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Enhancing the Digital Literacy Experience of Teachers to Bolster Learning in the 21st Century

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Abstract: The interconnected constructs of education in the 21st century cannot be divorced from teacher training. This article reports on the digital literacy experience of teachers amidst the worldwide recommendations of using distance learning and open educational applications to address education during the COVID-19 pandemic lockdown. Altogether, 840 participants were purposively selected from urban, semi-urban, and rural areas in South Africa; 217 completed an online qualitative survey, while 23 took part in three virtual focus-group discussions. Van Dijk's Resources and Appropriation Theory guided the study. Data analysis involved descriptive statistics and thematic analysis. The findings revealed the gaps between what is expected of teachers and their own realities, besides teachers' eagerness to be involved in digital literacy. Recommendations include the need to continually align the teacher education curriculum with the country's skills need and to provide teachers with the required support. Associated directions for further research are suggested.

Keywords: early years education, 21st-century skills, digital literacy, teacher education curriculum, resources and appropriation theory.

Introduction

The emergence of advanced "information and communication technologies (ICTs)", a term also used interchangeably with "technical devices" in this article, has accentuated the difference between the skills needed by learners in the 21st century in terms of professional life, citizenship and self-actualisation from those that were needed in the 20th century (Tican & Deniz, 2018). In a *Brooking* report, Madden and Kanos (2020), indicate that few Africans are acquiring the competencies they need for 21st-century occupations. Therefore, in many countries, government and educational institutions are providing support to modernise the technical equipment of schools and to develop learning materials for teachers at diverse levels of progress (Marci-Boehncke & Vogel, 2018).

African schools have their own challenges, and the current COVID-19 pandemic has further exposed these. As of March 30, 2020, over 87% of the world's student population — 1.5 billion children and youth — have been affected by school closures in more than 180 countries (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020). According to the UNESCO report, recovery will be more difficult for most African countries due to serious economic and technological challenges — an assertion also confirmed by similar studies on the continent (Krönke & Olan'g, 2020; Madden & Kanos, 2020; United Nations, 2019). Due to the seriousness of the COVID-19 pandemic in South Africa, various lockdowns were imposed on the country with devastating effect on education. The periods saw an introduction of rotational attendance, irregular school closures and days off for specific grades with a loss of a full academic year (UNICEF, 2021). The report in addition

asserts that about 750,000 children, especially those living in informal and rural settings, due to poverty, are out of school. As a result of the pandemic, recommendations worldwide were to use the distance learning mode and open educational applications to address teaching and learning during this period. Although these recommendations have highlighted the enormous inequality challenges facing South Africa's education system, they could be the catalyst for action to address them (McDonald, 2020).

Digital divides are complex and constantly evolving, and they refer to differences in access to ICTs (for instance, personal computers and mobile phones) and purposeful use of them (as determined by outcomes) by individuals, or by social or political units (Skaletsky et al., 2017). Factors that have an impact on who has access to technology, what kind of technology people have access to, and who can use technology include age, educational level, income level and behaviour (Umugiraneza et al., 2018). Others are policy guidelines, school support, and investment in ICT in the schools (Mustapha et al., 2020). Skaletsky et al. (2017) argue that difficulties with ICT access have an impact on the society involved and cause them to suffer unequal benefits and unequal participation, thus leading to social injustice.

In the 21st century, ICTs are invariably linked to education; therefore, teachers are expected to be familiar with the various pedagogical approaches to appropriately use them in promoting the development of their learners' 21st-century skills (Valtonen et al., 2017). However, this is not possible if teachers have been neither adequately prepared nor assisted to take up this role. There is a gap between the curriculum of teacher education, societal needs and the world of work, which is a problem that is not exclusive to South Africa (Zeichner, 2014). The implication of this is that higher education institutions will continue to churn out graduates whose skills are not relevant to the needs of the society, with no return on investment for the government and the public in general.

Studies in Africa have revealed that the majority of teachers lack essential technological knowledge and need extensive professional development to apply technology in teaching (Aluko, 2019). This is also very true in the South African context, where this study was conducted (Torres & Giddie, 2020). To access appropriate ICTs and improve digital competence, there is the need for digital literacy, which is widely understood as an inter-related set of skills that are vital for success in the digital age (List, 2019). Teachers' lack of ICT knowledge and skills is a key barrier to effective teaching, as teachers need to be conversant with digital media cultures that are vital for learners. They must also be able to use technology pedagogically in ways that are appropriate to the subject(s) being taught (Amhag et al., 2019; Torres & Giddie, 2020).

The current study examines to what extent educators were able to cope with teaching and learning during the COVID-19 pandemic. The main research question that guided our study was, *Given the worldwide recommendation of using the distance learning mode and open educational applications to address teaching and learning during the COVID-19 pandemic lockdown, how were teachers in our context able to continue with teaching?* The emphasis was on the digital literacy experience of teachers enrolled as distance education students in three geographical areas (rural, semi-urban and urban). The Resources and Appropriation Theory adopted for the study assisted the researchers to probe factors beyond physical access that affected educators' use of technology for teaching (Van Dijk, 2005, 2017).

Theoretical Background

The authors adopted Van Dijk's Resources and Appropriation theory (Van Dijk, 2005, 2017). The term digital divide, which originated in the mid-1990s (Casado-Muñoz et al., 2015), has been widely investigated from the lens of individualism, which is only descriptive in nature (Wellman & Berkowitz, 1988). Unfortunately, according to Van Dijk (2013), this kind of view only "measures the properties and attitudes of individual respondents' without necessarily giving reasons for the results. Therefore, the theorist situated his work in the 'relational or network' notion of inequality, which pays attention to the 'positions of individuals and the relationships between them" (29). According to Van Dijk (2017), definite inequalities in society produce an "unequal distribution of resources that causes unequal access to digital technologies"(3), and this "brings about unequal participation in society". Based on these core arguments, Van Dijk identified four successive phases of access that are briefly described below:

1. Motivation: to appropriate a technology, one should first be motivated to use it.
2. Physical and material access: when sufficient motivation is developed, one should be able to acquire physical access (e.g., to a computer, internet) and material resources (e.g., battery — an example of computer components). However, these will not automatically lead to its use.
3. (Mastering of) digital skills: the acquirer needs to develop the needed skills to make appropriate use of the technology.
4. Usage: this can be measured by the frequency of usage (Van Dijk, 2013), however, to transform instruction, this would depend on the purpose for which it is used.

The phases are recurrent because they are repeated wholly or partly with new technology or innovation (Tusiime et al., 2019).

Two of the criticisms levelled against the theory are that it might be less applicable in a society that has greater equality in socioeconomic status and resources, and that the full amount of information to operationalise the model is difficult to obtain for large samples (Pick & Sarkar, 2016). However, both criticisms are not applicable to this study because our context is largely divided regarding access to ICT and its usage, and our sample is not large.

In addition, we found Van Dijk's Resources and Appropriation theory relevant to our study because it goes beyond the individual notion of inequality to focus on the relational notion of inequality. The latter has assisted us to further examine factors that are beyond individuals regarding access to technology and its usage, especially in relation to the focus of our study — teachers' inability to meet up to society's expectation during the pandemic lockdowns.

Methods

Research Design

We adopted the explanatory sequential mixed-methods research design involving the use of a survey and focus-group discussion in order to involve more students and to strengthen the findings (Creswell, 2014). In addition to our gaining a deeper understanding of teachers' digital literacy experience, our choice of design was necessitated by the strenuous technological conditions under

which our distance education students were studying, worsened by the pandemic. We had envisaged the latter would have impact on the rate of response to the online survey.

Population and Sample

The strategy of non-probability, convenience and purposive sampling was used (Etikan et al., 2016). The sampling was convenient and purposeful because the participants were easily accessible to the researchers and were relevant to the study. Distance education programmes at the unit of study are for the upgrading of teachers' qualifications. A full programme is divided into Blocks (1-4) made up of a six-month cycle. Therefore, the population consisted of 2,970 educators (the total number of enrolled students), while the sample was 840 Block 1 students enrolled for the Bachelor of Education (BEd) Honours (Hons) Teacher Education and Professional Development (TEPD) distance education programme at a university in South Africa. Block 1 students refer to newly enrolled students, who we expected to be more familiar with technology usage for teaching and learning than students from the earlier blocks.

Context

The participants were from three geographical areas tagged rural, semi-urban and urban. Rural refers to schools in the countryside; semi urban implies schools in somewhat, but not wholly, urban areas, and urban refers to schools in the city (Urban Dictionary 2020). According to Atkinson (2014), the categorisation of the South African society is complex, especially due to its historical past. This has also impacted current educational landscapes regarding who has access to educational resources and technological gadgets (Torres & Giddie, 2020). Therefore, our categorisation was based on physical features (such as access to ICT infrastructure and electricity), especially with reference to our study and for analysis purposes.

Of the 840 sampled Block 1 students, 217 (25.83%) participated in the survey. These were comprised of rural (n = 128, 58.99%); urban (n = 45, 20.74%); and semi-urban (n = 44, 20.28%).

Twenty-three participants took part in the focus group discussion (rural: n = 7; semi-urban: n = 9; urban: n = 7).

Instruments

The survey contained 10 questions made up of closed and open-ended questions (text-entry) that had been developed in Qualtrics. These were divided into two sections: biographical information (two question items) and digital experience (eight question items). The latter covered questions on technical devices and access; usage frequency; integration of technology into lessons; benefits (to both teaching and learners); preparation for usage (relevant module at university and in-service training — INSET); areas where teachers need support; and recommendation or non-recommendation of the use of technical devices to others for teaching and learning.

The guide for the focus-group discussion was developed based on the data we gathered from the survey. Our aim was to generate more in-depth knowledge on the sections than we had obtained from the survey.

The development of both instruments was informed by the adopted theory and relevant literature.

Procedure

Survey

Each of the 840 sampled Block 1 students received a short message service (SMS) to prepare them for the data collection. The content is provided in Table 1.

Table 1: SMS content sent to sampled participants

Dear student, distance education research helps us to serve you better. Thank you for completing this survey. UP.

The SMS was followed by the survey, to which 217 students responded.

Focus-Group Discussion

In preparation for the focus-group discussion, the researchers first sent an SMS to the 217 respondents. The purpose was to: alert them to the planned focus-group discussion; request their voluntary participation; and to request their geographical area, a contact number and their student registration number. A total of 70 students responded but we purposively invited the first 11 students who submitted all the requested information per geographical area. The virtual discussions were zero-rated for the participants and they took place at different time slots on different days.

Data Analysis

Qualtrics analysed the closed question items (five) in the survey using descriptive statistics. We exported the open-ended data and read all the responses of the participants to each of the open-ended questions in order to group the data. We re-read them and categorised the responses into themes.

The analysis of the discussion data involved the transcription of the focus-group discussion recordings, coupled with familiarising ourselves with the data by reading it over several times. This led to the development of codes, from which we generated themes, and we subsequently reviewed and named the themes (Creswell, 2014). Table 2 depicts the themes and sub-themes generated from the data. The theory adopted for the study assisted us in interpreting the data.

Table 2: Themes and sub-themes that emerged from the data analysis.

Theme	Sub-theme
Technical devices and access	Access to technical devices and source
	Kinds of technical devices and usage frequency
	Integration of technical devices and benefits
	Technical support
	Reason for non-access or limited access
Preparation for ICT usage	Preparation during teacher training
	Coping with no training
	Digital experience
Virtual teaching during lockdown and support	Virtual teaching during lockdown
	Technical support during lockdown
Teachers' willingness to use technical devices	Willingness
Areas in which teachers need assistance	Support
Advice to stakeholders	Teachers and management
	Teacher training institutions
	Government

Ethical Issues

The unit that manages distance education obtained ethical clearance from the faculty to conduct research with enrolled students as participants. The information is included in the application form and in the students' Administration Booklet. The discussions were recorded with the participants' permission. They were reminded of their right to anonymity and the voluntary withdrawal nature of the discussion.

Results

Findings from both sets of data are presented in a corroborative way that supports the findings from both instruments.

Theme 1: Technical Devices and Access

Access to Technical Devices and Source

The feedback on teachers' access to technical devices shows that most of the participants were struggling. While few in the urban areas were privileged to be working in private schools, others who did not fall into this category lamented the inadequate devices that were available for teachers and learners. Most bemoaned the slow process of change, partly due to rigidity on staff's part and lack of funds.

In most cases, participants from both the rural and semi-urban areas used their own technical devices, such as laptops and mobile phones. Most participants indicated their schools were wi-fi connected; however, some — from both rural and urban areas — did not have access to the internet.

Kinds of Technical Devices Used and Usage Frequency

Findings from the survey showed our participants had access to more than one technical device — mostly mobile phones and computers (n = 89, 22.31%). Some reported having internet connectivity (n = 49, 12.28%), a projector (n = 40, 10.03%), an interactive whiteboard (n = 30, 7.52%), or an iPad (n = 2, 0.50%). Other technologies mentioned by participants included a blackboard, a laptop, a whiteboard and television. Only 80 (20.05%) participants indicated they had access to electricity that was needed to power almost all these devices. When the power went off, schools (apart from some private schools) had no other back-up, except to revert to the 'chalk-and-talk' method of teaching or the use of a whiteboard. The feedback that was received showed that most of the participants were struggling.

About a third (n = 44, 30.56%) indicated that they 'always' used technology for teaching; 21 (14.58%) 'often'; 54 (37.50%) 'sometimes'; 9 (6.25%) 'seldom', and 16 (11.11%) 'never' used technology. In summary, this implies that although some participants did not use technical devices for teaching, the majority used such devices regularly.

Integration of Technology and Benefits

Some participants indicated they made extra copies of notes to save time so that there would be enough time for teaching and learning; they used projectors and downloaded videos from YouTube for most of their lessons. Only a few in the urban areas made videos, sent voice notes to students, and created electronic assignments. This group found the use of technology beneficial because it increased their teaching efficiency, exposed them to different teaching methods, and improved communication between them and their learners. Learners also benefited greatly because they could get immediate feedback, collaborate with their peers and work at their own pace. Technology was indeed found to cater for diverse learning styles.

Those participants who did not use technical devices in their teaching lamented learners' lack of access to resources and their lack of data.

Technical Support

Participants from the three areas (urban, semi-urban and rural) had some form of technical support, although many complained that it was inadequate. Examples of such support are an ICT Department at school, an ICT circuit cluster formed in a rural area, service providers and assistance from a publishing house.

Reasons for Non-access or Limited Access

Reasons for non-access or limited access to technical devices cited by participants from both rural and semi-rural areas included limited network coverage, lack of budget and sponsorship, school managers' resistance, and technophobia. Commenting on the side-effects of these challenges, a participant bemoaned,

> We are not preparing learners for the Fourth Industrial Revolution. They don't know how to use (technology) in a way that will help them educationally or prepare them for university. This is like they are competing with learners that are at different level with them. I think it's a barrier for them … (Focus Group Discussion Rural 1 — FGDR1).

This quote brings to the fore the inequalities in society.

Table 3 reflects further some examples of participants' responses to Theme 1.

Examples of Participants' Responses to Theme 1

Table 3: Participants' Responses Illustrating Theme 1

Number	Sub-theme	Data Source	Response
1.1	Access to technical devices and source	Discussion (urban)	"I have a laptop, there is a projector and the learners have their desktop computers."
		Discussion (semi-urban)	"I think at my school, we have less than 20 tablets (to) more than 1,900 learners."
1.3	Integration of technology and benefits	Survey (urban)	"It gives me more information on my teaching and makes teaching complex life processes easier."
		Survey (semi-urban)	"I would like to use Google forms, Kahoot, etc … but the learners have trouble accessing data or the correct devices."
1.4	Technical support	Discussion (urban)	"… we do not have any ICT support, so we have to go out of our way to help (one another)."
1.5	Reasons for non-access/limited access	Discussion (semi-urban)	"… no budget; previous laptops were stolen; no sponsors."

Theme 2: Preparation for ICT Usage

Teachers' Preparation the Use of Technology During Preparation Period as a Student-Teacher

Over half of the respondents (n = 73, 53.28%) indicated they did not receive any ICT training, although one participant indicated this might be due to the period when a teacher studied. Those who did receive training cited a few ICT modules they completed at university, for example, technology-integrated learning, basic computer literacy, ICT for educators, and how to use smart boards and smart apps.

Coping with No Prior Training

The majority of the 133 respondents (n = 99, 74.44%) indicated that they had not received any in-service training related to ICT usage. Two of those who had, cited a publishing house and a training arranged by the department (which has been discontinued), while the rest were self-taught. While private schools in many instances were reported to train newly employed staff, some of the participants unfortunately complained about the quality of the training. Nonetheless, none of the participants indicated that they had received training on how to use technology to teach in their learning areas.

Digital Experience

Many of the participants felt their digital experience was average, with only one participant indicating he was comfortable. He did, nevertheless, lament the burden of being almost the only one among many. Some of the participants indicated that many teachers can neither use technical devices for their own gain nor for teaching; while one suggested that some teachers cannot even "type a simple document" (FGDS3 — Semi-urban 3).

Table 4 reflects participants' responses illustrating Theme 2.

Table 4: Participants' Responses Illustrating Theme 2

Number	Sub-theme	Data Source	Response
2.1	Teachers' preparation for the use of technology during training period	Discussion (rural)	"I did classes at varsity and we used to submit many assignments online."
		Discussion (urban)	"Unfortunately, on my side … I did not receive any training."
2.2	Coping with no prior training	Discussion (semi-rural)	"… many teachers don't have laptops; you are only told of training in the morning and you may not have your laptop on you. Only the facilitators have the technology … they give us manual."
2.3	Digital experience	Discussion (semi-urban)	"People are not able to submit something because they don't have access to a laptop. It's very difficult to print because there is only one computer at the office."

Theme 3: Virtual Teaching

Virtual Teaching during Lockdown

According to most participants, no virtual teaching took place during the lockdown. Although prior to this period, few were using WhatsApp to communicate with learners' parents (especially those from private schools), they and those who tried the app for the first time were all unsuccessful in respect of online teaching. The reasons included very few learners participating, lack of parents' interest, lack of money for data and smart phones, lack of network coverage, and because most parents were uneducated. Only two participants from private schools in the urban area indicated that they had used Zoom, Google Meet and Google Classroom to teach.

Technical Support During Lockdown

Almost none of the participants received technical support during the lockdown, except for one. In that particular case, the principal was experienced and was on all the school's WhatsApp groups.

Table 5 illustrates examples of participants' responses to Theme 3.

Table 5: Participants' Responses Illustrating Theme 3

Number	Sub-theme	Data Source	Response
3.1	Virtual teaching during lockdown	Discussion (semi-rural)	"In my own school, nothing has been happening – it is the old way of teaching and learning."
3.2	Technical support during lockdown	Discussion (urban)	"We need ICT support because I am the only one with ICT knowledge and it becomes a burden to assist everyone, including learners."

Theme 4: Teachers' Willingness to Use Technical Devices

During the focus-group discussions, all the participants from the three geographical areas indicated their willingness to use technical devices, and in the survey the majority of the 131 respondents (n = 127, 96.95%) also answered in the affirmative. The various reasons they cited for this can be summed up as 'the value the devices bring to teaching and learning'. They approved of the non-interruption of

classes and felt that teachers cannot afford to be left behind in the 21st century, despite the difficulties it presents to them. Two participants indicated that there was not much resistance from teachers regarding the use of technical devices but cited "overcrowded classes and lack of resources" (FGDR1), as well as "teachers' older age" (FGDR3) as reasons why the minority (n = 4, 3.05%) might be unwilling to embrace technology.

Areas in which Teachers Need Assistance

Participants indicated they would need support in the following areas: how to use a computer; technology to improve pedagogical skills in different subjects; available technologies/apps for teaching; being able to conduct online tests for leaners; collaboration; and platforms where they would be able to do online teaching with learners having access to internet. Other areas of desired support included how to conduct research, since not all information in technology may be relevant; reading online books, and online security.

Advice to Stakeholders by Participants

Advice to Teachers

Some participants recommend that teachers embrace technology and familiarise themselves so as not to become frustrated. Technology use has great value and it is relevant to the learners. Nonetheless, school management also needs to support teachers because management sometimes does not budget for technology.

Advice to Teacher Training Institutions

A participant captured this recommendation well in the following comment: "Embed technologies into the training on the subjects, teachers will be teaching at schools" (FGDR1).

Advice to the Government

Teachers need support from government to enable them to familiarise themselves with technical devices, especially in view of the requirements of the Fourth Industrial Revolution (4IR). The government should furthermore pair with institutions by offering yearly programmes to train newly appointed teachers in technology use. They should also provide training to those who have been in service for a longer time and do not know how to use computer technology, to make sure everyone is on par.

Regarding connectivity, the government should enter into an agreement with providers (for instance, Mobile Telephone Network [MTN]) to make sure schools are connected to the internet, because data is expensive. The department should also consider having a zero-rated website.

Schools need infrastructure, especially during a crisis like the current COVID-19 pandemic, and therefore also adequate security to protect technical devices, because they are often stolen.

Table 6 reflects examples of participants' responses to Theme 6.

Table 6: Participants' Responses Illustrating Theme 6

Number	Sub-theme	Data Source	Response
6.1	Teachers	Discussion (urban)	"It is advisable teachers attend courses."
6.2	Teacher training institutions	Discussion (rural)	"… teachers need subject-specific technology training."
6.3	Government	Discussion (semi-urban)	"Government should provide us with devices like in the private schools … find sponsors to donate laptops and tablet for learners."

Discussion

According to Van Dijk (2013), the roots of motivational access are mostly mental and psychological in nature — rather than social or cultural. In our study, all the participants indicated their interest in using technical devices for teaching. This is despite the diverse challenges faced, especially by those from rural and semi-urban areas. Their eagerness and motivation could be related to the practical value and benefits of computer usage and internet access as identified by the participants. Nonetheless, there appeared to be some pockets of resistance among teachers, as indicated by the participants who are described as "have nots" and "want nots" by Van Dijk (2013, 35). Motivation underlies a person's behaviour and there is empirical evidence that this is linked to performance (Lai, 2011). Our findings have shown that the reasons for non-motivation of teachers are not insurmountable; seemingly, teachers can be motivated to use technical devices, provided that the right conditions are created. Studies such as the one done by Van Dijk (2013) show that there is sparse research on people's motivation to have access to technology.

Our study confirms other research findings, namely, that lack of access or limited access to physical and material resources is a huge challenge to the use of technical devices by teachers (Tusiime et al., 2019). Apart from a small number of participants from private schools, most participants in our study indicated that their schools lack the necessary technical devices and associated technical support. Our findings are in consonance with those of Soomro et al. (2020), who found in a recent study that public institutions often have poorer physical access to ICT devices and services, and that schools that are behind are slower to adopt digital technologies for teaching and learning. Access to computers and the internet is important, because those without access not only lag behind but are also in danger of being excluded, which is considered the "legitimate final effect of unequal access" (Van Dijk, 2013, 46).

Our study also found that most of the participants use their personal laptops and smartphones for teaching. Although this lack of physical access is related to "a distribution of resources" as indicated by Van Dijk (2005, 2013, 38), our findings are not connected to 'income inequalities'. Rather, the lack has more to do with non-provision by the government and other stakeholders. Casado-Muñoz et al. (2015) posit that the inaccessibility of ICTs has resulted in significant inequities in respect of who can access, use and benefit from them.

Although research shows that educational background and age are the most significant factors that indicate technological skills, our findings are more consistent with those of Tusiime et al. (2019), which show a mismatch between formal education and digital skills access — in stark dissonance with Van Dijk's assertion. Due to other prevalent factors as discussed earlier, the level of education of the teachers in our study could not necessarily be equated to the required experience in using technical devices. Participants in our study were 'hungry' for training, confirming similar studies from our context (Ogegbo & Aina, 2020; Torres & Giddie, 2020). Although an average number of participants in our study had received training in ICT during their study years, such training was very formal and did not prepare them for using technology to develop their pedagogical skills. This corresponds with what Tusiime et al. (2019) found, namely that teachers' ICT training gained through formal approaches is generally broad and not specific to the teaching areas of teachers. Teachers, therefore, need adequate training on the effective integration of technology into their classroom teaching — two major areas that still need further research (Becking & Grady, 2019). Although, as found in our study, teachers could learn through self-teaching and from peers, Van Dijk (2005,) stresses the need to find a balance between these approaches.

Scholars such as Tusiime et al. (2019) argue that the best way to develop teachers' digital competence is by assisting them to understand the relationships between technology, pedagogy and content, and to apply such knowledge in a productive way. Based on our findings, we concur and emphasise that training is needed in subject-specific areas. Our findings also highlight the need for collaboration among teachers in areas where technical devices are sparse (Andema et al., 2013). Participants in our study, especially from semi-urban and rural areas, cited clusters being formed by teachers to boost the use of technical devices for teaching and learning.

Usage is the by-product of the whole process of appropriation (Van Dijk, 2013) because "effective and satisfactory use of digital media cannot occur without sufficient motivation, access and skills" (Van Dijk & Van Deursen, 2014, 44). All the participants in our study were interested in using technical devices but the truth is that teachers cannot develop the necessary skills if they do not regularly use them (Benali et al., 2018). If teachers are well motivated to use technical devices, and if they have both physical and material access that could aid the development of their digital skills, then usage will follow naturally (Ooko, 2016; Van Dijk & Van Deursen, 2014; Valtonen et al., 2017).

Conclusions

Our subjective interpretation of the collected data — as the researchers involved — could be regarded as a limitation to the study. Another limitation was the missed voices of other stakeholders (such as ICT firms or providers and policy makers). This study was conducted in the middle of pandemic lockdowns, which made us focus more on teachers that we could immediately sample. As part of its ongoing research plans, the unit of study is busy with research involving other stakeholders on the same phenomenon.

Recommendations include the following:

- Policy makers should develop a set of standards for teacher educators' competencies that can be aspired to, if not already in place. This is because our findings buttress the fact that struggling trainers cannot adequately assist trainees.

- There is the need for government to re-visit the quality of the training they provide to teachers in order to make them more relevant.
- The government and teacher training institutions need to close the gap between curriculum and societal needs, especially in relation to embedding technology in subject-specific areas.
- Tertiary institutions should provide in-service training for teacher educators and they need to strike a balance between their three core services: teaching, research and community service.
- Teachers need to develop their own 21st-century skills before they can prepare their learners.
- Teachers need to know not only the theory about pedagogical skills and tools that are available; they also need the technical expertise, especially in their subject-specific areas.
- Tertiary institutions, in collaboration with government, should provide more in-service training opportunities, and such training should be more effective.
- Teachers and learners not only need more technical devices; they also need on-the-ground technical support at schools.
- Policy support programmes should be implemented to assist government in fulfilling its promises.

In conclusion, our research supports Van Dijk's theory that studies on the digital divide need to move beyond the individualistic, descriptive level to an interpersonal notion of inequality that pays attention to the positions of individuals in society and the relationships that exist between them. This is because our findings helped us to juxtapose the challenges involving teachers' physical access to the technical devices needed for teaching with the reasons behind these challenges. Therefore, much research is needed on the relational notion of inequality. In addition, studies with larger sample sizes across different institutions could make findings more generalisable. In addition, because Van Dijk's theory (that was adopted for this study) is an emerging one, a larger number of in-depth studies into each of his four forms of access will be needed, especially in developing contexts.

Our data collection process (especially the discussions) was a highly emotional process for us, and it is well summarised in this response from one of the participants:

> The government is talking about the 4IR but teachers need workshops about how to teach different subjects using different technologies. We are still in the traditional way of writing on the board and submitting; students go to Varsity and they need to submit assignments online. I suffered the same fate and I paid dearly for it.

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