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NEWLY QUALIFIED TEACHERS' INTEGRATION OF TECHNOLOGY DURING CURRICULUM DELIVERY

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ABSTRACT

Newly qualified teachers (NQTs) not in all cases use the available technology in most constructive and effective ways to achieve better learning outcomes. This study explores how and why NQTs integrate technology during curriculum delivery. A qualitative method was used within an interpretive paradigm: six NQTs were observed and interviewed. The TPACK model formed the framework and data were deductively analyzed. Findings revealed that NQTs embraced technology and used it in varying ways and frequencies. The majority used videos to capture learners' interest during lessons and teach difficult concepts, to use PowerPoint to consolidate lesson, to use technology to facilitate collaborative learning; and to boost learners' self-esteem. Some of the NQTs in schools that lacked resources did not teach constructively with technology, they did not blend technology, pedagogy and content knowledge as required for effective teaching with technology. It is recommended that Western Cape Department of Education (WCED) and Departments of Education in other countries bridge the digital gap by prioritizing, in their planning schedules, the need to have one furnished computer laboratory capable of accommodating an entire class with the necessary technological resources in schools that lack resources.

Contribution/Originality: This study contributes to the existing literature on complex issues that teachers encounter when integrating technology with curriculum delivery. Based on results, researchers make recommendations to the WCED and Departments of Education generally as to how they can create enabling environment for more NQTs to adopt, adapt and teach effectively with technology.

1. INTRODUCTION

Due to the potential of technology to improve teaching and learning (Batane & Ngwako, 2017; Hartman, Townsend, & Jackson, 2019; Umugiraneza, Bansilal, & North, 2018) Education Departments across countries have purchased technology equipment for public schools. In South Africa in particular, the National Department of Education has been involved in many initiatives to provide technology equipment to schools. Two such initiatives can be found in the Gauteng Department of Education and the Western Cape Department of Education. In the Gauteng Department of Education, the 'Paperless Classroom Programme' was expected to cost R17 billion over five years, with an estimated number of 3000 schools being provided with smartboards and tablet phones (Gedye, 2016). The Western Cape Department of Education (WCED) launched the Khanya project in 2001 which provided technology to public schools and trained teachers in its use. The aim of the Khanya project was to encourage

teachers to deploy technology to improve their quality of teaching and learning, and bridge the digital divide at schools in the Western Cape. By 2008, 59% of schools had computer laboratories, 70% of teachers had been trained to use technology for teaching and learning, and 70% of learners had access to technology in their schools (cited in Chigona and Chigona, 2010).

The 'Broadband Initiative' which is currently ongoing in the Western Cape, aims to ensure that by 2030, all public schools are connected to 'Broadband' services such as high-speed internet access: teachers are encouraged to use the internet to enhance their teaching and learning (Department of Communications, 2010). The e-Learning initiative in the Western Cape is progressively providing technology in schools by equipping smart classrooms, maintaining computer laboratories, training and supporting teachers in the use of technology (Western Cape Education Department, 2017). To show and encourage commitment to the use of technology in schools, the e-Education White Paper was drafted (National Department of Education, 2004). This policy document seeks to "build digital and information literacy so that all learners become confident and competent in using technology to contribute to an innovative and developing South African society".

Despite this investment in, and commitment to, the use of technology in schools, literature such as that of Yang and Chun (2018) suggest that many NQTs still fail to use the available technology in a constructive manner to achieve better learning outcomes. The reason for teachers' widespread inability to effectively teach with technology is associated with factors such as ineffective professional development trainings on technology, inadequate pre-service training in the use of technology, lack of access to it, and a poor support from principals and school management (Blackwell, Lauricella, & Wartella, 2014; Gudmundsdottir & Hatlevik, 2018; Harju & Niemi, 2016; Kafyulilo, Fisser, & Voogt, 2016; Umugiraneza et al., 2018).

Researchers used a sample of NQTs[1] who had graduated from a TEI in the Western Cape, South Africa where they were apparently trained to use technology for teaching and learning. These teachers conducted and attended workshops, projects, assignments and presentations by using technological equipment. Owing to this, it is believed that these NQTs could develop the knowledge and skills to teach with technology during professional practice in their diverse contexts.

This study asked the following questions:

1) What technology did the NQTs integrate during curriculum delivery?
2) How are NQTs integrating technology during curriculum delivery?
3) Why are NQTs integrating technology during curriculum delivery?

2. REVIEW OF LITERATURE

In this section, the following two issues, pertinent to this study are reviewed: NQTs' use of technology and factors influencing teachers use of technology for teaching and learning.

2.1. Newly Qualified Teachers' Use of Technology

The terms 'beginning teachers', 'novice teachers' and 'NQTs' have often been used vaguely to mean teachers with little or no experience in teaching. According to Kim and Roth (2011) a novice teacher has "less than five years of teaching experience". For the purpose of this study, 'NQTs' refers to qualified teachers with less than three years of professional practice. NQTs are expected to use technology in their teaching since they are trained in the 21st century, an age of information technology. It is generally believed that these teachers should be competent, comfortable and confident in their use of technology. Existing research (Bozkurt & Ruthven, 2015; Yang & Chun, 2018) shows that some NQTs are interested in using technology and do use technology for a variety of purposes in their classrooms. Harju and Niemi (2016) found, however, that many NQTs do not use technology because they face

[1]NQTs in this paper refers to Newly Qualified Teachers with less than three years of professional practice

challenges in terms of demanding work schedules or some teachers used technology in a teacher-centred manner (Gao, Wong, Choy, & Wu, 2011) which may not have enhanced learning. Russell, Bebell, O'Dwyer, and O'Connor (2003) and Harju and Niemi (2016) acknowledge that the first few years in the teaching profession are usually demanding since teachers have to develop behavioral management techniques, become familiar with the curriculum, adapt to a new school culture, and familiarize themselves with assessment systems. These activities often hamper NQTs in their efforts to engage with learners in higher order critical thinking skills when they teach with technology since they need time to prepare for this new methodology.

2.2. Factors Influencing Teachers' Use of Technology for Teaching and Learning

Three factors can potentially enable and disable teachers' adoption and use of technology for teaching and learning. These factors include: benefits of using technology, resources and technical assistance.

2.2.1. Benefits of Using Technology

Many studies have established that teachers use technology because it is a useful instructional tool. For example, by using observations and interviews to examine elementary school teachers' integration of technology and enactment of TPACK in mathematics, it was found that technology increases student engagement, heightens student enthusiasm to learn and increases access to information (Urbina & Polly, 2017). Education software programs help to determine where students are struggling and provide additional assistance, as well as increasing level of communication and allowing for fast feedback to learner's work (Urbina & Polly, 2017). Teachers in Chen, Liao, Chang, Hung, and Chang (2019) study used technology because it aroused learners interest. In various studies such as those conducted by Handal, Campbell, Cavanagh, Petocz, and Kelly (2013); Kafyulilo et al. (2016) and Baz (2016) it appears that the majority of teachers employed used videos to explain concepts. This use of videos is based on the premise that visual components of technology have the potential to enhance learner understanding of subject matter (Prensky, 2001, 2005).

Kulasekara, Jayatilleke, and Coomaraswamy (2011) and Kafyulilo et al. (2016) recommend the use of videos to teach scientific processes. The visual components enabled learners to see the process live which enhanced learners understanding. A number of studies (Boadu, Awuah, Ababio, & Eduaquah, 2014; Raman & Mohamed, 2013; Yang & Chun, 2018) found that teachers used videos because they held learners' attention in their classrooms; motivating, engaging and boosting learner's self-confidence. When learner attention is won, according to Boadu et al. (2014) learners participate more fully in class activities, focus on the lessons taught and ask more relevant questions during the learning process. Boadu et al. (2014) indicate that technology increases class attendance and punctuality because it provides an avenue for learners to be excited about being at school. Teachers in the study conducted by Boadu et al. (2014) believed that the use of videos made History concepts more concrete and less abstract, to enhance learners' understanding.

Empirical studies have found that technology has the potential to cater for varying learning styles since some learners are more disposed to visual stimuli, others more to the auditory, tactile or kinaesthetic (Raman & Mohamed, 2013; Schrum, Shelley, & Miller, 2008). Yang and Chun (2018) reveal that teachers use technology to address learners' diverse needs as in some instances the teachers shared online sites which learners who did not understand the lesson as taught in class, could gain information to improve on their understanding of subject matter.

Despite these benefits, the majority of researchers such as Kafyulilo et al. (2016) suggest that using technology is more beneficial when teachers engage learners in activities that require them to take responsibility for their own learning. In this case, learning is shifted from teacher-centered to learner-centered methods which links to work done by Ahmadi and Reza (2018) who reviewed literature and concluded that teachers would use technology if it immediately and demonstrably improved learning performance and learning conditions. The constructivist theorist

(Piaget, 1972) believes that learners learn best when they are actively involved in constructing and owning knowledge, while the teachers merely steer the learning process towards progress.

2.2.2. Resources

Teachers are more motivated to use technology for teaching and learning when resources are available and accessible (Kafyulilo et al., 2016; Kopcha, 2012). At some schools, teachers have computer laboratories, smartboards, internet and laptops (Mai & Hong, 2014; Martin & Parker, 2014; Umugiraneza et al., 2018). Technology integration theorists (Venkatesh, Thong, & Xu, 2012) mention that an individual will be more likely to use technology if there are facilities to support its use.

There is evidence in several studies that teachers were reluctant to use technology because they had limited or no technological resources. For example in South Africa, studies conducted by Chigona and Chigona (2010) and Chigona (2017) found that schools could not purchase high-speed internet which made connectivity slow and, in some cases, there was no internet because it was too costly. These results suggest that unreliable network discouraged teachers from using technology and confirm what other researchers had noticed (Handal et al., 2013). In other studies, it is apparent that schools have limited hardware and software programs, and that the limited technology equipment was not maintained (Blackwell et al., 2014; El Semary, 2011; Hartman et al., 2019; Kafyulilo et al., 2016; Raman & Mohamed, 2013). Due to limited technological resources, learner to computer ratios were high which discourages teachers from using technology (Chigona, Chigona, Kausa, & Kayongo, 2010). Research conducted by Schrum et al. (2008) found that 92% of teachers in their sample lamented the lack of technological hardware and software programs. As a result, many teachers indicated that they purchased technological equipment from their own personal funds.

2.2.3. Technical Assistance

According to ChanLin, Hong, Horng, Chang, and Chu (2006) teachers naturally worry about their ability to overcome possible technical problems which makes them insecure and reluctant to use technology for teaching and learning. Several studies reveal that technical assistants employed in schools encouraged teachers to integrate technology into their teaching (Al-Faki & Khamis, 2014; Kandasamy & Shah, 2013; Kopcha, 2012). Technical assistants are reliable, quick in responding to technical hitches which prevent loss of instructional time. However, other studies by El Semary (2011); Raman and Mohamed (2013) and Kandasamy and Shah (2013) reported that some teachers did not have technical assistance in their schools. Some schools employed technical assistants but these assistants were few and they struggled to assist both learners and teachers in their classrooms (El Semary, 2011; Miima, Ondigi, & Mavisi, 2013). Given the likelihood of technical problems during classes, Chen et al. (2019) indicated that teachers should be able to manage problems with the technology devices they use for teaching and learning, so that their classes can resume faster after a technical problem.

3. TPACK MODEL AS A FRAMEWORK

The TPACK model Mishra and Koehler (2006) was used in this study as a lens to ascertain, what kinds of technology were used, and how and why NQTs were able to integrate technology into curriculum delivery. According to Mishra and Koehler (2006), TPACK is the knowledge that is needed for effective teaching with technology. They define TPACK as:

> … the basis of good teaching with technology [that] requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can

be used to build on existing knowledge and to develop new epistemologies or strengthen old ones.

This statement implies that, to be effective, teaching with technology requires a blend of different knowledges. According to Mishra and Koehler (2006) required knowledge includes: Technological Knowledge (TK); Pedagogical Knowledge (PK); Content Knowledge (CK); Pedagogical Content Knowledge (PCK); Technological Content Knowledge (TCK); Technology Pedagogical Knowledge (TPK); and Technology Pedagogical Content Knowledge (TPACK). These seven knowledge domains are conceptualized in Table 1.

Table-1. Conceptualization of the TPACK model.

Technology knowledge	NQTs awareness of technology, and ability to adapt technology in their teaching and learning.
Pedagogical knowledge	NQTs knowledge of strategies they can use for teaching and learning.
Content knowledge	NQTs knowledge of the subject matter in the phase that they teach.
Pedagogical content knowledge	NQTs ability to choose the best strategy that can be used to teach a particular subject matter.
Technology pedagogical knowledge	NQTs use of specific technology to achieve pedagogic goals.
Technology content knowledge	NQTs knowledge of technology applications that they can use to teach certain parts of the subject matter.
Technology pedagogical and content knowledge	NQTs ability to engage learners in constructive learning activities (learner-centered), when they use technology for curriculum delivery.

The TPACK model provides an analytical lens to ascertain what technology is, and how and why NQTs integrate technology during curriculum delivery. The variables from the TPACK model are used to draw conclusion on whether teachers effectively teach with technology, as according to Mishra and Koehler (2006) for teachers to effectively use technology, there must be a blend of seven factors explained above.

4. METHODOLOGY

This qualitative study gathers in-depth data from participants' natural setting, which is their classrooms, in terms of the research questions: what technology do NQTs integrate during curriculum delivery and how and why do they apply it. The NQTs were purposively sampled since they graduated from a TEI, and had less than three years of professional practice.

Table-2. Details of the research participants.

Pseudonyms names of teachers	Types of school	Classification of school	Gender	Race	Teachers interviewed	Teachers observed
Teacher 1	No-fee-paying school	Township	Male	Black	Interviewed	Observed
Teacher 2	No-fee-paying school	Township	Female	Black	Interviewed	Observed
Teacher 3	No-fee-paying school	Township	Female	Colored	Interviewed	Observed
Teacher 4	Fee-paying school	Urban	Male	White	Interviewed	Observed
Teacher 5	Fee-paying school	Urban	Female	White	Interviewed	Observed
Teacher 6	No-fee-paying school	Township	Female	Black	Interviewed	Observed

These participants were in their second year of professional teaching during the time of data collection, and they teach Intermediate Phase (Grades 4-6). They teach the following subjects: English Home Language, Afrikaans/Xhosa First Additional Language, Mathematics, Natural Science Technology, History, Geography, and Life Skills. These participants are knowledgeable about the topic under investigation. The sampled teachers were 97, while six voluntarily accepted to be observed while they taught with technology and interviewed on why they used a particular technology during teaching. Both observation and interview data assisted the researchers to gain a deeper understanding of the topic under study. The six NQTs in this study were assigned pseudonyms: Teacher 1, Teacher 2 …

From Table 2, Teachers 1, 2, 3 and 6 were from quintile (Gower, 2008; Western Cape Education Department, 2017) one, two and three schools. These are poor schools in which parents do not have to pay fees. The schools largely depend on the government for funding, to purchase resources. While Teachers 4 and 5 were from fee-paying schools (quintile 5) where parents have to pay fees. These are wealthy schools in which they have many resources to support teaching and learning, since the parents can afford it. The ranking considers the surrounding community and infrastructure. Using teachers from different context will bring value to the research, as the researchers will be able to conclude whether teachers are effectively using the available technological resources in their various schools to enhance teaching and learning.

4.1. Observations

The researchers used an observation schedule to collect data from the NQTs' natural setting, which was their classroom. The advantage of using an observation schedule was that the researchers observed first-hand what technology was used, and how NQTs integrated technology during curriculum delivery. The observation schedule was semi-structured because it had pre-determined themes taken from the literature and theoretical framework (Henning, Van Rensburg, & Smit, 2004). The semi-structured observation schedule allowed the researchers to focus upon issues that assisted in answering the research questions. However, the researchers remained open to the emergence of any unexpected issues. They created spaces in the observation schedule for additional information. The researchers conducted a non-participant observation (Bless, Higson-Smith, & Sithole, 2013) as they were not involved in classroom activities but sat at the back of the class making notes in relation to how teachers were teaching with technology. The researchers took notes on the physical environment of each school during classroom observations.

A total of 34 lessons were observed between March 2015 and September 2015. Teachers 4, 5 and 3 were observed seven times, Teacher 6 was observed five times, and Teachers 1 and 2, four times. The differences in the number of lessons observed was as a result of data 'saturation' (Punch & Oancea, 2014): if no newer information emerged, it was understood that the level of saturation had been reached. The majority of the observations lasted 35 minutes or the duration of one class period, while others spanned two or more periods because special projects were being conducted. All classroom visits were conducted based on the NQTs' preferred day and time, when he/she was using technology.

4.2. Interviews

The one-on-one interviews were chosen as a data collection method to confirm and supplement the observation data. The advantage of conducting a semi-structured interview was that researchers could probe for more information (Punch & Oancea, 2014) hence in-depth data. NQTs were interrogated on why they used a particular technology for teaching and learning. During interviews, notes were taken on non-verbal behavior. Interviews were conducted after each lesson was observed, they ranged from 10 to 15 minutes, audio recorded and transcribed for verbatim data (Bless et al., 2013; Fraenkel, Wallen, & Hyun, 2012).

4.3. Data Analysis

The interview and observation data were qualitatively analyzed. The interviews were transcribed, the researchers individually read through the printed information to familiarize themselves with the data, codes were written next to issues discussed that relates to the research questions, and similar codes were changed to form themes (Henning et al., 2004). The researchers met and came to a consensus on the themes reported in the findings and discussion section. The observation data and notes were analyzed in the same way as the interviews. The information gathered from all the data sources was reported thematically, linking it to the concepts of the TPACK model and literature.

The interview data were sent to teachers to check for accuracy of information (Creswell, 2014; Shenton, 2004). To achieve trustworthiness, researchers collaborated in designing and analyzing the observation and interview data. Permission to conduct research was sought from the University Ethics Committee (the researchers collected NQTs contact details from the TEI), and the WCED in order to gain access into schools. All six teachers who voluntarily accepted, and signed a consent form agreeing to be part of this study. The participants were assured of anonymity and confidentiality. No participant in this study was coerced to take part.

5. FINDINGS AND DISCUSSION

The research questions that guided this study are: what technology did NQTs use, and how and why did NQTs integrate technology during curriculum delivery? Data were collected through classroom observations and one-on-one interviews. From analyzing the data, it became evident that NQTs used a variety of technology for curriculum delivery, which included: use of videos, PowerPoints, smartboards, computers, blogs and audio recorder.

In relation to how and why NQTs use technology, the following themes are discussed:

- Use of videos to capture learners' interest and teach difficult concepts.
- Use of PowerPoint to consolidate lesson.
- Use of technology to facilitate collaborative learning.
- Use of technology to boost learner self-esteem.

5.1. Use of Videos to Capture Learners' Interest and Teach Difficult Concepts

All NQTs used videos to capture learner interest during teaching. It was observed that learners were more attentive and engrossed when watching videos. When teachers from poorly resourced schools were interviewed, they mentioned that learners were immersed in the lesson because they do not normally use technology owing to a lack of resources. When probed, it was evident that learners came from communities plagued with social issues such as gangsterism, poverty, drugs and alcohol abuse. These learners were not interested in attending school. As a result, these teachers tried to make their lesson interesting and fun by using videos to capture learners' attention and in this way, they regularly attended classes. Teacher 1 narrated:

> The learners in my class were not interested in school. They did not want to be in school. The attendance rate for classes was low. I had learners who were absent from school for a week or so. Using technology captivated their interest and made them interested in attending classes.

Yang and Chun (2018) found that teachers used technology because it made their lesson entertaining, lively and full of fun. Similarly, Boadu et al. (2014) provide empirical evidence that the use of technology made lessons more exciting and interesting, enabled learners to be attentive in class, ask questions and understand the lesson better. This finding bears out (Prensky, 2001, 2005) claim that today's learners are attracted to technology and will sit for many hours watching videos on a topic, but not read a textbook for half that length of time. This observation implies a change in the learning habits of learners who are routinely exposed to television, social media and the Internet, and who in a sense now expect pedagogy to be technologically based. This implies that NQTs were aware

of the socio-economic context in which they worked, hence used technology (TK) as a pedagogical tool to motivate, engage and capture learner interests.

All six NQTs indicated during interviews that they used videos to teach difficult concepts. According to these teachers, abstract concepts such as the topic 'Electricity', are difficult to explain verbally as learners cannot see it. Therefore, they showed videos, as the animation made it real, which enhanced learners understanding. A study by Kulasekara et al. (2011) reported that teachers used animations to teach bacterial genetics. The colorful frames, careful sequencing and sound effects of an animated presentation of the microbial process enabled learners to gain a more immediate grasp and sustained understanding of the stages of this process than could be conveyed by the teacher's voice or use of a textbook. Teacher 4 commented:

> … a concept like electricity is difficult to explain. I mean, how do I explain to my learners the process [by] which electricity travels in a circuit? It is difficult without learners seeing it live. So I showed learners the video so they could see it live.

It appears that the educational video was appropriate in illustrating the concept 'Electricity'. The researchers observed that Teacher 4 manually demonstrated how electricity travels in a close circuit, followed by a video, and then gave his learners activities to perform using static electricity. This three-stage strategy catered for the diverse learning styles of his learners and their differing pedagogic expectations. This finding could be linked to the TPACK model, as NQTs blended technology and pedagogy in order to achieve maximum result in the lesson.

Some subject matter is not abstract but nevertheless difficult for learners to comprehend, especially when they have no prior knowledge of it. Teacher 5 enhanced her learners' understanding of History concepts by introducing videos. She taught a lesson on 'Gandhi' by reinforcing her verbal account with an educational video that provided useful contextual information. In Boadu et al. (2014) study, teachers felt that Social Studies was uninteresting to learners if they simply described things that had happened in the past, so they used videos to make their lessons more lively and exciting. Teacher 5 in this current study explained:

> … History for me is one of the most difficult subjects. Learners learn about countries and people they don't even know or they were not born when an event happened. That was why with the lesson on Gandhi today, I showed learners videos which I got from YouTube to make the lesson interesting. So learners were learning content in a more interesting way.

Teacher 5 added:

> In fact, subjects that I felt like, 'oh', [exclamation] learners are going to struggle with because they had no prior knowledge, I tried to spice it [subject matter] up with videos in order to enhance their learning.

This finding confirms that of Baz (2016) who reported that 92.8% of the teachers agreed that the use of technology for curriculum delivery facilitated learners understanding of difficult concepts. Similarly, Kafyulilo et al. (2016) found that teachers used animation to ease learners understanding of science concepts. The aforementioned finding in this current study links the TPACK concept of TK: the NQT had the ability to choose the most appropriate video which had both visual and audio effects, and catered for the diverse learning needs of learners in the History lesson.

5.2. Use of PowerPoint to Consolidate Lesson

Two teachers used PowerPoint to round-off their lessons. These two teachers used PowerPoint to highlight important issues they had just taught. When interviewed, according to the teachers, using PowerPoint to conclude their lessons helped learners understand and retain subject matter more fully and more permanently. Teacher 1 reported:

> I used PowerPoint to emphasize important points so that learners would remember the content which I had taught. 'Wheat farming' is difficult because learners had no prior knowledge of farming you know.

This comment by Teacher 1 suggests that his focus was on the use of technology rather than the quality of teaching with technology, since the PowerPoint was used mainly to highlight words from the text which learners had just read. By using a chalkboard, this teacher could have conducted the same tuition as a PowerPoint presentation. Technology cannot be used for the sake of using it: teachers must use it to develop learners' critical thinking skills, so that they are able to compete and contribute in the 4th industrial revolution. Chen et al. (2019) acknowledged in their study that one problem teachers faced when designing technology lessons is to figure out how learners would not only enjoy the technology but engage with it to enhance the learning process.

According to Mishra and Koehler (2006) there is a tendency for teachers to focus upon technology rather than using technology to enhance the teaching and learning process. This assertion was supported by evidence in the current study, in that Teachers 1 and 2 consolidated some of their lessons by using PowerPoint to emphasize important issues in the subject matter they had just taught.

5.3. Use Technology to Facilitate Collaborative Learning

Teachers 4 and 5 assigned learners project-based tasks that required them to work in groups using technology. When interviewed, Teacher 5 indicated:

> … I did group work with my learners, because learners learn best when they are given hands-on activities to work with their peers….

From the researchers' observation, for example, Teacher 5 divided learners into small groups to discuss the process of making a sandwich in an Afrikaans First Additional Language lesson. Afterwards, she showed her learners a YouTube video that gave an explicit account of how a sandwich is made. To consolidate this lesson, each group came to the front of the class to put pictures and explained the different ingredients involved in making a sandwich on the smart board in sequential order. In this way, according to Teacher 5 during interviews, learners actively participated in the learning process and took responsibility for their own learning. It was observed by the researcher that greater autonomy was given to learners during the lesson, which created a positive learning environment. Each group confidently came in front of the classroom to do the exercise on the smart board. The learners communicated and responded to questions asked by the teacher and peers, which shows increased self-confidence.

Teacher 4 placed academically strong learners in the same group as weak ones in a Geography lesson on the topic of 'Weather'. He introduced the lesson by showing a video in which learners saw how weather was reported by a meteorologist. After the video, his learners were grouped to deliberate on and present minimum and maximum temperatures in the different provinces in South Africa as shown on a mute-map on the smart board; the sound of the video having been reduced on the smart board. It was observed that the learners felt empowered as they took control of the classroom to do the weather report. The learners were happy, as this could be seen from their body language and facial expressions which showed excitement.

In the interview that followed the classroom observation, Teacher 4 acknowledged that his learners had different academic abilities. Through their being placed in mixed ability groups, the learning of academically weak learners was supported by the clearer understanding of their academically stronger peers. "… my learners are like day and night. I mean you [the researcher] could have observed that. While one group is stronger academically, the other group is weaker. The learners have different abilities and I tried to group them and this has really helped the weaker learners, I mean increased their performance as they were supported by their peers". This finding is similar to literature that technology has the potential to cater for diverse learning needs of learners (Raman & Mohamed, 2013; Schrum et al., 2008).

The findings in this section highlight an important point: that teachers' philosophies guided how they taught with technology in their classrooms. Teachers 4 and 5 believed that their learners learned best when they were given hands-on or learner-centered activities requiring them to take responsibility for their own learning. Their learners understood concepts better when they were given the opportunity to interact with their peers in a group, assisting each other. Teachers 4 and 5 achieved TPACK, as learners were given opportunities to think and solve problems while completing their technological tasks.

5.4. Use of Technology to Boost Learner Self-Esteem

Two teachers taught speaking skills using technology in order to boost learner confidence in their academic ability. For example, Teacher 5 taught English Home Language lesson entitled 'Fable.' She first showed some educational videos that had moral lessons; then, each group typed their own original fables using a computer in the laboratory. Finally, they formulated the moral lessons of their stories. The fables were posted on the school's blog, a form of exposure that increased the learners' self-esteem. Teacher 5 stated:

> Most of my learners deal with so many social issues on a daily basis. It's either their parents got divorced or something happened at home, their self-esteem was always low. But when I posted their task on the school's blog and on the schools' notice board with their names as authors, they were so excited and their faces lit up – they were chuffed with their shoulders high.

From the researcher's observations, it was evident that learners took pride in playing the role of authors and having their stories published. These findings confirm an observation made by Heafner (2004) that if teachers build on learners' self-confidence, learners will more likely enjoy learning, which can greatly impact student achievement.

It was found that Teacher 6, in an English Home Language lesson on 'Prepared speech,' boosted her learners' self-confidence by audio recording their presentations and playing them back to the entire class. These recorded presentations made the class fun and interesting. When interviewed regarding this, the teacher responded:

> … I'm not sure, but what I know for a fact is that learners enjoyed it when I used the technology - the recorder - it was fun and interesting and I made the lesson relevant, you know. It was an amazing thing to do because they were interested and they gained confidence.

It was observed that the use of technology during teaching and learning made the lesson interesting and fun. All the learners enjoyed the technological aspect of the activity and were willing to appear in front of the class to present their speeches. The NQT understood that the audio recorder (TK) could be used to achieve a specific pedagogic (PK) objective of the lesson which was to improve learners' communicative skills.

6. CONCLUSION

This study explored what technology NQTs used, and how and why they used technology during curriculum delivery. From the findings, it was revealed that the six NQTs had embraced technology and were using it in varying ways and frequencies. The NQTs used technology such as use of videos, PowerPoints, smartboards, computers, blogs and audio recorders. Regarding how and why NQTs use technology, it was evident that they used it to capture learners' interest and teach difficult concepts, consolidate lessons, facilitate collaborative learning and boost learners' self-esteem. The researchers used TPACK to analyse and interpret data. From the findings, the following conclusions and recommendations were reached:

Teachers 4 and 5 had resources which they used to engage learners in hands-on tasks that required them to explore with technology. While Teachers 1, 2, 3 and 6 had limited resources, they used technology in a teacher-centred manner. Lack of resources is a major problem in countries, as for example in Hartman et al. (2019) study, there was issues of availability, accessibility and reliability of technology. Though limited technology could be the reason for the way Teacher 1, 2, 3 and 6 in this current study taught with technology, however, they did not make full use of the existing resources to get better learning effect. From the finding, the researchers concluded that

teachers who are interested in constructivist teaching, will use learner-centered approaches despite limited resources, to achieve better learning outcomes.

It is recommended that WCED and Departments of Education in other affected countries bridge the digital gap by prioritizing, in their planning schedules, the need to have one furnished computer laboratory capable of accommodating an entire class with the necessary technological resources in schools that lack resources. This will provide an enabling environment which may encourage more NQTs to adopt, adapt and teach with technology despite their diverse school contexts. Both national and international teachers need to be encouraged to use technology, since they are training learners who need to be equipped to contribute to the 4th Industrial Revolution, by being competent and confident in the use of technology. In addition, it is recommended that professional development training should focus on training teachers on how to integrate TPACK, when they teach with technology in their different school contexts.

We conclude that TPACK cannot solely be used as a model in examining how NQTs integrate technology during curriculum delivery, as other socio-economic factors affect the uneven uptake and use of technology. Therefore, it is recommended that future studies combine TPACK and other technology acceptance models such as the Unified Theory of Acceptance and Use of Technology2 (Venkatesh et al., 2012) to deepen our understanding of the topic under study.

As a limitation, we note that this study is limited to a small sample- six NQTs, hence it cannot be generalized because it is possible that other NQTs may teach with technology differently; since they may have different experiences in their various schools, or be acting under different professional agency. Despite these limitations, the researchers have provided overview of what technology NQTs used during curriulum delivery, and how and why they integrated technology with curriculum.

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