ICT Integration in a Multigrade Context: Exploring Primary School Teachers Experiences

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ABSTRACT

Technology offers pedagogical affordances that can transform teaching and learning in multigrade classrooms to assist in the process of teaching and learning. However, it is challenging for teachers to effectively integrate technology into their classrooms, given the complex and dynamic multigrade context. The technological pedagogical content knowledge (TPACK) model was a lens through which to explore teachers' experiences in ICT integration in their multigrade classrooms in selected primary schools in South Africa. A case study design guided this qualitative study. Semi-structured interviews were conducted with twelve teachers thematic analysis was used to analyse data. The findings revealed that access to ICT equipment for teachers and students is crucial. This study has found that generally, it is difficult for teachers to incorporate technology into their teaching because of the caveats, such as the multigrade context and the rural location which presents issues such as lack of basic technology infrastructure, limited training on integrating technology in teaching, time, the teaching context, and support from principals. This study recommends that teachers be trained on ICT usage and given the support needed to function effectively in their multigrade context. For teachers to be digitally connected and ensure ICT integration in the teaching and learning process, they need to be equipped with relevant knowledge and skills to use technology to transform their teaching and create new opportunities for learning.

KEYWORDS

Teaching context; support; technical infrastructure; time; training.

INTRODUCTION

The digital revolution has transformed how children and people play, access information, communicate and learn (Caena & Redecker, 2019) with Information and Communications Technology (ICT) offering extensive pedagogical affordances and great potential for transforming the teaching and learning environment. Integrating information, communication and technology (ICT) in education refers to computer-based communication incorporated into daily classroom instruction (Ghavifekr & Rosdy, 2015). ICT advancements have fundamentally altered how learners are taught and how they learn, opening up new avenues for learning and granting access to previously unattainable resources. ICT has become integral to the teaching-learning process.

The aim of technology integration is to improve and increase the quality, accessibility and cost-efficiency of the delivery of instruction to learners, ensure meaningful learner interaction of with information and advance cognitive skills such as comprehension, reasoning, problem-solving and creative thinking (DoE, 2004). Teachers are important role players in integrating technology into classrooms (Erduran & Ince, 2018) and as a result, teachers should possess a thorough knowledge of ICT and use it in their teaching practice. Akram et al. (2022) argue that teachers' attitudes, knowledge, technological competencies and skills are crucial to successfully integrating ICT in their practice and as such, they need to appreciate the affordances of ICT in helping learners reach their educational goals (Mailizar & Fan, 2020). Therefore, the issue is not whether to integrate technology but the current situation makes technology integration in the classroom vital.

However, for technology integration to be successful, literature suggests that teachers need to be competent in integrating technology in their teaching (Akram et al., 2022; Erduran & Ince, 2018; Khlaif, 2018) but in many cases, they seem to struggle to keep up with technological developments particularly with its rapid growth and development. Although technology forms part of our everyday lives, educational changes with the use of technology, have yet to be aligned in teaching and learning practices (Caena & Redecker, 2019). This occurs with the teaching of multigrade classes, which refers to the teaching of children of different grade levels at the same time, where teachers are challenged in integrating ICT in the teaching and learning process.

This study explored teachers' experiences in ICT integration in multigrade classrooms. Two research questions formed the basis of the study:

1. What are the experiences of primary school teachers in integrating ICT in their multigrade classrooms in selected primary schools?
2. How can teachers' ICT skills be enhanced to improve teaching and learning in multigrade classrooms in selected primary schools?

LITERATURE REVIEW

Teachers' knowledge and understanding of ICT influences how they integrate it and adapt it to suit their unique, complex multigrade context (Kelly, 2010). Therefore, teachers' experiences of technology integration in their specific context (Kulaksız & Karaca, 2022) have implications for practice which could support teachers in their ICT integration endeavours.

Multigrade teaching

In the broad sense, multigrade teaching has been defined as a teaching strategy that accommodates learners of different grades in one classroom (Taole, 2014; Joubert, 2010). Multigrade teaching is seen as a vehicle for providing primary education to learners (Novelia, 2021), particularly in schools with a shortage of teachers. Globally, multigrade teaching has a role to play in helping countries reach their internationally mandated education, such as the Sustainable Development Goals (SDGs) (UNESCO, 2016). Many countries practise multigrade teaching to overcome educational problems such as low learner enrolment and a shortage of teachers (Novelia, 2021; Kivunja & Kuyini, 2015). Multigrade teaching provides learners in rural and farm schools with opportunities to access education and improve their economic, physical and social opportunities (Makena & Mpahla, 2022). Although multigrade teaching promotes access to education for disadvantaged learners, especially in rural areas, access without resources, both teaching and learning materials and technological resources, is not beneficial.

Multigrade schools are prevalent in developing and developed countries for a variety of reasons (Cornish, 2014). In the South African context, many primary schools (27% of the total number of schools nationally) have implemented and practised a multigrade pedagogy (DBE, 2015) as a necessity to ensure access to schooling for learners in remote and sparsely populated areas (Taole, 2019; Joubert, 2010). Poverty and underdevelopment are two critical features of multigrade education and they reflect the inequalities and socio-economic issues in South Africa (DBE, 2015). Of concern is that multigrade schools are the most neglected part of the education system and are particularly under-resourced. Research has revealed that teachers are not trained to teach in a multigrade context and as a result, use an inflexible monograde curriculum, which leaves no room for them to adapt their teaching to the unique context (Cornish, 2014).

Teaching in multigrade classrooms is regarded as difficult (Naparan & Alinsug (2021). The difficulties in a multigrade teaching context include, amongst others, lack of teacher training in multigrade pedagogies (Doğan et al., 2020), a lack of parental interest in their children's education (Du Plessis & Mestry, 2019) and geographical location of schools (Naparan & Alinsug, 2021). Imasiku et al. (2022) assert that multigrade schools face the challenge of delivering quality education with budget constraints, isolation and a limited number of teachers. As a result, technological innovation is needed to ensure that learners in this context receive quality education. The value of ICT integration in multigrade classrooms has been documented in the literature. Naparan and Alinsug's (2021) study found that technology can enhance teaching and learning in multigrade classrooms. Research has been conducted on teachers' perceptions of integrating technology into the classroom (Abel et al., 2022; Hartman, 2019; Hana et al., 2019)

and it seems that teachers from poor communities and rural areas tend to have more challenges incorporating technology in their teaching (Zinger et al., 2017). Similarly, learners from lower socio-economic backgrounds tend to be digitally illiterate despite being born in the digital era, where they should have been exposed to various technologies (Tsakani & Jita, 2019).

Context tends to influence how teachers and learners use technology; however, ICT integration research tends to disregard the context in which teaching occurs (Wilson et al., 2017). This then would relate to ICT integration in multigrade schools which are predominantly located in rural areas where the socio-economic levels of community members are low, and the majority of the community members lack access to basic amenities such as sanitation and roads. Access to technology would thus be considered a luxury (Mathrani et al., 2022).

*Use of ICT in South African classroom**s**

The South African Department of Education (DoE, 2004) believes that developments in ICT create access to learning opportunities, redress inequalities, improve the quality of learning and teaching and deliver lifelong learning. ICT policies such as the e-Education policy (DoE, 2004), the Guidelines for Professional Development and Teacher Training in ICT (DoE, 2007), and the Professional Development Framework for Digital Learning (DBE, 2018), were developed to ensure that ICT is used to enhance the teaching and learning process. However, according to Vandeyar (2021), these policies have not been implemented. In addition, the role of ICT in rural education is not described in detail as an enabler of teaching and learning. Research on ICT school readiness conducted in twenty-four rural schools in South Africa has indicated that although teachers seem ready to implement ICT in teaching and learning, they need to acquire and develop more technical and digital skills (Mwapwele et al., 2019). Mwapwele et al., (2019) further add that in some instances, policies that prohibit learners from using cell phones on the school premises defeat the goal of policies such as the Professional Development Framework for Digital Learning (DBE, 2018).

ICT integration in classrooms

Embracing technology in the classroom requires teachers, as agents of educational change, to understand the pedagogical value of technology integration in teaching and learning (Kalimullina et al., 2021; Kilinc et al., 2018). Teachers play a pivotal role in technology integration in the classroom where gadgets such as laptops, tablets and smartphones are used in teaching and learning. Therefore, the teaching approach changes from being teacher-centred to learner-centred where teachers act as facilitators in a teaching environment where technology is integrated (Masdoki & Din, 2023).

There a need for a clear definition of ICT integration in teaching and learning (Summak et al., 2010). ICT is not about technology but content and effective instructional practices in teaching and learning where the focus is on curriculum and learning (Holznogel, 2005). Integration is defined not by the amount or type of technology used but by how and why it is used (Holznogel, 2005). ICT has changed the way people do things and their way of life, and teachers need to capitalise on the use of emerging technologies that can benefit the teaching

and learning process (Soomro et al., 2020; Tadeu et al. 2019). Technology is a viable tool to ensure achievement of the United Nations' Sustainable Development Goals (SDGs) (UNESCO, 2015), especially Goal 4, the provision of quality education. Therefore, ICT in education should be part of the Department's strategic plan (Wardhni et al., 2018). However, Soomro et al. (2020) caution that it does not mean access to ICT is a panacea to a nations' development, challenges or guaranteeing development in societies.

Important lessons can be learned from global transition to technology integration in teaching and learning. Literature has shown that ICT can improve the quality of life of learners (Soomro et al., 2020) and play an essential role in developing countries (Wardhani et al., 2018). Some benefits include broadening opportunities for learners to collaborate (Bengsen, 2016), enhancing lesson presentation (Greene & Jones,2020) and helping teachers design lesson plans in a practical, innovative and exciting manner that would result in active learning (Ghavifekr & Rosdy, 2015). Success of the integration of ICT into teaching and learning ensures that all learners are equipped for full participation in the knowledge society when they enter the workforce.

Teachers must find ways to use technology to transform their teaching practice and create new learning opportunities. However, factors such as a lack of resources (Porter & Graham, 2016), access to computers and appropriate software (Habibu et al., 2012), a lack of training (Erduran & Ince, 2018), lack of time (Koh et al., 2015) and connectivity issues (Brenes-Monge et al., 2020), as well as lack of motivation from teachers and learners to use ICT (Habibu et al., 2012) hamper teachers' integration of technology in their classrooms. Of concern to teachers is that integrating ICT in the teaching and learning process could create extra workload, challenges and stress for teachers (Dong, 2020).

Support plays a crucial role in teachers' use of technology. Thannimalai et al. (2018) indicated that principal and colleague support could improve teachers' technological skills and confidence in its use and Kulaksis and Karaca (2022) revealed that principal support can act as a motivation factor in ensuring that teachers use technology. If principals are supportive and have school policies in place that guide the integration of ICT in the classrooms, teachers will be encouraged to use ICT in their teaching.

THEORETICAL FRAMEWORK

Various studies have proposed different models of technology integration in classrooms. Models such asthe Substitution, Augmentation, Modification and Redefinition (SAMR) Model, which is a four-level taxonomy that describes how technology impacts teaching and learning (Arantes, 2022), the technology acceptance model (TAM)), developed by Davis (1989) which relates to external factors ensuring perceived ease of use and perceived usefulness, which, in turn, form influences attitude, use and behaviour and finally, the technological pedagogical content knowledge (TPACK) framework (Mishra & Koehler, 2006).

TPACK is one of the best-known frameworks for technology integration with roots in work done in the 1980s by Lee Schulman who noted that it was not sufficient for teachers to consider the content of their teaching area and pedagogy as two separate fields. To be successful, teachers also needed to understand the overlap of those two areas - the pedagogical practices specific to their intended subject area. However, it is worth noting that researchers are not unanimous on the different components of knowledge in the TPACK framework (Rosenberg & Koehler, 2015). Researchers felt that the framework should be refined, and the number of components should be reduced (Brantley-Dias & Ertmer, 2023) and some suggest that the framework should be expanded to lay bare the complexities of technology integration in classrooms (Angeli & Valanides, 2009).

The intersection of several types of knowledge teachers require for their technology-enhanced teaching practices is specified in the TPACK framework (Mishra & Koehler, 2006). TPACK considers the different school contexts (Taopan et al., 2020). Teachers are reminded that content and pedagogy are key in ensuring that learners learn, and that technology is a medium that enhances learning. Taopan et al. (2020) add that it is the combination of content pedagogy and technology that results in innovative teaching and learning.

Angeli and Valandes (2009) adopted the TPACK model and focused on knowledge of ICT and context. They added knowledge of learners and the context and renamed the technology domain information and communication technologies. The approach outlined five knowledge domains; content, pedagogy, learners, context and ICT that teachers need to be aware of when incorporating technology into the classroom.

Mishra and Koehler (2006) initially defined three main kinds of knowledge which include content knowledge (CK); pedagogical knowledge (PK) and technological knowledge (TK)

- *Content knowledge (CK):* speaks to the subject matter expertise of the teachers. It entails having a solid grasp of theories, phenomena, and practical uses of information.
- *Pedagogical knowledge (PK):* relates to teachers' in-depth understanding of their instructional experiences, including their methods, techniques and approaches. It includes knowledge of assessment techniques and the overarching objectives of education.
- *Technological knowledge (TK):* entails understanding specific pedagogy, hardware, software and tools. TK assumes that knowledge of instructional technologies can be used to improve and enhance the teaching and learning process (Hana et al., 2021).
- Research on the framework then led to developments and refinements resulting in overlapping circles defining types of knowledge which include:
- *Technological Content Knowledge (TCK):* relates to teachers' understanding of how technology and content can both influence and push against each other. TCK involves understanding how the subject matter can be communicated via different edtech

offerings, and considering which specific edtech tools might be best suited for specific subject matters or classrooms (Mishra & Koehler, 2006).

- *Technological pedagogical knowledge (TPK):* refers to using technology with the appropriate pedagogy to be effective in the classroom (Yurdakul et al., 2013).
- *Pedagogical subject knowledge (PCK):* refers to the interaction and occurrence of intersection between pedagogy (P) and subject matter (C) (Guerrero, 2005).

Figure 1.

TPACK framework.
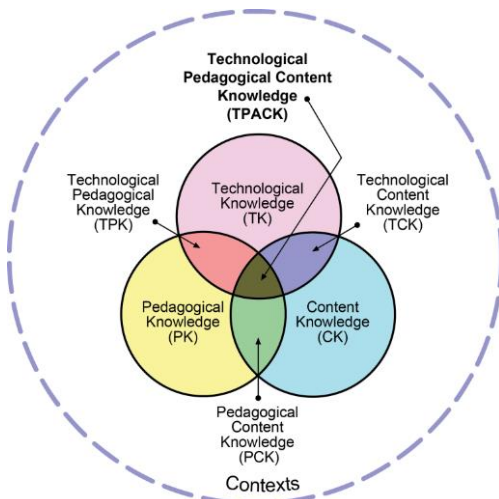
(Source: ©2012 by tpack.org)

The proponents of TPACK (Koehler & Mishra, 2009; Mishra & Koehler, 2006; Angeli & Valanides, 2009) emphasise the importance of context in ICT integration in classrooms. Although the context is key in the TPACK framework, researchers rarely discuss it (Kelly, 2010), suggesting that context is the least researched aspect of the TPACK framework (Rosenberg & Koehler, 2015). Context was included in the TPACK framework by Porras-Hernández and Salinas-Amescua (2013), who identified three levels of ICT integration in classrooms, the micro, meso and macro levels. As the teacher and learners are the two important participants in the context, the micro level includes factors in the classroom, the meso level refers to issues in the school environment, and the macro level has societal issues affecting the school teaching and learning, teachers' professional development and the curriculum (Porras-Hernández & Salinas-Amescua, 2013).

This study adopted TPACK as advocated by Angeli and Valanides (2009), to explore teachers' understanding of and knowledge about ICT and the use of ICT in the multigrade context as this model is central to research on integrating ICT in classrooms and professional development (Rosenberg & Koehler,2015). TPACK provides a good theoretical ground for teachers to understand that the practice of using technology in education, together with the context, can provide a more in-depth understanding of both practice and theory. The TPACK framework allows for an in-depth understanding of teachers' ICT integration in the teaching and

learning process, the positive and negative effects on the school and other stakeholders that affect the process of bringing about long-lasting transformation (Koh, 2019; Mishra, 2019). TPACK is important in that it assists teachers in thinking about how they use technology in their classrooms (Cox & Graham, 2009).

RESEARCH METHODOLOGY

This qualitative study was nested in a constructivist paradigm, which allowed individuals to construct their meaning based on their experiences in their natural setting (Creswell & Poth, 2018). A qualitative approach guided by a case-study design was appropriate because it aimed to elicit participants' views and allow an in-depth study of the phenomenon under study (Creswell, 2016; Creswell & Poth, 2018). This approach allowed for the exploration of the teachers' experience of and knowledge about ICT and the use of ICT in the multigrade context

Research context

The study was carried out in rural multigrade schools. Multigrade schools are prevalent in both developed and developing countries for various reasons. In the South African context, multigrade schools are established for necessity and to ensure access to schooling for disadvantaged learners (Joubert, 2010) particularly in rural areas. Schools are classified into quintiles (South African School Act, 1996), which is the classification of schools into five groups, from the poorest (Quintile 1) to the least poor (Quintile 5). The multigrade schools are classified as Quintile 1, which means that they are no-school fees paying schools with major subsidies from the government. In addition, these schools are part of the government feeding scheme where learners get at least one meal daily.

Participants

Ten schools in Vhembe district of Limpopo formed the population. Participants from the selected four schools were sampled and comprised 12 teachers (nine females and three males). The primary schools, which had between 80 to 140 learners in each school, and the individuals were selected using criterion sampling. The criterion was that the schools should be multigrade. Four out of the ten schools in Vhembe district in Limpopo agreed to participate in the study. In addition, the participants had to have two or more years of teaching in multigrade classrooms and be willing to participate in the study. Ten teachers had the minimum teacher qualification of a three-year diploma and two had bachelor's degrees in education, specialising in different subjects. Participants were teaching two grades in one classroom, for example, Grades R and 1, Grades 1 and 2, Grades 3 and 4 and Grades 5 and 6. Pseudonyms were used to protect the identity of the participants.

Data collection procedures

Prior to the commencement of the research, permission was sought from and granted by the Department of Education, participating schools and principals. Qualitative data were collected through semi-structured interviews with the purposefully sampled teachers. Semi-structured interviews were used to get deeper insights into the phenomenon under study (Creswell & Poth,

2018) and being semi-structured allowed for probing and clarification. Consent was sought from participants prior to the interviews which were conducted at the participants' schools after school hours. Interviews, which lasted between 45 and 50 minutes, were audio-taped with participants' permission.

Data analysis

Data were analysed through thematic analysis, providing detailed and nuanced data accounts (Clarke & Braun, 2018). The analysis began with a careful reading and re-reading of transcriptions to understand what was emerging from the data. Chunks of data were coded and then the codes were revised. After verifying the codes, these were merged into themes and sub-themes. Member checking, through teacher feedback on the accuracy of the study's findings and interpretation, assisted in enhancing the credibility of the study's findings. (Creswell & Poth, 2018). Confirmability was ensured by using participants quotes in the reporting of the research findings.

RESEARCH FINDINGS

In this section, Table 1 presents the biographical information and thereafter the themes are presented supported by direct quotes.

Table 1.

Biographical information of participants.

Participant	Gender	Qualification	Years of experience in multigrade schools	Grades taught
A	Female	Diploma	3	3 and 4
B	Female	Diploma	3	3 and 4
C	Male	Degree	3	1 and 2
D	Female	Diploma	3	5 and 6
E	Female	Diploma	4	1 and 2
F	Female	Diploma	4	R and1
G	Male	Degree	5	3 and 4
H	Male	Diploma	4	1 and 2
I	Female	Diploma	4	R and 1
J	Female	Diploma	5	R and1
K	Female	Diploma	3	R and1
L	Female	Diploma	5	2 and 3

The above table shows that most participants were female and most (10) had a minimum teaching qualification, which is a three-year Diploma while two had a four-year degree in education. All teachers taught two grades (that is, multigrade classes). The Department of Basic Education conducts ICT-based training sporadically in different schools and participants

indicated that they had attended the minimum of one ICT workshop, although Participant A had attended two and Participant G had attended three workshops.

Data analysis from thematic analysis yielded the following themes: Participants' views on the importance of technology in their multigrade contexts, limited training on integrating technology in teaching, support and lack of time. These themes are presented and discussed in the section below.

The importance of technology in multigrade contexts

In order to understand how participants experience ICT integration in their classrooms, it was important to establish how they view technology and its use in their multigrade classrooms. When asked about their opinions on the importance of technology in their multigrade context, participants had this to say:

We hear that we need to use technology when we teach (Participant D)

Technology can assist in multigrade classrooms. If all learners have laptops and are connected, it will be easy to teach different grades. I will send tasks and instructions to another grade while I am busy with the other grade. That will be awesome. (Participant A)

*Technology is the in thing, (*Participant F)

Participants indicated that they realised that ICT would assist them with the teaching and learning process in their multigrade context. Participants indicated that with provision of technology such as computers, laptops, software and access to the internet, learners in one grade could use technology to work in dependently or in groups on tasks while the teacher could teach the other grade.

Although participants see ICT as an enabler, they felt that ICT integration in the classrooms was not possible in rural areas for a number of factors. They realised that their rural contexts disadvantaged them:

Technology is unnecessary for us in rural areas. Even now, I do not have the network for my phone; how do I teach learners? I buy data for personal use. (Participant D)

*But with us, it is hopeless. Our learners do not even have a cell phone. I also do not have a laptop. If we can gather the resources and be taught how to use them, we might consider using technology. However, for now, this is nothing but a distant dream. (*Participant F)

The participants felt that their rural and multigrade context impedes the ICT integration. Participant C commented: *This is a disadvantaged community. Learners do not have gadgets that they can use at school, and they do not own cell phones.* The lack of digital devices, such as laptops and cell phones and connectivity, is regarded as an impediment to integrating ICT into the teaching and learning process. At present, participants use some technology, that is, cell phones, for personal use or for contacting parents: *If I want to communicate something to learners, I sometimes use their parents' cell phone numbers. However, the problem is that not all learners live with their parents. So sometimes the message is not delivered*.

Being equipped with computers, software and access to the internet, teachers could undergo a change of mindset to use technology in their teaching, which could benefit their

learners. However, one participant did indicate that their school had been provided with laptops but neither teachers nor learners had access to them: *The principal has taken all the laptops and other resources we could use and put them in the 'strong room'.* (Participant B)

Limited training on integrating technology in teaching.

Training is vital to ensure that teachers are adequately equipped with the relevant knowledge and skill to integrate ICT in their teaching. Participants reported that the Department provides some training; however, participants need technological resources to put into practice what they had been taught. Participants regard training as a futile exercise if they are unable to put the theory into practice and enhance their teaching: *It does not help to be trained; when you get to the school, you do not have the equipment to implement what you have learned.* (Participant G) Participant L had a similar comment: *We do go for training, but to me it is useless; what do I do with the information I gained during training if at school we are not given resources?*

The findings revealed that that participants did not have the opportunity for in-depth training and the training they received was more theoretical than practical as limited technical resources were available during training which meant that participants had to share the resources. For ICT integration to be effective, there needs to be ICT infrastructure, an ICT policy, ICT perception and ICT competence, that is, continuous teacher training and development. As indicated by participants, training albeit superficial, on its own, is inadequate but it will motivate them to use technology in their classrooms which could assist the teaching and learning process in a multigrade context.

Support

The findings revealed that participants valued and needed support. Support falls into sub-themes, which are support from principals, support from colleagues and technology support.

Support from principal

As the school leader, the principal is seen as the driving force in motivating the integration of ICT in the classroom. Even though one schools did have some technology, access was denied: *The principal has taken all the laptops and other resources we could use and put them in the 'strong room'.* (Participant B). In order to safeguard the resources, they were stored in a place of safety: *However, I do not blame him for the village's vandalism. So, he has to hide them, denying us and learners the opportunity to use them.* (Participant B), but this meant that ICT was not being used in the teaching and learning process.

However, some participants were sympathetic towards the principals and indicated they understand why they store resources in 'strong rooms' for safekeeping. *I believe I understand why they are doing it; they want to protect the resource*s (Participant E) and *I kind of understand where he is coming from, theft and property vandalisation is a norm in our village* (Participant H). This participant realised the negative aspect of the move by principals: *I do not like it because now we are robbing our learners to learn using technology.* Locking resources away is a significant way of keeping them safe, but if they remain in the locked space and never get to be used, it becomes a problem as learners are denied the opportunity to learn using technology.

It seems that in one school, only the principal has been provided with technology: *The only person who has a laptop is the principal. We do not have them. Not sure who should buy us, the school or the department. He is not bothered that we do not use technology in our teaching.* (Participant G). This is of concern as the integration of ICT in the teaching and learning process could provide many benefits to learners.

Participant reported the support of principals: *The principal allows us to attend the ICT-related workshops, but it does not help because we do not apply what we learned.* (Participant I)

The findings revealed that participants do not have the necessary technology resources to use in their classroom. When there is a shortage of resources that is, lack of appropriate and adequate technology and scarcity of software, it becomes difficult for teachers to even think of implementing technology in their classrooms even if they do attend ICT-related workshops The role of the principal in supporting teachers in ICT integration in the teaching and learning process is vital and ranges from the principal's attitude to ICT, level of interest in ICT and the mobilisation of the relevant sources which would mean that the principal would be driving the move to use ICT in the classroom.

Support from colleagues

In contrast, participants reported that they had received support from their peers; *My colleagues are supporting me, especially the young ones, they are* 'tech-savvy'. *When there is something that I do not understand, I usually consult them.* (Participant B). Such support was valued especially when further learning and explanation was needed: *You know, it is easier to learn from people you are familiar with rather than learning from someone that you do not know. In any case, these people will leave after training, but your colleagues will always be there to assist.* (Participant D)

Participant responses suggested that it was easy to get support from their colleagues especially the younger generation who were more knowledgeable with computers and had develop a good understanding of technology, therefore are digitally literate. In addition, colleagues are always available, thus making it easy to consult them at any time.

Technology support

If school are resourced with technology such as computers, laptops, software and the internet, there needs to be some sort of technology support in place to to advise and assist teachers with issues concerning their computers and access to the internet and ensure that all gadgets work well and run smoothly. This issue did not arise in the study as schools were poorly equipped; however, in a well-equipped school, technical support is vital.

Lack of time

Time limitations or the lack of time to plan lessons using technology, explore the different Internet sites or look at various aspects of educational software are barriers to effective ICT integration in the teaching and learning process: *I do not have time. I wish I were teaching in a normal school.* (Participant K). Participants in this study reported that lack of time is a serious

challenge for participants when integrating technology into their teaching in a multigrade context: *I am teaching all seven school subjects in different grades, so I am swamped with work. I do not have time to use technology.* (Participant H).

Even though time was limited for these participants: *Time is a scarce resource if you are a multigrade teacher. What can you do when you have two grades to teach simultaneously? I struggle with teaching two different grades, so technology is something else*, they were *open to learning; maybe technology can assist me. I do not know.* (Participant I).

Although teachers are mandated by policy to integrate technology in their teaching, the findings revealed that their workload was heavy, they needed to have access to appropriate and adequate technology, as well as software, and that continuous training and development was imperative to equip them with the knowledge and skills to be effective. This means that time is needed once teachers receive adequate training to explore and practise using the technology and deal with technical problems, to prepare lessons and locate Internet resources to support teaching and learning (Becta ICT Research, 2003).

The multigrade context makes it difficult for teachers to use technology without the above issues being in place. It is thus evident that context influences teachers' decision to use technology.

DISCUSSION OF THE FINDINGS

The current study explored teachers' experiences in ICT integration in their multigrade classrooms. How teachers perceive the importance of technology will influence how they use it in their classrooms (Mansour, 2018) although teachers' perceptions might act as a barrier to ICT integration (Abel et al., 2022). The findings revealed that participants did not have access to technological infrastructure such as laptops and local networks in their multigrade schools. These results are consistent with those of other studies and suggest that teachers' access to ICT is of the utmost importance (Soomro et al., 2020). Lack of access can influence how they view ICT integration in their classroom, and this view, if further emphasised by their multigrade context, makes it difficult to teach. ICT integration research typically ignores the context such as economically disadvantaged communities and rural areas (Zinger et al., 2017), even though it significantly shapes teachers' attitudes and beliefs (Mansour, 2018). The findings suggest that participants have various perspectives of ICT use in classrooms. According to Mathrani et al. (2020), users' perceptions of technology inhibit participation in the digital space. Perceptions are not easy to change, but if specific professional development opportunities are created to increase teachers' ability and their competency in the use of ICT for learning, they might develop a more positive view of ICT integration in the teaching and learning process.

The findings suggest that teachers in the multigrade context need more professional development and training. Such training, which relates to TK and developing teachers' understanding of specific hardware, software and tools, could positively impact teachers' general attitudes towards ICT in the classroom and provide specific guidance on ICT teaching

and learning within each discipline. However, theoretical training needs to go hand-in-hand with practical training so that teachers can put theory into practice and apply the skills learnt. To assist teachers in developing their ICT skills and their digital literacy, schools need to be equipped with the relevant technology resources such as computers, laptops, software and access to the internet. Basic ICT knowledge and skills is a vital first step but further training and support for teachers is needed to integrate ICT in ways which transform their approach to teaching. To achieve this, specific training must aim to introduce teachers to the range of ways in which ICT can be used to transform education. Limited technological training could serve as a barrier to ICT integration (Erduran & Ince, 2018). Research has shown that training that does not target the needs of teachers, tends to be unsuccessful which means that merely exposing teachers to professional development opportunities that focus on using technology does not translate into teachers gaining the relevant knowledge and skills needed to integrate ICT in the teaching and learning process (Harrell & Bynum, 2018).

Teachers therefore need to become confident in their use of technology so that the subject matter can be communicated and presented through multimedia and interactive ICT (Mishra & Koehler, 2006) and as a result, their teaching approach moves from being teacher-centred, lecture-based instruction to student-centred within interactive learning environments. This approach has the potential to change the teaching and learning process of multigrade classes by placing the learners at the centre. ICT would help learners discover knowledge through collaboration and peer support, an approach that could keep learners motivated, engaged and focused ensuring continued engagement.

However, teachers need support while they change their teaching approach and begin integrating ICT into their lessons. Principals, as leaders of the school, should lead by example by creating a school ICT policy for the integration of ICT and ensuring the provision of technology such as computers, laptops, software and access to the internet which would motivate to teachers to use ICT in their classrooms. Kulaksis and Karaca (2023) and Karaca et al. (2013) reiterate that school principals are expected to provide guidance and resources and create an enabling environment for teachers to integrate technology into their teaching. It is essential, therefore, that principals and colleagues are trained in ICT use to support teachers.

Teachers, once equipped with relevant knowledge and skills (TCK and TPK), need time to integrate technology into their teaching, particularly as they are teaching more than one grade at a time. As a result, they need more time to use technology as they need to plan for the different grades that they are teaching. Furthermore, their multigrade context needs to be taken into consideration as they apply their TCK and TPK in their lesson planning and teaching. In many cases, ICT integration in the classroom is regarded as a burden (Cheung et al., 2018), particularly in the multigrade context, with the number of grades that teachers are expected to teach. The findings align with those of Koh et al. (2015) that lack of time prevents teachers from using technology in their teaching, despite the benefit of technology in multigrade teaching, as advocated by Naparan and Alinsug (2021) who found that technology can enhance teaching and

learning in multigrade classrooms. As Koh (2019) and Mishra (2019) noted, ICT integration in the classroom can have a positive effect on the education of learners that leads to long-lasting transformation.

CONCLUSION

The current study aimed to explore teachers' experiences in ICT integration in their multigrade classrooms and determine how their ICT skills could be enhanced to improve teaching and learning in multigrade classrooms.

Lack of technological infrastructure impedes teachers from integrating technology in the teaching and learning process in a multigrade context. This means that access to ICT equipment for teachers and students is crucial. In addition, certain factors such as lack of ICT infrastructure, limited ICT training and development with insufficient practice, lack of time and support from their principals within a multigrade context, compounds the problem.

The study recommends that in order for ICT to be effectively implemented in multigrade classroom, schools need to be adequately resourced, teachers need to be trained on ICT usage and given the support and encouragement in the development of ICT skills needed to function effectively in their multigrade context. However, the focus should not be on ICT but rather on the quality of education delivered through the integration of ICT in the teaching and learning process.

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