study in order to understand the relationship between technological, pedagogical and course content as well as their implications on implementing innovative educational technology in the classrooms.

Literature Review

New technologies have changed traditional ways of thinking about curriculum and pedagogy and at the same time, appear to present exciting or radical possibilities for education (Merchant 2009). Teaching and learning are now moving from being institutionalised (physical) to virtual classrooms. The implementation of mobile technologies in education has revolutionised the traditional static classroom into a global classroom in which knowledge can be distributed not only in the classroom but also out of the classroom (Tay et al. 2012). The use of these technologies in teaching and learning is thus more of an alternative pedagogical approach than anything else, as it helps draw students’ attention as a teaching method. The advent of mobile devices has thus brought about changes in the student and educator perceptions about pedagogical practices. These changes encourage learning to take place anywhere, anytime, using one digital device that stores all that the student needs. The generation of carrying loads of textbooks is fast disappearing as e-books are preferred more than hard copy ones. There is also a growing perception that mobile technologies stimulate learning among the students as it involves additional skills in the use of the devices (Hennessy, Harrison, and Wamakote 2010).

The pervasiveness of mobile technologies has thus simplified access to an unlimited amount of information, and this has made teaching and learning procedures increase the demand for the ability to access, locate, extract, evaluate, organise and present digital information (Pagani et al. 2016). However, the educator occupies a key role in successfully using mobile technologies in teaching and learning. Hence, of foremost importance in the teaching and learning process is not only having access to mobile technologies, but also using them effectively. The relevance of educators in the ICT-equipped classroom is, therefore, under the spotlight, and as a result, an educator ill-equipped in digital literacy skills should have more to worry about in this digital era. This underscores the need to develop digital literacy skills and to integrate these skills within an e-pedagogy environment. Therefore, educators must be trained to use mobile digital technologies effectively and gain innovative teaching methods in an era driven by the everyday use of technology. The main objectives of HEIs should be that of developing educators and students with multifaceted skills to use any digital technology (Hague and Payton 2010). Digital literacy skills and knowledge are, therefore, integral for enabling educators to make use of mobile technologies for enhancing teaching and

learning. Educator development programmes should thus incorporate the use of mobile devices in the classrooms. The curriculum content also needs to be developed and aligned with the help of mobile technologies in teaching and learning.

The Concept of Digital Literacy

Digital literacy provides a theoretical combination of media literacy and information literacy, and applies them directly to the use of digital technologies. It is often used to refer to functional skills such as evaluation and contextualisation. Enabling educators to use computer technology effectively is an essential component of digital literacy (Hague and Williamson 2009). Digital literacy can also be thought of as a combination of social awareness, critical thinking and knowledge of digital tools (Hague and Williamson 2009). It also involves the ability to participate in the active and collaborative creation and communication of meanings. Digital literacy consists of the ability to access, understand and critically evaluate different aspects of digital media and media contents, and to communicate effectively in various contexts (Ala-Mutka et al. 2008). E-safety Support (2013) further describes digital literacy as locating, organising, understanding, evaluating and creating information using digital technology. Digital literacy can be seen as the ability to understand the appropriateness of technologies to support various processes, including the creation, collaboration and communication of meanings in various forms (Hague and Payton 2010). The UK-based Joint Information Systems Committee (JISC) (2011) denotes digital literacy as the capability of using technology for academic research and writing, critical thinking abilities, personal development and as a means for showcasing achievements. Digital literacy includes critical thinking and problem-solving, and it is ultimately about successfully resolving problems in a technology-rich environment (Organisation for Economic Co-operation and Development [OECD] 2013).

Bawden (2008) outlines four components of digital literacy, and these include:

- ***Foundations:*** "traditional" literacy and computer literacy.
- ***Background knowledge:*** information and information resources.
- ***Central competencies:*** basic skills and competencies in terms of reading, interpreting, evaluating information and knowledge creation.
- ***Attitudes and perspectives:*** independent learning and moral or social society.

Hague and Payton (2010) also outline the following components of digital literacy:

- ***Creativity*****—**the capability to think artistically and creatively, and to use technology to generate results and illustrate information in different layouts and approaches, knowing how and when technology can be used to support creative processes and creative thinking with technology.
- ***Critical thinking and evaluation*****—**the ability to use cognitive skills to engage with digital media and its content, to question, analyse, inspect, assess and articulate and support arguments about it and the way it is used.

- ***Cultural and social understanding***—the ability to identify the social, cultural and historical influences and contributions that outline the creation and use of digital content and how to understand it.
- ***Collaboration—***the ability to collaborate with others in producing and sharing information through technology and how it supports collaboration in and outside the classroom.
- ***The ability to find and select information***—to search for information required for a task or activity, to know how and where to search for information, to critically engage with sources to select relevant, valuable and reliable information.
- ***Effective communication***—the ability to successfully convey thoughts and ideas so that others can comprehend them and to be able to communicate effectively using different types of technologies.
- ***E-safety—***the ability to cautiously and appropriately use digital technologies such as the internet and mobile phones and to recognise what constitutes suitable use and content.
- ***Functional skills—***the capability of using a variety of new technologies proficiently and being articulate and flexible to acclimate this knowledge.

Figure 1 illustrates how the components of digital literacy are interrelated (Hague and Paton 2010):

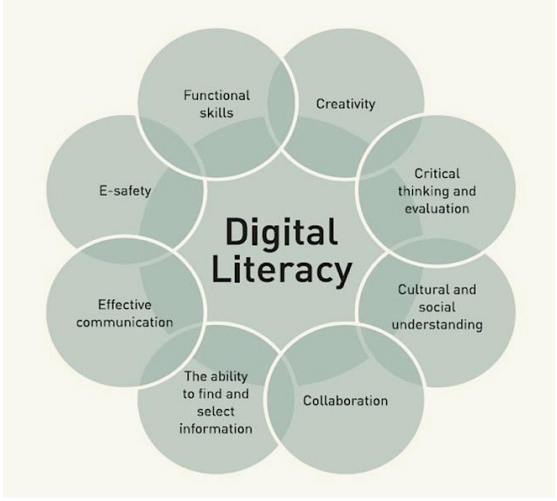

Figure 1: Digital literacy components (Hague and Paton 2010)

Developing digital literacy skills in schools encompasses designing classroom activities that adopt all the components of digital literacy. Digital literacy has thus been proved to be beneficial for basic skills and technology competency at all levels of education, and this has been supported by a growing body of national and international research evidence demonstrating the positive impact of digital technologies on measurable

learning outcomes as well (UNESCO 2006). Adopting the powerful and innovative means of digital technologies advances the education system by decreasing information's inaccessibility and providing access to an insurmountable wealth of knowledge (Hague and Payton 2010). Educators are vital for the effective integration of digital technologies within the classroom and are considered change agents, as noted by Mathipa (2014). Developing digital literacy means allowing educators to use an extensive array of digital technologies through innovative collaboration while equipping them with multimodal skills (Hague and Payton 2010). Eze and Olusola (2013) state that the educator's role continuously evolves as technology is developing new roles for them. They further assert that some of the equipment in schools, such as whiteboards, are rendered outmoded through new technologies. Therefore, the educator's didactic role is replaced by boosting learners to develop multimodal skills through the use of mobile digital technologies.

Findings and Discussion

The findings are presented under the following themes: the benefits of using mobile technologies in teaching and learning by educators in HEIs; barriers to the effective use of mobile technologies in teaching and learning; and the initiatives available to meet the educators' needs for improving their digital literacy skills

Benefits of using Mobile Technologies in Teaching and Learning

Educators in the 21st century are so fortunate to be living and teaching in a time of rapid educational change. Instead of personal student chalkboards, a number of students now have access to electronic tablets. Many teachers can now use smart boards instead of dry-erase boards and the limits of the central textbook have transcended the limitless information gathered online. Mobile technologies enable communication, how people wirelessly connect and share information regardless of their geographical location and time. The use of these technologies in the classroom should be seen as complementing the educator's role in the teaching and learning process rather than replacing the educator. Hoppe et al. (2003) describe mobile technologies as promising innovative technologies that will effectively and efficiently support collaborative learning scenarios. Hoppe et al. (2003) add that these technologies have offered a chance of moving away from using stand-alone computers and they allow interaction with several devices and provide easy access to information through a wireless connection server. The mobile devices which are personal and portable include smartphones, iPods, tablets, Personal Digital Assistants (PDA), games consoles, and so forth. Smartphones and tablets are mobile devices that are mainly used for learning and teaching purposes. The older generation of computers does not provide intelligence and new opportunities that these new mobile technologies offer to individuals who require mobile computing solutions. Mobile devices allow instant and easy access to the internet, easy communication and quick information sharing. The easy access to mobile devices will enable learners to check emails and access subject content online using mobile applications. Benefits range from messaging groups on their mobile cell phones, to

interacting with classmates and sharing information, solving problems, managing and keeping up with their schedules and tasks without having to check notice boards by the classroom corridors continually (Drury 2012).

Most of the HEIs have now taken an interest in new learning facilities to support learners' technological learning experience by using mobile devices. The focus has now shifted to the actual mobile digital literacy skills that both learners and educators need to acquire (Office of Educational Technology [OET] 2017). Digital literacy in teaching and learning has, therefore, become an essential aspect of growth in the educational institutions that have implemented teaching and learning programmes using mobile technologies. This benefits the educators as they are able to use mobile devices as a platform to remind the learners about certain tasks, homework, engage with them after school hours to solve problems, and share task-related information that learners can access anytime and anywhere. The use of mobile devices in classrooms also helps educators with not having to make copies of loads of material to take to the classrooms. Educators can also eliminate paper-based notes by introducing a cloud-based environment where learners can access the learning materials.

Barriers to Effective Use of Mobile Technologies by Educators in Teaching and Learning

Digital literacy is a crucial element of an innovative, enhanced learning experience. As a result, mobile technologies become of no value until educators receive adequate training on operating, maintaining and incorporating these technologies into their classrooms. Although the education sector is embracing the application of digital technologies in teaching and learning globally, it appears that most educators in South African HEIs are still not well prepared or do not feel confident to teach in a digital environment. According to the Via Africa Publishers Report (2014), out of South Africa's 413 067 educators, only 132 884 had been officially trained in basic computer skills and ICT machines by the year 2014. Therefore, not all educators have adequate online teaching competencies. Barriers to the effective use of mobile digital technologies are discussed below.

Lack of Educator Confidence in using Mobile Technologies

Educators are not always confident enough to use mobile technology when using it in front of the students, who might be more knowledgeable about using the devices. Guha (2000) states that students place pressure on their educators when they spend a lot more time interacting with various mobile technologies and therefore have expectations for the educators to display the same level of knowledge. The lack of confidence can be closely related to other problems, which can be viewed as barriers to mobile technology. As an example, educators' lacking confidence in using mobile devices is increased by insufficient time spent accessing personal technologies at home. In school, regular interruptions from technical difficulties can affect the educator directly. This induces a fear of devices breaking down or the educator causing the breakdown themselves

(Makgato 2012). Research literature has provided evidence that effective training is vital if educators wish to integrate ICT in their teaching effectively (Kirkwood and Price 2014). Competency can thus be achieved by providing educators with the appropriate professional development training. If training is insufficient, then educators will not be adequately equipped and perhaps not suitably confident to make full use of technology in and out of the classroom.

Lack of Time for Training

Snoeyink and Ertmer (2001) highlighted the lack of time for training as a major barrier and suggested that educators be granted training during school hours with no interruptions. Kirkwood (2000) noted that training educators in their personal time would cause a slow uptake in training.

Lack of Pedagogical Training

The study by Tedla (2012) on mobile technologies in teaching and learning found that educators were unable to transfer ICT skills acquired from their personal use into the classroom. Even though educators received pedagogical training in ICT, they found it challenging to make full use of the acquired knowledge in teaching practice sessions. Educators should thus be adequately trained on using new innovative technologies in their classrooms to help students reach their full potential.

Lack of Access to Resources

The lack of access to ICT resources, including lack of internet connectivity is a complex barrier. The lack of access to ICT in the rural areas is increasing the division between the haves and have-nots in basic education. The majority of learners in rural schools do not have access to the internet, specifically the smart devices to access online resources. For example, the lack of electricity in Botswana rural schools and the high cost of developing computer labs are substantial stumbling blocks (Eze and Olusola 2013). Internet connectivity is a challenging feat in areas with no telephones and electricity. This adds to the digital divide among learners in HEIs in South Africa. Rural schools also face a number of challenges, such as poor basic infrastructure and few material resources. The lack of sufficient ICT resources in institutions not only inhibits educators from integrating mobile technologies in their teaching, but also prevents the development of learning enhancements for students.

Lack of Technological Infrastructure

The study by Hennessy et al. (2010) has found that the available computers are outnumbered by the students in some schools. This poses challenges as students are required to share a computer, and they tend to get frustrated (Mathipa 2014). Apart from that, most HEIs have very outdated equipment and therefore, lack of resources is not only a barrier, but the availability of obsolete equipment is challenging to use.

According to a Via Africa Publishers Report (2014), only five out of nine provinces in South Africa currently use mobile devices for teaching and learning.

Lack of Institutional and Management Support

In order to sustain digital literacy programmes in HEIs, it is essential to align these initiatives with the organisation's goals and policy. The lack of management support at HEIs can be indicated by a lack of resources (financial and human resources), lack of technological infrastructure, lack of regular servicing of the available equipment, which then increases the risk of more frequent breakdowns. Institutions need to purchase equipment that has support agreements in place. The institutional factors supporting the realisation of digital technologies should include the prioritisation of digital literacy by senior management, the promotion of standardised and generic information and communications technologies (ICTs) infrastructure, managing partnerships and collaborations, and developing human resources and funding. There should also be a shared vision with the institution's stakeholders to support digital literacy initiatives and formulate appropriate budgets to include mobile devices.

Resistance to Change and Negative Attitudes

Traditional educators who are used to the traditional didactic methods would not feel the need to change to new teaching methods. These educators remain caught in their traditional ways of educator-centred approaches that give a sense of authority in their students' presence (Makgato 2012). Sang et al. (2010) emphasise that the educators' confident attitude towards mobile technologies for teaching is a significant determining factor of implementing ICT in teaching and learning. The use of ICT in some countries is considered immoral and goes against their religion.

Lack of Perceived Benefits

An important area of educators' attitude towards mobile devices is the comprehension of their teaching's benefit to their students. Snoeyink and Ertmer (2001) suggest that only observing other educators using mobile technologies will not demonstrate how this will be advantageous for use in their own teaching. Ertmer (1999) states that the problem with the low acceptance of mobile digital technologies by educators can be tackled by addressing the internal barriers, and that there is no point in furnishing the educators with digital devices when they lack confidence and a positive attitude required to change their classroom environment.

Initiatives for Developing Digital Literacy Skills

Mobile technologies have significant potential for revolutionising teaching in terms of accessibility, interaction and collaboration. However, there are substantial challenges involved that affect the effective use and integration of digital technologies in teaching and learning in HEIs. Digital literacy skills training is, therefore, a prerequisite for the practical application of these technologies, and it promotes transformation, skills

advancement and enables greater productivity, especially when an institution is continuously changing to the digital form. Considerable efforts and strategies have been made globally over the past few years to equip educators and learners with digital literacy skills. The Irish Government has recognised the importance of digital literacy and developed strategies, including the Schools IT2000 Plan, which was introduced in Ireland in September 1996 in line with the "Learning in the Information Society" (IT2000 Plan 1996). The IT2000 Plan (1996) proposed four main reasons for integrating ICTs into the Irish school system, including to:

- Recognise the potential social benefit of digital literacy to society.
- Recognise the potential vocational and economic benefits that could be created by promoting Information and Communication Technologies (ICT).
- Support pedagogic reasons for adopting ICTs in the classroom by providing rich, entertaining and motivating learning environments.
- Suggest catalytic reasons for ICT integration, as computers could increase positive trends such as active learning.

The Digital Schools Strategy (DES) was recognised and all the suggestions from the IT2000 Plans were therefore implemented in HEIs in Ireland. The introduction of the National Digital Strategy (2013), supported by the National Council for Teacher Education (NCTE), encompassed education and economic incentives to encourage digital engagement. The use of digital technologies as an integral part of teaching, learning and assessment was endorsed in all recent educational policies and plans. These include the Digital Futures in Teacher Education (DeFT), the project-based programme at Sheffield Hallam University, designed Open Educational Resources (OERs) in the form of an Open Textbook, to address the opportunities and challenges of creative and innovative uses of digital literacy in the school and teacher education sectors (Gruszczynska and Pountney 2015). The project team worked with teachers in various schools in South Yorkshire to develop case studies of digital practices, including mobile devices, digital video, Web2.0 applications, and school intranets. The DeFT project became a focus for exploring the intersections of digital literacy and creativity. One key outcome of the project was the preparation of new teacher training courses in digital literacy and the use of OER for learning and teaching in formal and informal settings (Gruszczynska and Pountney 2015). An important part of the DeFT project was to involve teachers and students, trainee teachers and university colleagues as equal partners in exploring digital literacy possibilities (Gruszczynska, Merchant, and Pountney 2013).

In South Africa, The White Paper on e-Education (2004) outlined the elements of transformed learning and teaching through ICT and it was supported by the publication of "Guidelines for Teacher Training and Professional Development in ICT", which provides guidelines for teacher professional development in ICT and educator competencies within a developmental framework. The United Nations (2015) adopted the Sustainable Development Goals (SDGs), and Goal 4 of the SDGs commits the

international community to ensure inclusive and quality education for all and promote lifelong learning. The "Professional Development Framework for Digital Learning" (2017) also provides a fresh approach to teachers' and all stakeholders' professional development, using digital tools and content resources to support improved learning outcomes and higher learner attainment in the curriculum. Goal 16 of the Department of Basic Education's (DBE) (2019) action plan also commits the department and its partners to improve teachers' professionalism, teaching skills, subject knowledge and computer literacy throughout their careers. The "Integrated Strategic Planning Framework for Teacher Education and Development" (ISPFTED) (2011) in South Africa also has its primary outcome of improving the quality of teacher education and development to improve the quality of teachers and teaching. The ISPFTED leads implementation agencies at the national and provincial education department levels, including the Provincial Teacher Development Institute (PTDI) and District Teacher Development Centre (DTDC).

Conclusion and Recommendations

The study identified barriers to the effective use of mobile technologies that need to be addressed to ensure the effective integration of mobile technology in teaching and learning. Digital literacy is viewed as a prerequisite for the effective use of digital technologies in teaching and learning in HEIs in South Africa. Recommendations derived from a review of the literature to address the impediments, include:

- The government must provide sufficient professional development opportunities for educators to enable them to receive adequate training, which will enhance teaching and learning.
- Institutions' management must encourage educators to collaborate among themselves, share and gain experience from competent and experienced educators (Hennessy et al. 2010), and establish policies that endorse all educators to use mobile technology in their courses.
- Some educators resist change and the typical reasons are that educators are happy with the status quo, possible inconvenience caused by change, and that they cannot see the need and benefits for adaptation. There is also a lack of clear communication and a lack of support, as well as a lack of competence and general negativity among educators. HEIs must find ways of dealing with resistance to change to suit the current promising mobile technology teaching. It is thus recommended that an analysis to investigate resistance to change be undertaken, firstly by identifying the sources and reasons for resistance. Institutions can clear up misunderstandings and communicate the benefits of change through discussion, memos and reports. The involvement of as many people as possible is essential in the decision-making and planning process to reduce resistance. Finally, there is a need to maintain a clear focus on change and to embrace resistance as part of learning.

- The use of multiple digital platforms, mobile devices and various web interfaces should form part of the curriculum to enhance students' and educators' digital literacies. HEIs also have a crucial role to play, as they have to introduce digital technologies to enable educators and learners to master skills on the use of multiple digital devices and adapt to emerging technologies. These institutions should thus prioritise professional development and digital literacy training for both educators and learners through workshops and seminars. They should encourage technology-enabled communities of practice among educators and learners to ensure effective knowledge sharing. Educators should also collaborate with educators from other learning institutions to develop technology-oriented lesson plans.

References

Aktaruzzaman, M., M. R. H Shamim, and C. K. Clement. 2011. "Trends and Issues to Integrate ICT in Teaching and Learning for the Future World of Education." *International Journal of Engineering and Technology* 11 (3): 114–199.

Ala-Mutka, K., Y. Punie, and C. Redecker. 2008. *Digital Competence for Lifelong Learning.* Policy brief. Digital Competence. European Commission.

Bawden, D. 2008. "Origins and Concepts of Digital Literacy." *Digital Literacies: Concepts, Policies and Practices*, 17–32.

Beetham, H., and R. Sharpe. 2013. *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*, 2nd edition. Routledge. Accessed April 17, 2013. https://doi.org/10.4324/9780203078952.

Burns, J. 2017. "Pupils Need Internet Lessons to Thrive." Accessed October 25, 2018. https://www.bbc.com/news/education-39329967.

Burnett, C. 2009. "Personal Digital Literacies versus Classroom Literacies: Investigating Pre-service Teachers' Digital Lives in and beyond the Classroom." In *Digital Literacies: Social Learning and Classroom Practices*, 115–129, edited by V. Carrington and M. Robinson. London: Sage. https://doi.org/10.4135/9781446288238.n8.

Common Sense Media. 2018. "What is Media Literacy and why Is it Important?" Accessed 22 October 2018. https://www.commonsensemedia.org/news-andmedia-literacy/what-is-media-literacy-and-why-is-it-important.

Department of Basic Education (DBE). 2019. *Quarter 4 Performance.* South Africa.

Drury, E. 2012. "Mobile Phones in the Classroom: Teachers Share their Tips." *Teacher Network. The Guardian.*

Ertmer, P. A. 1999. “Addressing First- and Second-order Barriers to Change: Strategies for Technology Integration.” *Educational Technology Research and Development* 47: 47–61. https://doi.org/10.1007/BF02299597.

E-Safety Support. 2013. “What Every Teacher Needs to Know About Digital Literacy Issues.” Accessed September 10, 2013.

Eze, R. I., and E. Olusola. 2013. “The Teachers and the Use of ICT for Professional Development.” *International Conference on ICT for Africa.* February 20–23, Harare, Zimbabwe.

Falloon, G. 2020. “From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework.” *Education Tech Research Development,* Springer. https://doi.org/10.1007/s11423-020-09767-4.

Geer, R., B. White, Y. Zeegers, A. Wing, and A, Barnes. 2017. “Emerging Pedagogies for the Use of iPads in Schools.” *British Journal of Educational Technology* 48 (2): 490–498. https://doi.org/10.1111/bjet.12381.

Gruszczynska, A., G. Merchant, and R. Pountney.2013. “Digital Futures in Teacher Education: Exploring Open Approaches towards Digital Literacy.” *Electronic Journal of e-Learning* 11: 193–206.

Gruszczynska, A., and R. Pountney. 2015. “Developing the Concept of Digital Literacy in the Context of Schools and Teacher Education.” *Enhancing Learning in the Social Sciences* 5 (1): 25–36. https://doi.org/10.11120/elss.2013.05010025.

Guha, S. 2000. “Are we all Technically Prepared? Teachers’ Perspectives on the Causes of Comfort or Discomfort in Using Computers at Elementary Grade Teaching.” Paper presented at the Annual Meeting of the National Association for the Education of Young Children. Atlanta, GA, November 8–11.

Hague, C., and B. Williamson. 2009. *Digital Participation, Digital Literacy and School Subjects. A Review of the Policies, Literature and Evidence*. National Foundation for Educational Research (NFER). United Kingdom.

Hague, C., and S. Payton. 2010. *Digital Literacy across the Curriculum.* Future Lab.

Harris, J., and M. Hofer. 2009. “Instructional Planning Activity Types as Vehicles for Curriculum-based TPACK Development.” In *Proceedings of Society for Information Technology and Teacher Education International Conference,* 4087–4095, edited by I. Gibson et al. Chesapeake, VA: Association for the Advancement of Computing in Education.

Heitin, L. 2016. “Digital Literacy: An Evolving Definition.” Accessed October 23, 2018. https://www.edweek.org/ew/articles what-is-digital-literacy.html.

Hennessy, S., D. Harrison, and L. Wamakote. 2010. “Teacher Factors Influencing Classroom Use of ICT in Sub-Saharan Africa.” *Itupale Online Journal of African Studies*, 2.

Hilton, T. 2016. “A Case Study of the Application of SAMR and TPACK for Reflection on Technology Integration into two Social Studies Classrooms.” *The Social Studies* 107 (2): 68–73. https://doi.org/10.1080/00377996.2015.1124376.

Hoppe, H. U., R. Joiner, M. Milrad, and M. Sharples. 2003. Guest editorial: “Wireless and Mobile Technologies in Education.” *Journal of Computer Assisted learning* 19: 255–259. https://doi.org/10.1046/j.0266-4909.2003.00027.x.

Hughes, J., R. Thomas, and C. Scharber. 2006. “Assessing Technology Integration: The RAT-Replacement, Amplification, and Transformation Framework.” *SITE 2006 Proceedings*, 1616–1620.

IT2000 Plan. 1996. *Schools IT2000 Full Report.* Ireland. Irish Information Society.

Joint Information Systems Committee (JISC). 2011. “Digital Literacy Anatomised: Access, Skills and Practices.” Accessed December 4, 2012. http://jiscdesignstudio.pbworks.com/w/file/40474828/Digital%20literacies%20anatomy.

Kirkwood, A. 2000. “Learning at Home with Information and Communication Technologies.” *Distance Education* 21: 248–259.

Kirkwood, A., and L. Price. 2014. “Technology-enhanced Learning and Teaching in Higher Education: What Is ‘Enhanced’ and how do we Know? A Critical Literature Review.” *Learning, Media and Technology* 39 (1): 6–36. https://doi.org/10.1080/17439884.2013.770404.

Kirkland, A. B. 2014. “Models for Technology Integration in the Learning Commons.” *School Libraries in Canada* 32 (1): 14–18.

Koehler, M. J., P. Mishra, and W. Cain. 2013. “What is Technological Pedagogical Content Knowledge (TPACK)?” *Journal of Education* 193 (3):13–19. https://doi.org/10.1177/002205741319300303.

Makgato, M. 2012. “Status of Teachers’ Use of Educational Technology: A Case of some Schools in South African Semi-urban Locations.” *International Proceedings of Economics Development and Research (IPEDR),* 47 (23).

Maphosa, C., and S. Bhebhe. 2019. “Digital Literacy: A Must for Open Distance and e-Learning (ODEL) Students.” *European Journal of Education Studies* 5 (10): 186–1999.

Mathipa, E. R. 2014. “Teacher Factors Influencing the Use of ICT in Teaching and Learning in South African Urban Schools.” *Mediterranean Journal of Social Sciences* 5 (23). https://doi.org/10.5901/mjss.2014.v5n23p1213.

Mishra, P., and M. J. Koehler. 2006. “Technological Pedagogical Content Knowledge: A Framework for Integrating Technology in Teachers’ Knowledge. *Teachers College Record* 108 (6): 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x.

Merchant, G. 2009. “Web 2.0 New literacies and the Idea of Learning through Participation.” *English Teaching: Practice and Critique*, 8 (3).

Meyers, E. M., I. Erickson, and R. V. Small. 2013. “Digital Literacy and Informal Learning Environments: An Introduction.” *Journal Learning, Media and Technology* 38 (4): 355–367. https://doi.org/10.1080/17439884.2013.783597.

National Digital Strategy .2013. *Investing Effectively in Information and Communications Technology in Schools: The Report of the Minister’s Strategy Group*. Ireland: Department of Education and Science.

Ndongfack, M. 2015. “TPACK Constructs: A Sustainable Pathway for Teachers’ Professional Development on Technology Adoption.” *Creative Education* 6: 1697–1709. https://doi.org/10.4236/ce.2015.616171.

Ngulube, P. 2017. “Overcoming the Difficulties Associated with Using Conceptual and Theoretical Frameworks in Heritage Studies.” In *Handbook of Research on Heritage Management and Preservation,* 1-23, edited by P. Ngulube. IGI Global, Hershey, PA.

Office of Educational Technology (OET). 2017. *Reimagining the Role of Technology in Education: National Education Technology Plan Update.* United States: US Department of Education.

OECD. 2013. “Teachers’ Professional Development: Europe in International Comparison.” Paris, OECD. Accessed January 28, 2013. http://ec.europa.eu/education/school-education/doc/talis/report_en.pdf.

Pagani, L., G. Argentin, M. Gui, and L. Stanca. 2016. “The Impact of Digital Skills on Educational Outcomes: Evidence from Performance Tests.” *Journal of Educational Studies* 42 (2): 137–162. https://doi.org/10.1080/03055698.2016.1148588.

“Professional Development Framework for Digital Learning.” 2017. *Building Educator Competencies in Facilitating Learning with Digital Tools and Resources.* South Africa: Department of Basic Education.

Puentedura, R. 2006. “Transformation, Technology and Education: A Model for Technology and Transformation. Accessed August 22, 2019. http://hippasus.com/resources/tte/puentedura.pdf.

Sang, G., M. Valcke, J. Van Braak, and J. Tondeur. 2010. “Student Teachers’ Thinking Processes and ICT Integration: Predictors of Prospective Teaching Behaviors with Educational Technology.” *Computers and Education* 54: 102–112. https://doi.org/10.1016/j.compedu.2009.07.010.

Shulman, L. 1986. “Those who Understand: Knowledge Growth in Teaching.” *Educational Researcher* 15 (2): 1–22. https://doi.org/10.3102/0013189X015002004.

Study Smart Zone. 2018. “What Is Digital Literacy?” Accessed October 23, 2018. www.westernsydney/studysmart/digital_literacy.

Snoeyink, R., and P. A. Ertmer. 2001. “Thrust into Technology: How Veteran Teachers Respond.” *Journal of Educational Technology Systems* 30 (1): 85–111. https://doi.org/10.2190/YDL7-XH09-RLJ6-MTP1.

Sutton, S. 2011. “The Pre-service Technology Training Experiences of Novice Teachers.” *Journal of Digital Learning in Teacher Education* 28 (1): 39–47. https://doi.org/10.1080/21532974.2011.10784678.

Tay, L. Y., S. K. Lim, C. P. Lim, and J. H. L. Koh. 2012. “Pedagogical Approaches for ICT Integration into Primary School English and Mathematics: A Singapore Case Study.” *Australasian Journal of Educational Technology,* 28 (4). https://doi.org/10.14742/ajet.838.

Tedla, B. A. 2012. Understanding the Importance, Impacts and Barriers of ICT on Teaching and Learning in East African Countries.” *International Journal for e-Learning Security* (JeLS), 2 (3/4). https://doi.org/10.20533/ijels.2046.4568.2012.0025.

Terrell, S. 2018. “Digital Learning Theories and Models You Should Know.” Accessed January 11, 2019. https://www.techlearning.com/digital-learning-theories-andmodels-you-should-know.

The Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED). 2011. *Together, Taking Responsibility for Teacher Education and Development*. South Africa: Basic Education, Higher Education and Training.

UNESCO. 2006. *UNESCO Guidelines on Intercultural Education*. Paris: UNESCO.

UNESCO. 2011. *UNESCO ICT Competency Framework for Teachers.* UNESDOC Digital Library.

United Nations. 2015. *The 2030 Agenda for Sustainable development: 17 Sustainable Development Goals (SDGs).* United Nations Development Programme (UNDP). Department of Economic and Social Affairs.

Via Africa Publishers Report. 2014. *Snapshot of eLearning.* South Africa: Via Africa Publishers.

White Paper on e-Education. 2004. Department of Education, RSA. http://www.education.gov.za/Portals/Documents/Legislation/White20paper.