HYBRID COMMUNITIES OF PRACTICE TOWARDS DEVELOPING EDUCATORS' TPACK: IMPLICATIONS FOR TEACHER EDUCATION

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ABSTRACT

Although widely acknowledged for their significance, contemporary Teacher Professional Development (TPD) initiatives have faced growing criticism due to their failure to effectively foster the seamless incorporation of technology into educators' pedagogical practices. Educators depend on their informal Communities of Practice (CoPs) rather than TPD programmes to acquire the knowledge they need to both competently and meaningfully integrate technology into their pedagogical practices. This study investigates the innovative approaches educators employ in three (*n=3*) Western Cape public primary schools to create a hybrid CoP in their school to improve their collective technological, pedagogical, and content knowledge (TPACK). The criticism of TPD efforts extends beyond primary and secondary school contexts. This challenge substantially impacts teacher education and highlights the increasing necessity for developing digital literacy among the professoriate in this discipline. The theoretical basis for this study was Wenger's (1998) CoP social learning theory and Mishra and Koehler's (2006) TPACK model. The study employed a qualitative research approach involving a cohort of 12 educators who engaged in open-ended survey questionnaires, one-on-one semi-structured interviews, and observational sessions. Additionally, the research incorporated one (*n=1*) school principal and two (*n=2*) deputy principals who actively contributed to all data collection modalities except for the survey questionnaires. Document analysis, specifically from WhatsApp group chat screenshots, was conducted across

all three (*n=3*) schools as part of the research approach. While the data set used in this study originates from a study involving school educators, it aims to extend the findings to determine their significance for teacher education. The results revealed that the sampled educators had established an informal hybrid CoP at their respective schools through innovative approaches, such as joint enterprise, mutual engagement, and shared repertoire. These educators gained TPACK from one another throughout this process. Universities and provincial governments might profit from the findings, the knowledge gained from which could assist in their structuring of TPD programmes in ways which would foster their organic development in educators' particular employment contexts.

Keywords: approaches, hybrid communities, communities of practice, educators, teacher professional development, technological pedagogical and content knowledge

INTRODUCTION

TPD programmes, like those initiated in the Western Cape, have come under increasing scrutiny for failing to promote successful and meaningful integration of technology into educators' pedagogical practices (Chigona 2018; Graham, Stols, and Kap 2020; Koranteng and Chigona 2016; Sadeck 2016), despite the recognition of their value. These programmes have been critiqued as being insufficient for several reasons, the most significant of which is a lack of and/or non-existent follow-up ICT training sessions (Popova et al. 2022). Educators in South Africa are more likely to learn how to use and integrate technology both competently and meaningfully into their teaching from fellow teachers in their CoP (Mahlo and Waghid 2022; 2023), rather than from government-organised training. A CoP is "a group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly," as defined by Wenger (2011, 01). A wide range of options exists for ways in which these communities may assemble. Wenger (2011, 03) lists three (*n=3*) types of groups: those that "meet primarily face-to-face; those that meet primarily online; and those that are formally recognised, often supported with a budget; and those that are completely informal and even invisible". Some, as noted by Byington (2011), may even meet using both in-person and virtual means. This latter option is known as a hybrid CoP (Sumandiyar et al. 2021). Hybrid meetings, as Neumayr et al. (2021) explain, may happen simultaneously in different places or at different times in different locations. In our research, we define hybrid meetings as those that take place asynchronously, i.e., at different times and places (Sumandiyar et al. 2021).

According to Davis (2015), CoPs provide educators with the opportunity to engage in self-reflection on their approaches to teaching, to exchange knowledge and expertise with others, and to establish connections with other educators. Lundin, Lantz-Andersson, and Hillman (2017) emphasise that the teacher professional group, operating as a CoP, encompasses shared

knowledge and expertise in the service of enhancing their teaching practices. This includes approaches for tackling specific teaching difficulties within a particular context and exchanging perspectives on the most efficient and creative utilisation of teaching material. However, existing literature (Baya'a, Daher, and Anabousy 2019; Chigona 2013; Jho, Hong, and Song 2016; Xu and Ko 2019) suggests that CoPs can only be established through educators' implementation of specific approaches. For instance, these studies have individually reported on approaches, such as mutual engagement, joint enterprise, and shared repertoire. These approaches have been found to be crucial in facilitating successful initiatives that foster collaboration among educators within educational institutions.

The hybrid CoP model has gained significant popularity in the realm of school education, particularly in the context of, and in response to, the prevailing COVID-19 pandemic and associated lockdown measures. However, it is worth noting that there is a dearth of empirical research which has investigated the impact of this CoP model, specifically of those CoPs established and employed to disseminate TPACK within South African public schools. Several notable studies have been conducted by Baya'a et al. (2019), Coutinho and Lisbôa (2013), and Phillips (2014) to examine the impact of face-to-face or online CoPs on the enhancement of educators' TPACK. Davis (2015) discovered that when teachers shared their knowledge and experiences and made connections with colleagues on Twitter, it unintentionally led to the formation of hybrid CoPs. Based on her study into a hybrid CoP, Caudle (2013) found that although in-person gatherings are crucial to a community's growth, the ongoing dialogue and self-reflection made available by the internet are as vital. These studies have mostly focused on school educators in different countries, rather than specifically on South Africa. In the context of this research, cohorts of primary school educators who both purposefully and unintentionally form hybrid CoPs are used as illustrative instances for the collective acquisition and the exchange of TPACK. Given the aforementioned factors, this study aimed to respond to the following research question:

- What are some of the innovative approaches which, through a hybrid CoP, are being used towards developing primary school in-service educators' TPACK?

Despite the fact that this present study examines the innovative approaches used by sampled cohorts of educators in primary schools with the purpose of providing a critical analysis and proposing ways to improve TPD programmes, the findings and recommendations may also have positive impacts on teacher education institutions.

LITERATURE REVIEW

CoPs within the school context

Mustikawati and Tarwiyah (2022) assert that a CoP can both facilitate and enhance educators' transformative practices and creative abilities. This process includes the development of identity, the establishment of relationships, and the establishment of social structures. The study conducted by Jho et al. (2016) examined the factors that contributed to the success of a collaborative initiative involving educators in Korea. The results of their study revealed that mutual respect, joint enterprise, and shared repertoire were significant variables in the formation of the CoP under study. The establishment of CoPs have been found to occur when educators engage in communication and collaborative work towards a common goal (Jho et al. 2016; Chigona 2013). Similarly, Xu and Ko's (2019) study posits that educators in three ($n=3$) primary schools in Hong Kong actively participated in mutual engagement while they deliberated and collectively developed pedagogical strategies for the creative and innovative use of the curriculum content they were teaching.

The aforementioned study by Jho et al. (2016) in Korea investigated the effects of a CoP formally established between two schools. The study revealed that these schools and their teachers exhibited common characteristics, such as an open-minded attitude and a commitment to self-innovation as a joint enterprise. They also engaged in mutually beneficial interactions and continuous role exchange as a means of mutual engagement. Lastly, the schools shared educational materials and had ample time at their disposal, which served as a shared repertoire. The research conducted by Xu and Ko (2019) suggests that educational institutions are not independent entities. This assertion has been corroborated by subsequent studies, such as those conducted by Hargreaves (2021) and by Mahlo and Waghid (2022). Thus, based on this literature, one could assume that educational institutions located within a certain area may together develop a CoP to enhance the knowledge and abilities of their educators pertinent to their responsibilities and practice.

Educators' roles in CoPs

Baya'a et al.'s (2019) study included those educators already in the profession and those still in training brought together to assess the potential of a CoP for enhancing the ability of the participants to incorporate technology into their lessons. Pre-service teachers, due to their recent specialised training in the integration of technological tools into the delivery of curriculum, were acting as mentors for their more experienced colleagues. In this case, Baya'a et al. (2019) found the newcomers were not always on the outside of a community but were occasionally

welcomed into the fold and quickly promoted to mentorship roles. This discovery serves as a notable illustration of the process of cultivating a shared repertoire of resources and fostering mutual engagement. Mahlo and Waghid's (2022) study in the Western Cape shows that inexperienced educators, with few teaching years' experience can also serve as informal mentors as they have the necessary knowledge and understanding to successfully incorporate technology into their lessons despite their lack of formal training and experience in the field. The practice of mentorship is also advocated by Knipp (2019) who argues for the possibility of school leaders boosting their educators' knowledge and confidence by providing opportunities for them to engage with other educators whom they would see as good role models. For this reason, Knipp (2019) argues that principals and other school leaders play a crucial role within CoPs in inspiring and motivating educators to embrace technology in the classroom. Therefore, according to a recent review done by Hart (2023), a case can be made for principals of South African schools to prioritise the incorporation of technology into classrooms.

Online technological tools used to support CoPs

Social media and Web 2.0 have been increasingly used in learning to create and study online/virtual CoP (Peeters and Pretorious 2020). Email, Facebook chat, Twitter, YouTube, and WhatsApp have been suggested as useful in the establishment and strengthening of CoPs (Bouhnik and Deshen 2014; Byington 2011). Communication technologies are also being used in educational institutions to facilitate effective communication and meetings among educators (Byington 2011). Pollock and Hauseman (2019) discovered that the use of emails by Canadian school principals had many benefits. These include streamlined and effective communication with stakeholders, enhanced task management, and the capability to record daily conversations to ensure accountability. However, Pollock and Hauseman (2019) question the desirability and practicability of this, drawing attention to the difficulties associated with email usage: the proliferation of email correspondence, the extension of work hours, the escalation of work responsibilities, the elevated demand for prompt responses, and the erosion of the demarcation between professional and personal spheres are just a few of the challenges of email usage.

WhatsApp is a popular social networking application tool that enables users to easily and quickly send and receive messages most often to communicate with relatives, family and friends (Asmara 2020). Lua (2023) claims that, as of March 2023, WhatsApp has surpassed YouTube and Facebook in terms of user base, with 2 billion people actively using the service every month. WhatsApp may be used to send and receive text messages, photos, videos, and links to websites (Asmara 2020; Bouhnik and Deshen 2014). According to Moodley (2019), the members of a virtual CoP can make better use of WhatsApp if they are aware of the factors that

shape the community's existence, and if they are willing to consider and accept the perspectives of others. According to research done by Ajani (2021) and by Bouhnik and Deshen (2014), the content of WhatsApp groups plays a key role in promoting educators' professional growth in the context of e-learning. Based on the results of these two studies (Ajani 2021; Bouhnik and Deshen 2014), both educators and learners tend to value WhatsApp for its technological benefits, such as its low cost, ubiquitous availability, and real-time communication features. Thus, it follows that WhatsApp's principal use would be the group messaging and conversation features it offers.

THEORETICAL FRAMEWORKS

CoP social learning theory (Wenger 1998)

This current research relied on Wenger's (1998) CoP social learning theory. Wenger (1998) claimed that CoP social learning theory has the status of a theory because it offers a framework for understanding and encouraging learning. Wenger's (1998) CoP social learning theory defines "community" as a group established via mutual engagement, joint enterprise, and a shared repertoire. Therefore, these three dimensions may be utilised for establishing CoPs.

Mutual engagement

Wenger (1998) observed that members of a CoP participate in reciprocal behaviour, resulting in the development of practice through teamwork, checking and disputing the meaning of what they are doing together. Mutual engagement was later described by Jho et al. (2016) as the continual contact between members of a community, together with the roles and relationships that come up as a direct consequence of this interaction. As part of a dynamic, reciprocal process members of a CoP need to interact and establish roles and relationships with one another, as well as work together, support one another, and take part in shared activities. A recent study by Miguel et al. (2022) illustrates this process. When people work together in this way, they feel appreciated (Wenger 1998).

Shared repertoire

Members of the CoP engage in joint enterprise. Community members' feeling of belonging is enhanced when they work together toward a shared objective (Jho et al. 2016). Joint enterprise, also known as domain, is a common goal that encourages educators to interact and work, as found by more recent research by Mortier (2020). This goal not only inspires them to participate and contribute but also guides their academic efforts and gives their work meaning (Mortier

2020). A recent example of this is provided by Cobb et al. (2003) showing educators in the secondary school setting work together to ensure that learners understand fundamental mathematical concepts and do well on standardised tests.

Shared repertoire

In the process of collaborating on socially negotiated practices, members of a community build a shared repertoire that "includes routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions, or concepts that the community has produced or adopted throughout its existence, and which have become part of its practice" (Wenger 1998, 83). Members of the CoP employ these pooled resources, or accumulated repertoire, to their mutual advantage. Qi and Wang (2018), for instance, found that participants in a collaborative learning process developed new teaching strategies and improved their professional abilities. Educators' access to a wider variety of materials for their development and progress was boosted by the widespread use of WeChat, a digital platform for group communication.

This present study draws on Wenger's (1998) CoP social theory to gain a deeper understanding of the approaches employed by in-service educators towards the formation of a CoP whose collective aim was to develop their TPACK. The research delves into the relationship between Wenger's three ($n=3$) dimensions of CoP: mutual engagement, joint enterprise, and shared repertoire. The data were analysed according to the emergent sub-themes concerning each of these three ($n=3$) CoP dimensions. Since Wenger's (1998) social theory of CoP does not define the nature of the knowledge gained through participation in CoP, the TPACK model developed by Mishra and Koehler (2006) was used.

TPACK model (Mishra and Koehler 2006)

We used the TPACK model developed by Mishra and Koehler (2006) as a supplementary framework to CoP social learning theory to understand the specific types of knowledge that primary school educators learn and share in their hybrid CoP. See Figure 1.

Figure 1 shows the model with seven areas of knowledge, overlapping with the three circles representing content, pedagogy, and technology. TK encompasses both traditional and modern media, referring to the understanding and acknowledgement of technological capabilities (Koehler and Mishra 2012; Mishra and Koehler 2006; Zhang and Tang 2021). PK involves an in-depth understanding of teaching and learning procedures, practices, and techniques, incorporating larger educational objectives (Koehler and Mishra 2009; Mishra and Koehler 2006). In the work of Valtonen et al. (2020), CK, encompasses fundamental knowledge

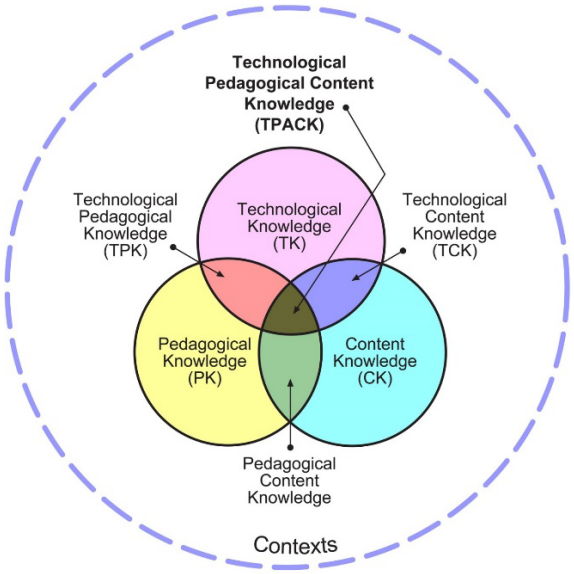

Figure 1: TPACK model (Koehler and Mishra 2009, 63)

of disciplines without considering the pedagogical aspect of teaching. TPK involves acquiring an understanding of how to use technology competently and meaningfully to support specific pedagogical approaches, while PCK refers to converting subject matter expertise into effective teaching strategies and creating conducive learning environments (Taopan, Drajati and Sumardi, 2020; Valtonen et al. 2020). Roussinos and Jimoyiannis (2019) and Valtonen et al. (2020) have provided a more comprehensive definition of TCK, one which encompasses an understanding of the dynamic interplay between technology and content, as well as familiarity with the various appropriate technologies employed in different subject domains. TPACK requires educators to facilitate the acquisition by learners of subject matter knowledge through designated pedagogical approaches, together with the incorporation of specific technological tools as stated by Koehler and Mishra (2012). It is the foundation of effective and meaningful technology integration in the classroom.

METHODOLOGY

Specifically, this research was conducted in three ($n=3$) purposively selected public primary schools in the Western Cape province of South Africa. For the sake of discretion, we refer to these schools as Schools A, B, and C. Initiated by the Western Cape Government (WCG), the Khanya Project, GreenShoots (also known as the MCO project), Click Foundation, and the Game Changer (also known as the smart classroom project) are four large-scale ICT initiatives that have benefited all three ($n=3$) schools in the historically 'disadvantaged' township of Khayelitsha. These three ($n=3$) schools are classified as quintile 3 schools. Schools

in the 1–2 quintiles receive full financial support from the government of South Africa. There are around 1100 learners and 31 educators at School A, 979 learners and 29 educators at School B, and 1700 learners and 38 educators at School C. In the last two years, every one of these schools has had a more than 90 per cent pass rate. These schools were selected based on their reasonably high ICT resources in Khayelitsha and for their having benefitted from WCG's ICT programmes in the past.

The Ethics Committee of the Faculty of Education at Cape Peninsula University of Technology (CPUT) and the Western Cape Education Department (WCED) approved our research project before we organised visits to the respective schools. Participants provided their informed permission by signing and returning a consent form. Out of a total of 98 educators, 15 were purposefully chosen to represent the sample. This included 15 educators, one (*n=1*) principal, and two (*n=2*) deputy principals. The principal and the deputy principals were chosen as they play leadership roles concerning their educators' technology use in their respective schools. Open-ended and self-administered survey questionnaires were distributed to 95 educators (excluding the three principals) with the primary aim of identifying and recruiting willing and suitable participants for the sample. Of those in-service educators who completed and returned the open-ended survey questionnaires, at School A, nine (*n=9*), eight (*n=8*) at School B, and at School C, ten (*n=10*). However, four (*n=4*) educators at each school were selected. Therefore, 12 out of these 27 educators were included in the study as they affirmed through their responses in the survey questionnaires that they collaborate as a cohesive unit within their schools regarding the use of technology for teaching and learning, thereby providing evidence of the presence of a CoP. To protect their privacy, educators are referred to as Educators A, B, C, D, E, F, G, H, I, J, K, and L, and the school's principal and the two deputy principals are referred to as Principal C, and Deputy Principal A and B, respectively. All 15 participating educators took part in one-on-one interview sessions, while all educators within the three (*n=3*) school populations were notified regarding the planned observations of educator meetings and informed about the analysis of WhatsApp group chat screenshots. The 12 educators involved all taught grades 3–6. Mathematics, English as a First Additional Language (FAL), and IsiXhosa. The survey questionnaires, interview questions, observation protocol, and WhatsApp group chat screenshot analysis used in this study were informed by the CoP social learning theory and TPACK model, which together served as the theoretical frameworks for this research. Data were analysed using ATLAS.ti, a computer-assisted programme for qualitative data analysis, following the systematic steps described by Creswell and Guetterman (2019, 241).

FINDINGS

This study delves into those innovative approaches which foster the creation of a hybrid CoP to cultivate the in-service educators' TPACK. The study identifies three dimensions: mutual engagement, joint enterprise, and shared repertoire, all of which are crucial for the formation of a CoP during which process educators learn TPACK from one another. These dimensions emerged as themes for the analysis of the findings.

Table 1 only represents the data collected from the survey questionnaires and interviews with the participants. The symbol "X" in the table indicates that the participants mentioned and/or implied in their responses that a particular dimension (approach) was involved in the

Table 1: Innovative approaches present in a hybrid CoP whose purpose was educators' TPACK development

Schools	Educators	Data collection tools	Mutual engagement	Joint enterprise	Shared repertoire		
			Roles	Common goals	Communication tools		
					WhatsApp	Facebook	e-mail
A	A	Questionnaire	X				
		Interview			X	X	X
	B	Questionnaire					
		Interview	X	X			X
	C	Questionnaire		X			
		Interview	X	X	X		
	D	Questionnaire					
		Interview	X		X		
B	E	Questionnaire		X			
		Interview	X		X		X
	F	Questionnaire	X				
		Interview	X		X		X
	G	Questionnaire	X				
		Interview			X		X
	H	Questionnaire	X				
		Interview	X		X		
C	I	Questionnaire					
		Interview			X		X
	J	Questionnaire					
		Interview			X		
	K	Questionnaire	X				
		Interview			X		X
	L	Questionnaire					
		Interview	X	X			
Principal/deput	A	Interview		X			
	B	Interview	X				
	C	Interview	X		X		

formation of their hybrid CoP while at the same time, their colleagues' TPACK was growing through participation. However, to explain and analyse these dimensions (approaches) in detail, data from the participants' meeting observations and document analysis (WhatsApp screenshots) were used to supplement the survey questionnaires and interviews.

Mutual engagement

From the data analysis of interviews, educators' roles in the CoP (see Table 1) emerged as a sub-theme associated with mutual engagement, which helped us understand how these hybrid CoPs were being formed by participant educators towards improving their TPACK.

Members' roles in their hybrid CoP

Educators' roles have been found to be a significant part of fostering mutual engagement among educators, thereby contributing to the formation of hybrid CoPs. Specifically, leadership roles held by principals and deputy principals and informal mentorship from experienced educators who are regarded as knowledgeable about technology use for curriculum delivery are crucial in facilitating knowledge sharing among educators. The survey questionnaire responses revealed that five ($n=5$) out of 12 educators (A, F, G, H, and K) acknowledged the roles played by school principals, deputy principals, or fellow educators as mentors in their schools. In interviews, seven ($n=7$) out of 12 educators (B, C, D, E, F, H, and L) also emphasised the pivotal roles of principals, deputies, and other educators in enhancing their colleagues' knowledge and skills. These findings were consistent across participating educators:

> Educator B at School A:
>
> > "Yes. For instance, if you go to someone more advanced than you in a particular ... let's say in ICT, maybe you are not a pro, then you get assistance from another teachers."
>
> Educator L School C:
>
> > "I think communication happens between the principal and the teachers. The principal shares curriculum information with the teachers."

Educator F and H at School B, along with Educator L at School C, highlighted the crucial leadership role played by school principals in ensuring effective technology use by educators in their classrooms. Their comments align with the findings of Hart (2023), who suggested that motivated and visionary leaders can help address challenges related to limited technology access and insufficient technological expertise among teachers and learners. Leaders can achieve this by offering encouragement and support to educators.

In response to the question about how educators gain technological skills beyond those

offered at the workshops provided by the WCED, one deputy principal (B) and the one participant principal (C) emphasised the significance of "knowledgeable" educators within their schools in facilitating other educators' development of essential technological skills and knowledge:

> Deputy principal B at School B:
>
> "One of us would, maybe, have more knowledge in that specific area so that person helps ...."
>
> Principal C at School C:
>
> "... Most of the teachers were not familiar with IT but since some of the teachers at school do have the skill. So, they transferred the skill to the educators who didn't have any knowledge in IT or technology."

Informal mentorship, primarily facilitated by "more skilled and knowledgeable teachers," emerged as a key means of sharing (TK), as mentioned by Educators B and D at School A, Educators E and H at School B, and Principal C. CK was the second most shared type of knowledge through informal mentorship, as noted by Educators C, H, and L. Educator A mentioned that a form of coaching is used at her school, where experienced educators mentor novice educators, creating a two-way learning process. Similarly, Educator F at School B receives assistance in using technology for teaching and learning from colleagues, especially newly appointed educators. This finding aligns with that of Baya'a et al. (2019), who highlighted the collaborative development of lessons between in-service and pre-service educators using technology, fostering mutual engagement.

Joint enterprise

Per Mortier (2020) defines joint enterprise, also known as domain, as the common objective that motivates members to engage and collaborate. In the current study, from the survey questionnaires and transcribed interviews, a common goal emerged as the only sub-theme concerning joint enterprise (see Table 1).

Common goal

In both the survey questionnaires and interviews with the educators, the common goal was mentioned by educators as being the reason for their helping each other acquire and develop TPACK in their hybrid CoP. Two ($n=2$) educators (C and E) from schools A and B (see Table 1) respectively reported in the survey questionnaires that in their respective schools, most educators are united, their main goal being to enhance learning through the use of technologies so that ultimately learners feel positive about learning. In the interviews (see Table 1), three

(*n=3*) educators (B, C, and L) of the 12 participant educators, and Deputy Principal A, mentioned educators' common goal as a vital prerequisite for, establishing joint enterprise:

> Educator C at School A:
>
> "It's because the main aim of us being here is for the learner to get a quality education. And for that to happen, we need to use the best teaching strategies and resources and to work together as teachers."
>
> Deputy Principal B:
>
> "... because we're all here for learners. So, for us to achieve what we want as a school and what the province wants, the province has got its vision, and the school has got its vision. To meet those visions, we must use whatever resources we have."

The primary knowledge exchanged in this collective endeavour, according to educators in the survey questionnaires and interviews, is TK. Educators' remarks are consistent with the findings of Cobb et al.'s (2003) study of mathematics educators. A common goal – ensuring learners' understanding of key mathematical concepts, and their achievement in mathematics assessments – encouraged educators' involvement and directed their educational efforts. Various types of knowledge, including PK, CK, TPK, TCK, and PCK, were the second most shared forms of knowledge, as reported by participants in the survey questionnaires and interviews. Educator C from School A emphasised in her survey questionnaire response that teaching aims to promote inclusivity and diverse learning experiences to foster learners' positive attitudes toward their learning. This diversity in knowledge, represented by the terms "inclusivity" and "diversifying," aligns with the concept of TPACK, as explained by Koehler and Mishra (2009). TPACK, a diverse knowledge type, is a result of educators' shared goals, leading to the formation of a joint enterprise within their hybrid CoP. In this context, the joint enterprise, driven by educators' common goals, played a pivotal role in establishing the hybrid CoP to share various knowledge domains, including TK, CK, PK, TPK, TCK, PCK, and TPACK.

Shared repertoire

In this current study, from the transcripts of interviews with the participants, together with the analysis of WhatsApp group chat screenshots, we identified communication tools and teaching resources as shared repertoires in these educators' hybrid CoP while they were in the process of learning TPACK from one another (as seen in Table 1).

Communication tools shared by educators

CoP can benefit from various technological tools, as noted by Bouhnik and Deshen (2014), Osterrieder (2013), and Singh and Awasthi (2020). In this current study, educators highlighted their use of communication tools like WhatsApp, email, and Facebook to interact with colleagues, primarily in discussions around curriculum and non-curricular matters (see Table 1). Specifically, 11 out of 12 educators (A, B, C, D, E, F, G, H, X, J, K, and Principal C) mentioned using WhatsApp, Facebook, or emails to communicate with other educators. However, only a subset of these educators (A, C, I, and K) reported using these tools to share knowledge related to TPACK. For example, Educator C commented:

> "... at the school we have WhatsApp group for colleagues, and we also have a WhatsApp group for Phase whereby we communicate about teaching resources and share videos."

The primary communication tool used among participant educators was WhatsApp. This finding aligns with Asmara's (2020) claims, indicating that WhatsApp is widely used for communication and interaction in teaching contexts. In summary, participants' responses show that the knowledge primarily shared by participants when using WhatsApp for communication is CK, followed by PK. This is consistent with the analysis of WhatsApp screenshots from School C, where educators shared subject-related content (CK), such as lesson plans and learner activities, along with a Google Drive link (TK), a software tool for accessing resources like documents, videos, and photos.

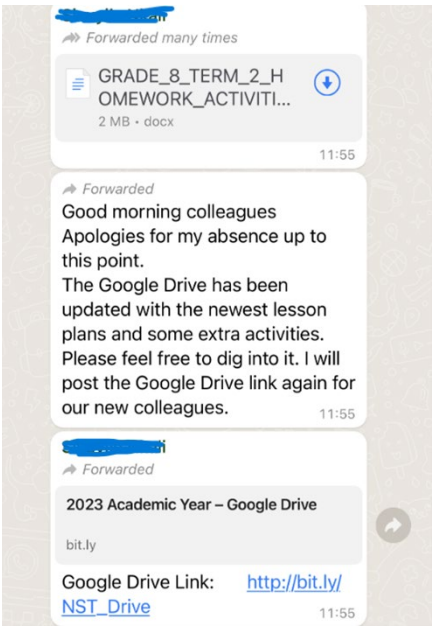

Figure 2: WhatsApp screenshot posted by a participant at School C

Figure 3: WhatsApp screenshot from a participant at School C

Participant educators' comments and WhatsApp screenshots in Figures 2 and 3 provide evidence that establishing and maintaining shared repertoire, notably through these educators' WhatsApp group chat, is an innovative approach that leads to the formation of a hybrid CoP.

DISCUSSION

In response to the research question: what innovative approaches were being used by participant educators through hybrid CoP towards developing primary school in-service educators' TPACK? the results of our study revealed the significant role played by either the principal or by the deputy principals, together with highly skilled and knowledgeable educators in the three ($n=3$) sampled schools, in fostering mutual engagement within a hybrid CoP. The findings do not feature data derived from observations during teachers' staff meetings. We did not consider these within the scope of our study. Most participant educators saw as highly important the practice of principals and deputy principals disseminating crucial information on educators' use of technology in the realm of learning and teaching, using mostly WhatsApp group chats. This suggests that effective communication between principals, deputy principals, and educators might promote the integration of technology within educational settings. This conclusion aligns with the assertion made by Hart (2023) that principals should prioritise the incorporation of technology in their schools. In this present study, this result suggested that efficient communication using WhatsApp group chats by and among principals, deputy principals, and

educators could play a significant role in advancing educators' development of CK. This in turn facilitates mutual engagement, ultimately contributing to the formation of a hybrid CoP. In our study, in all three ($n=3$) schools, the presence of educators who possess more expertise in, and understanding of, the use of technology for teaching purposes was seen by their peers as crucial in fostering the formation of a hybrid CoP. Thus, evidence of the acquisition of TK and CK may prove to be significant in this context. The intriguing aspect of this discovery resides in the comments made by Educators A and F in the survey questionnaires. Their responses indicate that novice educators, specifically those who have recently joined the teaching profession, exhibit more proficiency and expertise in the domain of technology use. This could be attributed to these educators' heightened exposure to emerging educational technologies in the course of their teaching degrees, which seems to align with the results reported by Baya'a et al. (2019) and Mahlo and Waghid (2022) from their respective studies. While recently graduated educators may have had relatively little classroom exposure, they may exhibit enhanced proficiency in using technology for teaching purposes. Consequently, the roles assumed by the "technology-knowledgeable" educators contribute to fostering and sustaining mutual engagement and serve as an innovative approach that could in turn foster the development of a hybrid CoP.

The analysis of survey questionnaire responses and the interviews revealed the presence of common goals among educators to be a characteristic crucial to the process of forming a joint enterprise. Participant educators emphasised the need to acquire technology skills and knowledge to be able to deliver lessons successfully and to enrich learners' learning experiences. This collective response may be attributed to the recognition among educators of the beneficial effects of this for learners, such as enhanced reading skills, which can be achieved through the use of technology in their teaching practices. Primary school educators often include technology in their teaching strategies to support learners in acquiring essential literacy skills, such as phonemic awareness, phonics, vocabulary, fluency, and comprehension (Michael and Susan Dell Foundation 2022), an observation consistent with the results of Cobb et al. (2003). Further analysis of survey questionnaire responses and interviews found this joint enterprise facilitated the acquisition of several types of knowledge by educators in the study. These include TK, PK, CK, TPK, TCK and PCK. Educator C from School A expressed her/his conviction in a survey questionnaire, that educators strive to improve the quality of teaching and learner achievement by promoting inclusion and diverse learning approaches. This statement highlights the extensive range of knowledge, known as TPACK, that educators acquire and develop in the course of their teaching (Koehler and Mishra 2009). This knowledge is both a product and fulfilment of their common goal, one which fosters joint enterprise and ideally leads to the formation of a hybrid CoP.

WhatsApp was found to be the most popular and widely used communication tool.

Participants also used emails and Facebook messages to exchange information crucial to their teaching practice. Asmara (2020) notes a reason for WhatsApp being a popular social networking application: it makes it easier for people to stay in touch and initiate conversations. From the data gathered through interviews, educators were learning CK and PK from one another over WhatsApp. WhatsApp group chats among educators used to establish and maintain a shared repertoire represent an innovative approach that may foster the creation of hybrid CoPs in schools and between educators of neighbouring schools. Based on the findings, participating educators were acquiring TK, CK, PK, and TPACK from their peers through this process, a conclusion drawn from evidence derived from educators' interview comments and screenshots obtained from WhatsApp conversations.

We consider these findings significant for teacher education. The results suggest the urgent necessity for a curriculum which emphasises the enhancement of educators' competencies in technology integration and leadership to empower them to promote and lead the use of technology in their schools. Educational leadership curricula in teacher education should include modules on managing and leading rapid change, particularly in digital transformation. Educators' use of WhatsApp group conversations to exchange important information and promote mutual involvement is an important approach for TPD, one which may inform teacher education curricula that include digital communication technologies in instructional practices. This underscores the capability of these platforms to function as convenient, adaptable, and prompt avenues for professional education and assistance, particularly in the hybrid CoP context. Training prospective educators in the use of these technologies can raise the level of their preparedness to engage in, and add value to, professional teaching and learning communities. The relatively higher level of novice educators' technology skills indicates teacher education is incorporating technology into their curricula. This also indicates the changing role of professors, to respond to the increasing demand for academic staff to acquire expertise in new instructional technology. This implies a transition towards pedagogical practices in teacher education that are increasingly technology-focused in response to the rapidly evolving educational technology environment. Educators sharing such aims as ensuring both they and their learners gain digital skills to enhance learning highlights the importance of collaborative teaching and learning environments in schools. The findings of our study we see as confirming the need for increased collaborative and interdisciplinary methods in teacher education among professors, one which ensures that the cultivation of TPACK is viewed as a joint effort.

CONCLUSION

The findings of this research demonstrate ways in which participant in-service educators

engaged – unintentionally – in the organic formation of a hybrid CoP and, in this process, collectively began a process of sharing and employing innovative approaches. These approaches encompass mutual engagement, enabled by the diverse roles assumed by principals and/or deputy principals and teachers. They include joint enterprise, arising from teachers' common goals, together with shared repertoire, enabled by the accessibility and user-friendly nature of communication tools, specifically the WhatsApp group feature. Within hybrid CoPs, such as the three in our study, educators are supported in their acquisition of extensive TPACK from their peers which plays a vital role in enhancing their teaching practice. We propose practical implications for teacher education through an increased focus on designing and preparing teachers' ICT training programmes to emerge in an organic, rather than a rigidly structured way in teachers' working environments. Most significantly, we see the need for universities, provincial governments and schools in South Africa to develop policies that support the establishment of hybrid CoPs in schools. These would be CoPs in which educators would be collectively supported in their development of TPACK and, through a process of sharing, acquire other kinds of important knowledge from one another. On a theoretical level, the findings of this study encourage further research on the influence of hybrid CoPs on teachers' TPACK growth and other types of knowledge and their practice. Since this study used a small sample size, more thorough empirical research is needed, ideally, in a different setting, one which offers access to more innovative technological resources for communication and delivering curriculum. Different outcomes may result from a variety of different situations.

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