CPD and The Development of Teacher TPCK For Technology Integration: A Hermeneutic Phenomenological Study

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ABSTRACT

This paper explores the role of Continuous Professional Development (CPD) in developing teachers' competence in integrating technology into their practice to better understand the provision of equitable and quality teaching and learning. Employing a phenomenological research paradigm, underpinned by a hermeneutic phenomenological methodological research design, data was collected from a purposive sample of 10 primary school teachers in the Western Cape. Narrative and semi-structured interviews provided a rich and textured account of the diverse ways in which teachers' competence in technology integration was developed by CPD. The data explication process applied, suggests that teaching and learning resources were important factors in which CPD model participants were selected. However, teacher agency exercised within structural and cultural conditions significantly shaped the effective integration of technology in the diverse classroom context. This paper provides a more nuanced understanding of the relationship between teacher context and CPD's effect on Technological Pedagogical and Content Knowledge.

Keywords: Continuous Professional Development, Technology Integration, Phenomenology, Hermeneutic, TPACK

1 INTRODUCTION

Technological innovation tends to place new professional demands on future citizens. Graduates entering a world transformed by technology require the education sector to respond to the need for innovative technology integration (Xing & Marwala, 2017). Butler-Adam (2018) predicted that educators will be challenged to prepare citizens for the exponential growth of new technology. Over the past decade, the importance placed on technology in education has grown significantly, focusing on two aspects (Hew, Lan, Tang, Jia & Lo, 2019). Firstly, technology integration is integral for education to remain relevant. This promotes the case for integrating technology throughout teacher education, based on the premise that teachers' knowledge must include the integration of technology into their practice (Redmond & Peled, 2019). In support, in the second aspect researchers suggest that teachers are vital in technology integration. Jan (2017) and Butler-Adam (2018) underscore that the ability to use new technology is in society increasing, implicating education in addressing the demand through teaching, learning, and curriculum change.

2 BACKGROUND

Elbaz (2018) emphasised the interconnected link between teacher practice, learning and curriculum development, supported by Taylor, Carlson, Gardner,

Wilson and Stuhlsatz (2019) who motivate that teacher practice is fundamental to learner achievement and curriculum change. This supports Jan's (2017) earlier motivation for teacher professional development programs to address the demands of an increase of integrating technology into teacher practice, on the notion that teachers are vital to technology integration in education.

Jan's (2017) notion leads to the last focal aspect in research which suggests that it is necessary for Continuous Professional Development (CPD) to develop teachers' competence in integrating technology into their practice. Redmond and Peled (2019) accentuate that technology has yet to be harnessed globally in teacher practice, attributing this to teachers' inability to contextually integrate technology into education. Consequently, integrating technology is dependent on teachers' Technological, Pedagogical and Content Knowledge (TPACK) (Krauskopf & Forssell, 2018). If we are to accept that technology integration in education is critical to empowering future citizens, the adequate preparation of teachers to integrate technology into their practice is critical (Drummond and Sweeny, 2017). Teachers' inability to take advantage of society's saturation of technology is depicted in Moreno, Cabero-Almenanra and Almargo's (2019) study of in-service teachers. This study concluded that increased integration of teachers' TPACK was present after receiving CPD. The development of TPACK for improving technology integration into teacher practice has received much attention in research emphasising the CPD of teachers TPACK (Mishra & Kohler, 2006; Drummond & Sweeny, 2017; Mutereko, 2019).

3 RESEARCH AIM

This study is motivated by the aspects addressed in literature where the emphasis is placed on technology integration in education, teachers' vital role, and the need for CPD to develop teachers' competence for integrating

technology into their practice. The purpose of this phenomenological study, therefore, is to provide contextual insight into the role of CPD in developing teachers' competence in integrating technology into their teaching.

4 RESEARCH QUESTIONS

To address the aim, this study is guided by the following research questions:

1. *How do different CPD models develop teachers' competence in integrating technology into their practice* and

2. *How do contextual factors influence CPD in developing teacher competence in integrating technology into their practice?*

5 LITERATURE REVIEW

Continuous contextual changes and innovations in education require teachers' engagement in lifelong professional development referred to as Continuous Professional Development (CPD) (Louws, Meirink, van Veen & van Driel, 2017; Bernadine, 2019). In short, CPD is described as a way of capacitating employees on the premise that teacher compliance does not impact public service delivery without competency (Mutereko, 2019).

CPD is critical to developing and refreshing teachers' quality of practice and learner achievement (Erdas Kartal, Dogan, Irez, Cakmakci, & Yalaki, 2019). There is a global call for prioritizing in-service CPD in education, especially those involving technology (Bernadine, 2019; Mutereko, 2019). The United Nations Educational, Scientific, and Cultural Organisation (2016, p. 38) calls for teachers to be provided with regular CPD opportunities, stating that "technology could be deployed to improve access to education for disadvantaged communities, to support professional development...". The recommendation that integrating technology into teacher practice should be a goal of current CPD is made in

much-related literature due to the contextual impact of the pace in technological innovation (Louws et al., 2017; Dlamini & Mbatha, 2018). Local studies of teachers' CPD support its role in improving South African education and influencing teacher practice, linking CPD, technology integration and the consideration of contextual demands (Christiansen & Bertram, 2019).

In line with the national strategy to improve education through enhancing teacher practice, the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa (ISPFTED) 2011 - 2025 mandated SACE to implement, manage, and quality assure CPD (DBE & DHET, 2011). The ISPFTED 2011 – 2025, and Teacher Professional Development Master Plan 2017 – 2022 provide details of the provision of South African CPD. These documents give details of the CPD models provided by the Department of Basic Education (DoBE), four of which can be classified into the following models of Kennedy (2005):

1. **Training Model:** Arguably the dominant model used, employing a skills-based technocratic view where CPD is delivered to teachers by an expert, commonly off-site.

2. **Award-Baring Model:** Like the training model, however, the CPD is validated, and the participant is awarded documented proof of completing the training.

3. **Mentoring Model:** A variety of CPD practices are encompassed by this model, all defined by the relationship between two teachers; the mentor is the one providing the CPD.

4. **Community of Practice (CoP) Model:** Colleagues participating in a learning community to provide CPD. Kennedy (2005) closely relates the Me and CoP models, stating that in

some literature the two only differ in the confidentiality of the members'[1] interactions.

South Africa's CPD programmes followed the provision of the models outlined in the aforementioned documents receiving large investments, however, teachers were reported to be left with persisting incompetencies (Dlamini & Mbatha, 2018). Kimathi and Rusznyak (2018) noted SACE's little success in their CPD mandate, attributing it to variations in contextual settings, suggesting that in-service CPD must be aligned with current trends in contextual change and teacher development goals (Louws et al, 2017, Kimathi & Rusznyak, 2018). Three internationally influential trends can be identified in the South African approach to teacher CPD. The first is that CPD is the duty of the professional, registered under a professional licensing authority. The second is the imposition of CPD by national or provincial authorities, which was evident during the South African curriculum changes. The third is in the framing of CPD in the role of research, policy, and practice reform implementation, which has also been used historically in South Africa (Guldenhuys & Oosthuizen, 2015; Bernadine, 2019). Internationally all three trends met with success and challenges. South Africa faced many challenges in implementing CPD in these trends due to vast variations of contextual inequalities, receiving criticism for limited provision of long-term contextually aware CPD opportunities (Kimathi & Rusznyak, 2018; Bernadine, 2019).

Despite significant investments in technology integration in South Africa, inequities in teacher competency persist. Research urges that CPD is integral to teachers' technology integration into their practice (Dlamini & Mbatha, 2018; Baran, 2018). Contextual factors pose a challenge to CPD efficacy and a challenge of the

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[1] Member(s) referring to participants in the CPD models.

trends in South African CPD provision. Louws et al. (2017) warn that the efficacy of CPD relies on alignment to teacher contextual needs supporting this claim in research done by Borko, Jacobs and Koellner (2010), Little (2012), Webster-Write (2009) and Van Veen, Zwart and Meirink (2012). Louws et al. (2017) suggest that (1) CPD is principally influenced by school context, (2) context determined the CPD opportunities afforded to teachers, and (3) teacher initiative towards their CPD is partial to their context. Edras Kartal et al. (2019) described effective CPD as being able to make provision for teacher's learning to be a process of meaningful interactions between teachers and context, characterising context as a highly important CPD component. Bernadine (2019) states that CPD policy design is dependent on context, recommending that contextual factors be considered for CPD improvement. This study locates itself within the recommendation of multiple studies in the field of CPD and technology integration suggesting the need for insight to be gained into technology integration, CPD and context. This motivates the aim of this study, to address the need to provide contextual insight into the role of CPD in developing teachers' competence in integrating technology into their practice. Being aware that the meaning of context differs frequently in multiple studies, this study, based on the work of Dey (2001) and Briand, Bianculli, Nejati, Pastore and Sabetzadeh (2017), defines context as *human* (beliefs, background, motivation), *organisational* (limitations of resources and time), and *domain-related* (level of compliance with professional standards) factors which are evident to be of interest in participants lived experiences related to their professional identities.

Technological Pedagogical and Content Knowledge (TPACK)

The TPACK framework of Mishro and Koehler (2006), describes the knowledge teachers need in order to integrate technology efficiently into their practice, building on the work of Shulman (2005). TPACK, uses three founding perspectives,

1. **Technological knowledge (TK)**: knowledge of various technologies available and characteristics thereof

2. **Content Knowledge (CK)**: Knowledge related to concepts and theories of a discipline, or subject,

3. **Pedagogical knowledge (PK)**: Knowledge of the teaching theories and strategies related to the discipline.

The combination of these three founding perspectives is referred to as intermediate TPACK perspectives, namely:

4. **Technological Pedagogical Knowledge (TPK):** Knowledge of the benefits and disadvantages of technologies for specific pedagogical practices.

5. **Pedagogical Content Knowledge (PCK):** Knowledge of applying relevant teaching theories and strategies to teaching the discipline, or subject.

6. **Technological Content Knowledge (TCK):** Knowledge of the use of relevant technology in teaching specific discipline content.

TPACK, therefore, is defined as the knowledge of how to integrate appropriate technology with relevant pedagogical approaches to teach the content of disciplines (Valtonen, Sointu, Kukkonen, Mäkitalo, Hoang, Häkkinen, Järvelä, Virtanen, Pöntinen, Kostianinen. & Tondeur, 2019). TPACK served as a theoretical framework for this study, providing a theoretical lends to search for insight into how different CPD models develop teachers' competence in integrating technology into their practice. Chai (2019, p. 6) states that "it is now

commonly accepted that teachers need to develop TPACK to integrate technology…", supporting the notion that TPACK provides insight into teacher knowledge of technology integration and their pedagogical and content knowledge influencing their practice (Valtonen et al., 2019)

6 METHODOLOGY

This study positions itself within the phenomenological research paradigm to describe participants' lived experiences, drawing out the meaning of a phenomenon (Neubauer, Witkop & Varpio, 2019). The researcher bracketing their presumptions is key to Husserl's (1964) phenomenology, allowing an unbiased view of participants' experiences. Bracketing is often rejected by divergent methodologies of phenomenology, therefore, a phenomenological study must orient itself with one of the phenomenological schools (Gill, 2020).

Two main schools are associated with phenomenological research: hermeneutic and transcendental. In Husserl's (1964) transcendental, the researcher as an observer can transcend the phenomenon under study to assume an overarching view of the phenomenon's essence (de Zengotita, 2019). Phenomenologists who follow the school of Heidegger's (1889 – 1976) hermeneutic phenomenology often criticise transcendental phenomenology, arguing that the researcher inevitably has an impact on the research and cannot fully separate their subjectiveness (Gill, 2020). Hermeneutic phenomenology moves beyond using participants' lived experiences to describe the phenomenon, interpreting the context that underpins the experiences (Sloan & Bowe, 2014). As this study was concerned with the contexts of the participant's experiences, hermeneutic phenomenology was the school of choice. This is supported by van Manen (1990) who credits the application of hermeneutic phenomenology in studies related to education through interpretations of a deeper relationship between a broader range of contexts and lived experiences (Sloan & Bowe, 2014).

Hermeneutic Phenomenology

Van Manen (1990, p. 37) describes lived experiences as being an element of "a system of contextually related experiences", and later states that to study lived experiences is to know the world in which the participant exists: "to know the world is profoundly to be in the world in a certain way, the act of researching – questioning – theorizing is the intentional act of attaching ourselves to the world, to become fully part of it, or better, to become the world" (Van Manen, 2010, p. 5). Wai Sum and Shi (2016) used hermeneutic phenomenology to explore the lived experiences of Physical Education teachers to gain insight into their lived world to produce rich descriptions of contextual factors that influenced their professional development. Similarly, Chan, Walker and Gleaves (2015) were guided by a hermeneutic phenomenological design to describe the diverse contexts of their participants, crediting it with allowing them to uncover the uniqueness of the individuals' experiences, emphasising their context. Guided by a hermeneutic phenomenological design, this study explored participants' lived experiences to gain insight into their context.

Trustworthiness and Ethical Considerations

Researcher subjectivity plays a key role in hermeneutic phenomenology, but there is a need for the researcher to be self-aware of their own subjectivity to be conscious of how it would impact the study (Gill, 2020; Chan et al., 2015). In this study, it was important for the researcher to recognise and acknowledge preconceptions that could influence the interpretations of the participants' lived experiences. It was also important to not "step outside of the

moral values" of ethical research considerations, remaining mindful of how the research could affect the participants (Van Manen, 2015, p. 2). Therefore, an assessment of possible risks and harms of the research was done beforehand through obtaining ethical clearance from the institute that the researcher is affiliated with (Yin, 2011). All participants were made aware of the aim and questions of the study and were allowed to peruse the research proposal before participating. Member checking was practised during the research period where participants were asked to check for inaccuracies in the researcher's analysis of interview data and field notes taken during interviews. This assisted in combating researcher subjectivity (Sum & Shi, 2016). The application of Licon and Guba's (1985) methods for trustworthiness has been beneficial in hermeneutic phenomenology for addressing subjectivity (Noble & Smith, 2015). Applying this

method, this research addressed the: *truth value* by providing evidence of participants' verbatim statements when presenting the findings, *consistency* in keeping a comprehensive record of data, *neutrality* in the aforementioned steps of reflexivity, and *generalisability* in the detailed discussion of sampling, data collection, and data analysis procedures which follow (Noble & Smith, 2015).

Participant Selection: Sampling

This study aimed to provide contextual insight; therefore purposive sampling was used to select ten participants who would enable the researcher to explore the lived experiences of individuals from a variety of contextual factors (Maxwell, 2012). Table 1 below provides a visualisation of the criterion used to purposefully select participants for this study.

Pseudonym	Gender	Age	Self-perceived technological competence	School resources in technology	Learners' household income bracket
Holly	F	52	Low-Mid	Mid	Mid
Rudy	M	52	Low	Low	Low
Gary	M	46	Mid	Mid-High	Mid-High
Mary	F	41	Mid-high	Mid	Mid
Dave	M	35	Mid	Low	Low
Zoe	F	35	Low-Mid	Low	Low
Maggie	F	30	Low-Mid	Mid	Mid
Rob	M	29	Low	Mid -High	Mid
Katy	F	23	Mid	Low-Mid	Low-Mid
Lisa	F	21	Mid-High	Low-Mid	Low-Mid

Table 1: Criterion for participant selection

Data collection

Data was collected through two interviews with each participant. The first was a narrative interview. This type of interview is described as a story of unfolding events and was only structured by the researcher asking the participant to describe their professional journey with CPD that was related to the development of their competence in integrating technology into their practice (Stuckey, 2013). The researcher took field notes and asked questions where needed to keep the participants' narration of their journey with

CPD relevant to the research aim. Participants were provided with an opportunity to member-check the field notes at the end of the narrative interview. Semi-structured interviews were then used as follow-up interviews for each participant. These interviews are often used as a follow-up to other data collection instruments and are often used in hermeneutic phenomenology (Noon, 2018). The semi-structured interviews allowed the researcher to ask questions related to the data collected in the narrative interviews. Participants had the opportunity to check the initial analysis of the data collected in the narrative

interviews, and the researcher was able to question the participants to gain further insight into questions that arose during the initial analysis. All interviews were audio recorded and verbatim transcriptions were used in the presentation of findings, which is important in the interpretation of lived experiences in hermeneutic phenomenology for developing a written statement (Gadamer; 2004; Van Manen, 1997; Sloan & Bowe, 2014).

Data explication framework: Analysis

Hermeneutic phenomenology receives critique for the ambiguity and non-standardised approach to data analysis (Gill, 2020). Noting this critique, this study both follows the tradition of flexibility and language emphasis of hermeneutic phenomenology, while embracing an Interpretive Phenomenological Analysis (IPA) framework to guide the process. IPA is often criticised for the limited role of language placed in data analysis, therefore being guided by Van Manen (1990) and Gadamer (2004) in the selection of which steps of the various IPA methods to select, supported the framework used in this study to utilise the strengths of both IPA and hermeneutic phenomenology (Noon, 2018). The following steps provide an explication of the data analysis framework:

1. **Immersion**: Usually done by reading and-re-reading transcriptions to immerse oneself in the participants' descriptions. The researcher found it easier to practice immersion by listening to the audio recordings multiple times.

2. **Noting**: Making notes of the participants descriptions that will allow the identification of emergent themes.

3. **Developing themes and connections**: connections between emergent themes are made to develop more established ones. The IPA techniques of *abstraction*, *polarisation*, *contextualization* and *function* were practiced in this step.

4. **Circle of reflexivity**: The researcher practices reflexivity and takes note of possible subjectivity, circling back to steps 1, 2 and 3. Member checking by participants was used to assist. This step enabled the researcher to deeper explore the lived experiences of the participants' which were related to the emergent themes in search of the essence of the lived experiences.

5. **Writing a statement**: After themes have been fully established, a written statement is produced using verbatim examples of participants' descriptions to illustrate the themes (Van Manen, 2007; Noon 2018).

The theoretical framework of TPACK (Mishro & Koehler, 2006), the contextual factors derived from Dey (2001) and Briand et al (2017), and the CPD model definitions (Kenny, 2002) were used as a lens to aid data analysis. Table 2 below shows an example of the application of the data analysis process in this study, and Table 3 provides the coding that was used in this study.

Participant description (Verbatum)	CPD model	TPACK	Context factor	Emergent Theme	Essence
Rob *...yes, so what I normally, um, look for is where I can learn the skills I need to know the different types of technology. You know I don't know I always struggle with using these things, I want to learn about how to use them myself...*	TR	TK	HU	Selection of CPD models	Agency: *Rob's self-perceived level of competence in technology integration influenced his CPD model selection*

Table 2: Example of data analysis process

CODE	DESCRIPTION		CODE	DESCRIPTION
TK	Technical Knowledge		TR	Training CPD
TCK	Technical Content Knowledge		AB	Award-Baring CPD
TPK	Technological Pedagogical Knowledge		ME	Mentoring CPD
TCPK	Combination of TCK and TPK		COP	Community of Practice CPD
HU	Human contextual factors (beliefs, background, motivation)			
OR	Organisational contextual factors (limitations of resources and time)			
DR	Domain-Related contextual factors (compliance with professional standards)			

Table 3: Coding used in this study

7 FINDINGS AND DISCUSSION

The purpose of this study was to provide contextual insight into the role of CPD in developing teachers' competence in integrating technology in their teaching. Two research questions were used to guide this study in its aim: (1) *How does different models of CPD develop teachers' competence in integrating technology into their practice* and (2) *How does contextual factors influence CPD in developing teacher competence in integrating technology into their practice?* The application of the data analysis framework illustrated in Table 2 was beneficial to the development of themes in the data which addressed these research questions, assisting in the formulation of a written statement to present these themes in addressing the research aim.

7.1 How does different CPD models develop teachers' competence in integrating technology into their practice?

The association between different aspects of TPACK, different CPD models and specificity in the development of technology integration was evident in the emergent themes identified in the participants' experiences. It was firstly suggested that specific TPACK perspectives were more influential in developing teachers' technological integration. Participants described that TK

in isolation was not sufficient in developing their technology integration.

Dave: *...when we wanted to use this* (Programme's name)... *we worked on ways to get through to them. So, it's like (pause) we, I know how to teach with it but together we work on the didactics of teaching using the computer, I mean the new, um, technology...*

In this description, Dave described a moment when he admitted to having TK, but needed to develop his TPCK to integrate the technology into his practice. This was commonly described in the data collected:

Katy: *I asked her to show me how it works when I want to do the shapes lessons because I did not understand that part in the training...*

Here, Katy also used ME to develop her TPCK to integrate technology into her practice. Similarly, Mary engaged with COP to develop TPCK for similar purposes:

Mary: *It was really just us working together to see how to use it in our lessons and teaching...*

These participants' descriptions not only correspond with Patton and Parker's (2017) signature pedagogy but also corresponds to the study of van As (2018) who links the development of discipline knowledge (CK) and instructional

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methodology (PK) with teachers' development of new and existing skills in their practice. Elbaz (2018) also placed Shulman's PCK at the centre of teacher practice which is supported by Barendsen and Henze (2019) stating that teacher classroom practice needs to be informed by addressing multiple elements of PCK. Emphasis is placed on the COP and ME models for their development of Teacher PCK (Wenger, 2000; Mupepi, 2021). The consensus is that these two models are powerful locations for developing PCK through collaboration and learning through practice (Boreham, 2000; Patton & Parker, 2017). Participants' descriptions in this study support this, making connections between COP and ME models with the development of TPCK.

Gary: *... we still work together when we try new things, especially the technology integration and see how to use it to teach the subjects.*

Here Gary describes how he participated in COP to develop not only his TPK but also his TCK. Rob and Holly also describe the development of elements of TPCK in ME and COP models, respectively:

Rob: *she is always ok to show me how to teach any subject, ... will give me tips on how to teach the work using, like, a projector or laptop or other digital technology.*

Holly: *... for all the years I've worked like this with my colleagues where we will share what works with our classes, it's the same now with Teams.*

Contrary to this, participants' descriptions suggested a connection between TK with TR and AB models.

Katy: *So, we only covered things like how to work it, how it connects to the laptop, how we can use the laptop to type on it and it will immediately go through to the interactive whiteboard...*

In the above description, Katy described developing her knowledge of TK in TR she had received. Similarly, Mary and Rudy describe their participation in AB and TR, respectivtly, where they also reported developing their TK.

Mary: *... they showed us how to use Kahoot and other apps but there was not really time given to showing us how to use it in teaching.*

Rudy: *Um, so yah, like I said we went to the training, and they were teaching us how to use the* (Programme Name) *and what we need to do as teachers, how to log in, how to view the children's results.*

Rose and Reynolds (2006) agree, stating that TR and AB models are methods of passive knowledge transmission, echoing Kennedy (2005) who credited them with the type of knowledge development synonymous with TK. Almari, Aldahmash and Alsharif (2018) also describe the top-down, hierarchical approach of these models which do not influence teacher real-world practice. Therefore, in addressing the question: *how do different CPD models develop teachers' competence in integrating technology into their practice*, the findings of this research suggest that (1) developing teacher TPCK will influence the development of their competence in integrating technology into their practice, and (2) ME and COP models are effective in TPCK development.

7.2 How does contextual factors influence CPD in developing teacher competence in integrating technology into their practice?

The findings described two primary contextual factors which influenced CPD in developing teacher competence for integrating technology into their practice. Firstly, participants described being influenced by OR factors of school resources in their choice of CPD.

Zoe describes why she often chose the AB: *I went because I wanted to learn*

how to use this ... I wanted to listen and bring it back into my classroom... to see what's gonna make me work smarter. And, you know, and, what's going to advantage these children more than anything.

Gary describes a self-initiated COP: *…created a group for us on teams so that we could work together on how to teach our classes online… this session was good because we got a chance to look at strategies on how we were going to teach the learners online…*

Participants who described their schools as being low-resourced mostly chose TR and AB as seen in Zoe's description, whereas participants who described their schools as med-high-resourced participated mostly in ME and COP as seen in Gary's description. Almusawi Durugbo and Bugawa (2021, p. 4) state that "organisational factors play a critical role in the emergence and sustainability of technological innovations", however, this was not the most influential contextual factor evident in the findings of this study. HU factors were more influential in teachers' selection of CPD model.

Rob (describing why he chooses TR): *...yes, so what I normally, um, look for is where I can learn the skills I need to know the different types of technology. You know I don't know I always struggle with using these things, I want to learn about how to use them myself…*

Participants who described themselves as having low technological competence mostly selected TR and AB models. Rob's explanation of needing to learn how to use the technology (TK) is indicative to participants' descriptions. Participants who believed they had mid-high technology compitence mostly participated in ME and COP to develop what Mary referred to as "*…to see how to use it in our lessons and teaching…*". This can also be seen in Gary's description:

Gary (describing why he chooses COP): *We all have different strengths in using IT (Technology), I personally know a bit more than the others... we still need to work together to see how we can use it in the planning for the subjects. (Pause) And what lessons will work better with the things like a projector or video or game, um, online quiz or …*

Participants' perception of their competence in technology was the most influential contextual factor in their choice of CPD model. Addressing the first research question the association between specific CPD models that develop TPCK were most influential in the development of teacher competence in technology integration. This suggests that participants' perception of their competence was most influential in the development of their competence in technology integration. Durak (2019) supports this, stating that self-efficacy of technology integration is the most significant variable to TPACK development, linking achievement in technology integration to teacher beliefs. Leijen, Pedaste, and Lepp's (2020) adaptation of Priestley, Biesta & Robinson's (2015) model of agency depict the suggestion of participants, linking teacher perspectives of professional competence and professional purpose with their practice. This is supported by Imants and Ven der Wal (2020) place emphasis on the generation of self-validating environmental knowledge on teacher agency.

8 CONCLUSION

Increased importance has been placed on technology integration in education over the past decade (Hew et al., 2019). This paper, therefore, provides insight into the role of CPD in developing teachers' competence in integrating technology into their practice guided by hermeneutic phenomenology. Following the traditions of both hermeneutic phenomenology and IPA, this study used a

five-step data analysis framework that emphasised language (Gill, 2020; Van Manen 1990). A discussion of themes which emerged from that data produced a twofold written statement describing the essence of the phenomenon. Firstly, TPACK was used as a theoretical lens, which revealed that different CPD models developed different perspectives of teachers' TPACK. COP and mentoring which promoted TPCK were more influential in developing teachers' competence in integrating technology (Boreham, 2000; Patton & Parker, 2017). Secondly, contextual factors of Organisational (resources) and human (beliefs) influenced participants' choice of CPD. It was evident that human contextual factors were the most influential factor in participants' choice of CPD. This contextual factor suggested that teacher agency within the structural and cultural conditions was significant in motivating their selection CPD models that were more influential (Leijen et al., 2020). It can therefore be deduced that insight gained into the role of CPD in developing teachers' competence in integrating technology into their practice suggested (1) Mentoring and COP models of CPD were more successful at developing teacher TPCK which developed teachers' integration of technology into their practice, however, (2) teachers' selection of CPD models, guided by teacher agency, was more influential at hindering or promoting TPCK development.

9 LIMITATIONS AND RECOMMENDATIONS

Despite this study being conducted during the COVID-19 pandemic, the focus was not solely on CPD for technology integration that teachers participated in during the pandemic. The data did suggest that despite an increase in the demand for such CPD during the pandemic, overall emergent themes and suggestions remained consistent. The participants of the study, although selected for contextual diversity were all primary school teachers in the Western Cape, South Africa, limiting transferability.

The data collected recommends further research into what mechanisms of CPD models lead to the development of specific teacher TPACK. Further research into how changes in teacher agency could affect CPD for developing teacher integration of technology is also recommended.

Lastly, the data analysis framework application combination of hermeneutic phenomenology, IPA and TPACK theoretical lens was beneficial in this study. Recommendations for further application and development of this analytical framework for related studies is suggested.

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