



Research Article

© 2023 Oluwatoyin Ayodele Ajani and Samantha Govender.
This is an open access article licensed under the Creative Commons
Attribution-NonCommercial 4.0 International License
(<https://creativecommons.org/licenses/by-nc/4.0/>)

Received: 17 April 2023 / Accepted: 29 July 2023 / Published: 5 September 2023

Impact of ICT-Driven Teacher Professional Development for the Enhancement of Classroom Practices in South Africa: A Systematic Review of Literature

Oluwatoyin Ayodele Ajani¹

Samantha Govender²

¹Languages and Social Sciences Education,
University of Zululand,
1 Main Road Vulindlela,
KwaDlangezwa, Empangeni, 3886,
South Africa

²Curriculum and Instruction,
University of Zululand,
1 Main Road Vulindlela,
KwaDlangezwa, Empangeni, 3886
South Africa

DOI: <https://doi.org/10.36941/jesr-2023-0125>

Abstract

Education is critical to the development of any country. The quality of education depends on the quality of teachers in the education system. Studies affirm that the initial teacher education that teachers enter the teaching profession with, is not enough to sustain the education system. Hence, there is a need for continuing life-long learning for teachers to keep abreast of their profession. Seemingly, teachers play a significant role in the integration of ICT into teaching and learning. Therefore, adequate and regular professional development of teachers is paramount to the use of learning technologies in classrooms. This study employed a systematic review of the literature to explore the impact of teachers' exposure to ICT through professional development activities on teaching and learning success. The TPACK framework was adopted as an underpinning lens to understand the phenomenon. The study affirms that the professional development of teachers should be situated within ICT pedagogical and content-related content to capacitate teachers' ICT knowledge and skills. Hence, teachers' ICT knowledge enhances classroom instructional delivery, using various learning technologies in teaching and learning. The study recommends adequate and regular capacity building for teachers with ICT training, while teachers should be supported with ICT gadgets and resources. Follow-up should be designed to ensure teachers' adoption and use of ICT for teaching and learning in South African schools, to familiarise their learners with various learning technologies, and to enhance their academic performances.

Keywords: *ICT, classroom practices, professional development, skills, gadgets, teaching, and learning*

1. Introduction

The Fourth Industrial Revolution (4IR) in various sectors of the economy has transformed our ways of doing many things globally (Albion, Tondeur, Forkosh-Baruch, & Peeraer, 2015; Ajani, 2019; 2020). The education system has greatly benefited and enhanced teaching and learning while making learning accessible to learners in the comfort of their homes or at their convenience. Globally, many countries have made significant achievements in their education systems through the adoption and use of ICT in teaching and learning. It has been argued that teachers' knowledge and skills in ICT can motivate the use and adoption of ICT in teaching and learning. Ajani (2022) further argues that the presence of various serviceable ICT gadgets in schools can also inspire teachers to integrate ICT into their classroom practices. Hence, Ajani and Govender (2019) report that the adoption and use of ICT in classroom teaching and learning are critical to curriculum delivery in schools. While Li, Yamaguchi, Sukhbaatar, and Takada (2019); Schildk, Woperis, Kat-De Jong, Peet, and Hoetjes (2020) agree that the provision of ICT training or workshops to teachers is an effective way of introducing ICT to teaching and learning. Information and Communication Technology (ICT) simply refers to the adoption and use of various ICT gadgets and skills in the teaching and learning of various learning contents in schools. Fernandez-Batanero, Montenegro-Rueda, Fernandez-Cerero, and Garcia-Martinez (2022) agree that the integration of ICT into teaching and learning will enhance and make learning concrete for learners. However, this can only be attained effectively if teachers have good competencies in ICT in classroom teaching and learning. Hence, Ajani and Govender (2019) posit that teachers' entry knowledge and skills into the teaching profession cannot sustain them, therefore, teachers require in-service training on the use of ICT in education. Ajani (2019, 2020, 2021) explains that the professional development of teachers is also known as in-service training. While Govender, Ajani, Ndaba, and Ngema (2023) posit that it is also referred to as continuing teacher professional development, Hrastinski and Ekman Rising (2020) opine that the aim of the professional development of teachers in the education system is to capacitate teachers for better classroom performance, as well as improved learners' performance. while Govender and Ajani (2021) agree that teacher professional development is designed to improve the classroom practices of teachers across the globe. The principles of the TPACK framework, which explain different types of knowledge that teachers need to acquire, serve as guidance on how and why teachers, through various professional development programmes, can be equipped and supported to integrate ICT into classroom practices. This discursive article aims at establishing the significance of ICT in teacher professional development in South Africa. The study will also highlight the significance of integrating the TPACK framework into teacher professional development, for teachers in South African schools. Raman and Thannimalai (2019); Esfijani and Zamani (2020); Agyei (2021); and Ajani (2022) assert that quality training of teachers adequately and regularly is necessary to keep them relevant to dynamic changes in teaching and learning across the globe.

2. Literature Review

Several scholars have established the significance of professional development programmes to teachers across the globe (Barakabitz et al., 2019; Maisiri, Darwish, & Van Dyk, 2019; Lembani et al., 2020; Ifinedo, Rikala, & Hamalainen, 2020; Makhahanesa & Sepeng, 2023). According to Barakabitz et al. (2019); Dube (2020); Govender et al. (2023), teacher professional development is highly valued in most developed countries such as Canada, the United Kingdom, the United States of America, Germany, and others. Hence, there is an emphasis on the professional development of teachers. Ajani (2020b) suggests that with the rise of ICT in education, teachers' professional development has changed to help them learn about different ways to use ICT in teaching and learning. According to de Beer (2023), the role of ICT in teaching and learning cannot be overemphasised. The main goal of the education system is to help learners become responsible citizens who can make a difference in their communities. In an attempt to drive and ensure the adoption of ICT into education, several policies

have been developed, clearly outlining the rationale for the adoption of ICT by teachers, and various teacher professional development activities have been designed or mandated, to drive ICT skills and knowledge in teachers. ICT in teacher professional development as well as in teaching and learning has attracted various studies that focus on the adoption and use of ICT in the school system (Barakabitze et al., 2019). However, this paper focused on teachers and their professional development, using the TPACK framework so that they could use ICT in their teaching and learning within the South African context (Makhanesesa & Sepeng, 2023). This is because the adoption and use of ICT in teaching and learning require teachers' knowledge and skills of ICT in teaching and learning to be delivered via learning technology and processes (Celik & Yesilyurt, 2013; Ajani, 2021). Furthermore, the adoption of the TPACK framework will provide insights to ensure the teachers' best practices, for classroom usage of TPACK in the teaching and learning process. Moreso, the TPACK framework will also guide teachers on how the best professional development programmes are framed with the integration of ICT (Wangdi, Dhendup, & Gyelmo, 2023). So, the next section will discuss teachers' professional development before moving to the TPACK framework.

3. Teacher Professional Development

The professional development of teachers refers to all activities or programmes that can be organised for teachers, to improve their classroom performances and ultimately improve learners' academic performance in the education system (Ajani, 2019, 2020, 2021). According to Govender and Ajani (2021), teachers can be engaged in various aspects of professional development programmes. Jimenez et al. (2023) opine that these activities include or can comprise various programmes or approaches. Similarly, Rodriguez-Jimenez et al. (2023) argue that e professional development for teachers includes the following activities:

- specialised or introductory instruction in a variety of areas (including pedagogy, curriculum development, and subject matter).
- professional development opportunities like seminars and education conferences (where teachers and scholars collaborate on lesson plans and discuss challenges in the classroom).
- Training and Certification Plans (e.g., a degree or certificate programme).
- Teachers can improve their skills by going on field trips to see how things are done in other classrooms or by joining a community of practice.
- Mentoring, in the form of either one-on-one instruction or group observation and subject coaching, is another common educational structure.

Various scholars (de Beer, 2023; Govender et al., 2023; Jimenez Sierra et al., 2023) argue that professional development is set to capacitate teachers for the pedagogical change that must occur in their classroom practices and to improve learners' performances. According to Makhanesesa and Sepeng (2023), professional development activities are required to expose teachers to knowledge and skills that will improve their understanding and linking of knowledge and skills from professional development programmes to their classroom situations. This concurs with Govender et al. (2023) in their argument that the contents of professional development activities must relate to their classroom needs. Hence, the professional development of teachers on how to integrate ICT into their teaching and learning must be ICT -based, appropriately capacitating them on how to adopt and use ICT for lesson delivery. Teachers need to develop a positive belief towards the effective use of ICT based on their subject learning objectives when using ICT. Thus, for teachers to adequately use ICT for teaching and learning purposes, they must be capacitated and willing to use ICT. Makhanesesa and Sepeng (2023) assert that policies or regulations that will ensure appropriate learning content for teacher professional development programmes must be in place, especially to drive the adoption and use of ICT resources.

According to Jimenez et al. (2023), the use of ICT significantly facilitates classroom pedagogy, which is necessary for the teaching and learning process and capable of enhancing learners' academic achievement, especially when teachers integrate ICT into curriculum delivery. According to various

scholars, learners' learning, and academic achievement should be the focus of the education system, with teachers' professional development situated within their subject-matter understanding, teaching skills, and pedagogical knowledge to be attained (Ajani, 2020; Maipita, Dongoran, Syah, & Sagala, 2023). Seemingly, Sanusi, Oyelere, and Omidiora (2022) stress that the professional development of teachers within 4IR should embrace the capacity building of teachers to adopt, use, and maximise ICT for effective teaching and learning processes. Thus, professional development programmes situated within ICT enable teachers to acquire appropriate knowledge and skills, that help them learn better how to integrate various learning technologies meaningfully. Over the years, scholars (Ertmer & Ottenbreit-Leftwich, 2010; Ouyang & Scharber, 2018; Purwianingsih, Novidsa, & Riandi, 2022) have agreed that adequate knowledge of ICT from various ICT-based professional development programmes will improve classroom pedagogy and subject-content delivery through the use of appropriate technologies to teach their subjects. Cennamo et al. (2010) further avow that appropriate knowledge and skills on how to use ICT for the delivery of subject curriculum through professional development programmes is necessary. Driving ICT knowledge and skills in teachers for teaching and learning processes and employing appropriate and particular learning technologies through the knowledge and skills gained from professional development, result in effective teaching strategies (Venketsamy & Zijng, 2022; van Wyk & Waghid, 2022). The TPACK framework provides directions on ICT-driven professional development programmes for teachers.

De Beer (2023) confirms that teachers' knowledge and skills in ICT, can assist in the selection of learning technologies and teaching approaches that can help curriculum delivery and also learners' performance in teaching and learning. However, Ajani (2022) asserts that regular training of teachers in ICT enables them to effectively integrate learning technologies into teaching and learning, and encourages learners to use ICT. Various learning technologies can be used for curriculum delivery in the education system. Teachers need to select appropriate ICT that can be used to enhance learning. Hence, creating an enabling and conducive learning environment for learners through teachers' selection of appropriate ICT (Sanusi, Oyelere, & Omidiora, 2022). However, Ouyang and Scharber (2018) suggest that the adoption and use of ICT in teaching and learning, with the support of ICT-based professional development, should be learner-centred, for learning to take place. Ajani (2022) recommends that schools that have ICT resources make teachers more likely to use ICT in teaching and learning. According to Wangdi, Dhendup, and Gyelmo (2018), the support teachers receive from ICT-based professional development activities encourages them to develop their ICT competencies in the adoption and use of ICT. Furthermore, Purwianingsih et al. (2022) state that teachers' knowledge and deep thinking on the selection and use of ICT in teaching and learning, will enhance learning in their learners.

UNESCO (2009) reports that the significance of 4IR in the education system is the integration of various ICT gadgets into teaching and learning, which results in learning being more concrete, meaningful, and productive. Mwalongo (2011), in his study conducted in Tanzania, reports that the integration of ICT into teaching and learning has continued to be promoted in schools. Similarly, Ajani (2021) also reveals that the governments of South Africa and Nigeria have continued to invest in the provision of ICT gadgets to schools to enhance learning amongst learners. Despite their efforts, many African countries need to increase their support for the integration of ICT into their education systems, with adequate provision of ICT gadgets and training of teachers. However, Ajani (2020b, 2022) asserts that inadequate support from stakeholders for the adoption of ICT into curriculum delivery in schools continues to hinder the adoption and use of ICT in teaching and learning. Learning is better enhanced with the integration of ICT, as it makes learners experience concrete and meaningful learning. Thus, it is significant for teachers to possess ICT knowledge and skills that can enhance teaching and learning. Professional development of teachers is an appropriate avenue to capacitate teachers for enhanced classroom practices. Thus, learners' understanding is enhanced when ICT gadgets are integrated into teaching and learning. ICT enables learners to learn quickly, and concretely and construct meaning from the learning content, they are exposed to. However, Concina (2023) proposes that inadequate capacitation of teachers for ICT usage and adoption affects

the integration of ICT in teaching and learning in most schools across African countries. Liscombe, Tindall-Ford, and Lamanna (2023) blame this on inadequate funding of the education system, while Ajani (2020; 2021) argues that corruption and mismanagement of funds allocated to the education system are some of the key challenges to the meaningful integration of the 4IR into education at various education institutions in Africa.

Ajani (2020) emphasises the significance of professional development to teachers as well as learners in the education system. While de Beer (2023) argues that training teachers on ICT is more important than focusing on only the provision of ICT gadgets in teaching and learning, for learning must be established effectively in learners. Findings from various studies across different countries have established that the use of ICT in teaching and learning is critical to learners' academic performance, as well as the effective classroom practices of teachers (Hinostroza et al., 2011; Ajani, 2021; Govender & Ajani, 2021; Ajani, 2022). de Beer (2023); Govender et al. (2023) assert that attainment of great success in the education system anchors on teachers' classroom practices, while teachers' regular capacitation on ICT depends on their access to professional development programmes. Conversely, Raman and Thannimalai (2019) agree that the integration of ICT in the process of teaching and learning in the education system requires an adequate budget and the provision of laptops and other gadgets for both teachers and learners. However, Esfijani and Zamani (2020) propound that a lack of learning technologies does not allow teachers to improve their ICT. Evidence from research has revealed that many ICT initiatives have failed because ICT-driven professional development programmes are usually theoretical in workshops, and many teachers fail to own personal laptops and thus struggle to apply the theory to their practice.

Findings from studies such as Fernandez-Batanero et al. (2022) and de Beer (2023) argue that the lack of ICT in classrooms is of no value for the effective integration of ICT into the teaching and learning process. It is important to note that the provision of different learning gadgets to schools does not guarantee the use of ICT in these schools unless teachers are well-capacitated to effectively integrate ICT into teaching and learning. Thus, Behar and Mishra (2015) advocate that the success of the 4IR in schools significantly depends on teachers, even when schools have been adequately provided with ICT gadgets. Hence, Ajani (2020, 2021, 2022); Govender et al. (2023); Lipscombe (2023) call for adequate and relevant training of teachers on ICT. While studies (Al-Madani & Allafiajiy, 2014; de Beer, 2023) assert that professional development programmes for teachers should be reviewed to focus on and adopt appropriate ICT gadgets for teacher training in ICT. Dube (2020) opines that reforms in education should embrace the promotion of ICT in teaching and learning, while teachers' competencies in ICT should be strengthened through ICT-based professional development, to drive massive integration of ICT into teaching and learning. However, Dube (2020); Lembani et al. (2020) affirm that despite different education reforms in South Africa, the professional development of teachers in ICT is poor. Most South African teachers, especially those in rural areas, require professional training in ICT pedagogy and skills (Ajani, 2022).

de Beer (2023) notes that knowledge and skills from initial teacher training courses that teachers joined the profession are not adequate or relevant to their present classroom practices. This is so because the education system is dynamic and requires constant updates, to keep abreast of classroom practices. Behar and Mishra (2015) argue that most teachers left schools when the focus was not on ICT or were never privileged to be introduced to ICT during their preservice teacher training years. Professional development is significant to teachers' updates, as it provides continuous opportunities for teachers to be trained or access knowledge on what is relevant to their classroom practices. Therefore, appropriate ICT basic knowledge and skills that can benefit both teachers and learners, can be provided to teachers through appropriate ICT-based professional development, to enhance their pedagogical practices.

Teachers must be made to understand why ICT skills are important to teaching and learning, and how to relate ICT pedagogy to classroom practices. In addition, studies affirm that pre-service teacher training does not adequately capacitate teachers to use ICT for future classroom practices, due to institutional challenges (Ajani, 2020; de Beer, 2023; Govender et al, 2023). Jaiya (2015) stresses

the need for significant ICT training for pre-service teachers that can effectively prepare them for the use of ICT in their future classrooms; and in-depth training on ICT provides them with knowledge and skills to maximise various ICT for learning content delivery of their subjects, as well as teaching methods for their classroom practices. Thus, ICT training during teacher education provides pre-service teachers with solid foundations that professional development programmes can build on when they join the profession. Ajani and Govender (2021) propose that ICT training during pre-service teachers' training at university, ensures they start their careers with teaching confidence and ICT skills to effectively explore innovative teaching methods, that can benefit their learners.

A review of various extant studies (Govender & Ajani, 2021; Ajani, 2022; de Beer, 2023) reveals that the professional development of teachers in ICT integration is made easier through the TPACK framework. The framework emphasizes and aligns teacher professional development in ICT to teaching and learning contexts, taking into consideration diverse contexts that exist across South African classrooms (Maisire et al., 2019; Lembani et al., 2020; Ajani, 2021). Seemingly, González-Sanmamed, Sangrà, & Muñoz-Carril (2017) argue for the adoption of the TPACK in ICT-driven teachers' professional development to effectively integrate ICT into teaching and learning, capable of improving learners' academic performance in different subjects. Moreso, the TPACK enables teachers to accept ICT, as more innovative, to engage learners in extensive knowledge, increase their confidence, and grant them ICT awareness for concrete learning. Therefore, deductions from various studies assert that teachers are provided with various techniques to integrate and select appropriate ICT that can meet learners' differences in the learning process. Teachers' expertise in their teaching subject is enhanced with the ability to select the most appropriate relevant ICT resources; which is advantageous to learning. Teachers, through the TPACK, gain confidence in using various ICT resources, which can lead to learning, engaging learners in deep thinking, for a clear understanding of every lesson. Thus, the knowledge of appropriate pedagogy in their classroom practices is crucial, as it helps in the use of different kinds of knowledge necessary for classroom practices (learning content, learning technologies, and classroom pedagogy) as highlighted in the TPACK framework (Lembani et al., 2020; Liscombe et al., 2023).

A further review of extant studies posits that ICT-based professional development enables teachers to effectively use ICT in their classroom practices, and supports their classroom pedagogical needs in different contexts, based on their differences in learning and interactions with learners (Al-Madani & Allafajiyi, 2014). In a study conducted by Ajani (2021, 2022), findings revealed that despite teachers' different ways of learning; the TPACK allows teachers to learn meaningfully and interact with others, using various learning resources; providing support through monitoring and feedback to improve their classroom pedagogy (González-Sanmamed, Sangrà, & Muñoz-Carril, 2017). Thus, making them social change agents that are more confident and skilful to facilitate learning.

Scholars (González-Sanmamed et al. 2017; Ajani, 2019; Govender, 2021; Ajani, 2022) argue that professional development of teachers in the use and adoption of ICT for teaching and learning must be learner-centred, types of learning to be acquired and classroom situations to effectively attain learning. Thus, policymakers and teacher-educators must design ICT-based professional development activities that ensure learners are equally targeted (both rural and urban), for teaching and learning, if the quality of education is to be improved across schools. ICT can be used as a tool in the preparation, planning, presentation, and administrative tasks of learning content, while ICT can also be used as a method, where ICT gadgets are integrated into the teaching and learning process. Hence, for ICT to be effectively integrated as a tool or method into the teaching and learning process, there is a need to understand how to integrate ICT into teaching and learning appropriately, for desired results to be achieved. Hence, the adoption of the TPACK framework into teacher professional development. This implies that the adoption of TPACK in designing and framing professional development programmes that are for the integration and usage of ICT in classroom practices will be significantly enhanced through TPACK. TPACK, as a framework explains and guides on effective integration of ICT into professional development activities for teachers, as discussed in the following section.

3.1 TPACK Framework in teacher professional Development

TPACK is an ICT technology integration framework that explains how the three forms of knowledge can be combined effectively by teachers, for instructional delivery in education, using learning technologies (edtech). These three types of knowledge are technological, pedagogical, and content knowledge (TPACK). The TPACK framework describes the integration of several types of knowledge teachers need for technology-based instruction (Mishra & Koehler, 2006; de Beer 2023). This approach assumes that integrating technology in classrooms is not adequate because education is complex and involves various types of skills, including ICT, to properly teach learners (Mishra & Koehler, 2006; Lipscombe, 2023). TPACK assumes high-TPACK teachers use ICT successfully in education. This connected factor is crucial when using ICT in education, but other factors also affect their activities. TPACK recognizes the many contextual aspects that influence teachers' ICT use. ICT knowledge and abilities help teachers integrate any technology into teaching and learning. ICT integration must be closely linked to pedagogical and content issues, which teachers must know in addition to their ICT knowledge if it is to enhance and improve learning. The TPACK framework is a useful ICT model for teachers because it allows them to effectively integrate ICT into the teaching and learning process and improve learning.

Thus, effective ICT integration in education requires teachers to learn enough about ICT to change classroom methods for teaching and learning. (Koehler et al., 2011; Al-Madani & Allafajiy, 2014; Govender et al., 2023). This method will guide teachers in integrating ICT into the classroom. The TPACK framework is based on Shulman's 1986 and 1987 PCK framework, which emphasizes the necessity for teachers to blend subject and teaching expertise. (Pedagogical knowledge). Blending them provides pedagogical content knowledge, which teachers can use to engage learners and connect subject matter. (Shulman, 1987; Koehler & Mishra, 2005; Ellis et al., 2023). Koehler and Mishra's 2005 TPCK framework added technical expertise to the PCK framework. This tested teachers' IT competence. (Koehler & Mishra, 2005, 2009; Concina, 2023). Technology, pedagogy, and content should be "integrated," hence TPACK was renamed, thus. encourages teachers to use technology. (Thompson & Mishra, 2007; Ellis et al., 2023).

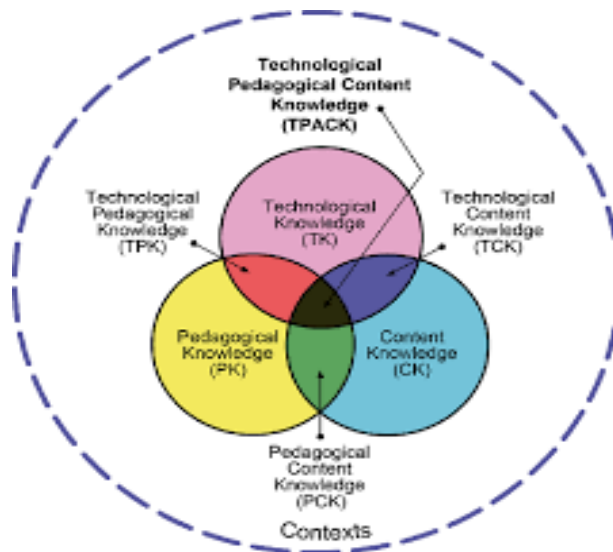


Figure 1: The TPACK Framework (Adopted from Ouyang & Scharber, 2018).

3.2 TPACK's main kinds of knowledge

TPACK emphasizes three types of knowledge needed to integrate ICT into teaching and learning (Ouyang, & Scharber, 2018). Effective teachers use three TPACK knowledge kinds, according to Mishra and Koehler (2006; 2009), Content knowledge (CK) is what teachers know, Pedagogical Knowledge (PK) is how they teach, and Technological knowledge (TK) is how they use technology. These can be explained as follows:

3.3 Content knowledge (CK)

This is about the level of expertise that teachers possess in their respective fields. Content knowledge is critical to the integration of ICT into classroom practices. Ellis et al. (2023) opine that teachers need to possess content knowledge of the subjects before ICT can be selected for lesson delivery in classroom practices. If the teacher does not already possess the CK, they must acquire it by first gaining an understanding of the various components of their general topic content that are relevant to it for teaching and learning to be successful.

3.4 Pedagogical Knowledge (PK)

This is a reference to the extensive knowledge that teachers have of their own teaching experiences, specifically their teaching procedures, techniques, or strategies. Teachers who have a strong understanding of pedagogy can comprehend how learners think and learn, as well as how they develop their own bodies of knowledge (Rodriguez-Jimenez, 2023). They are also aware of the most effective methods of instructing learners to ensure that their learning is maximized, and they know how to select the most effective evaluation methodologies.

3.5 Know-how of technological advancements (TK)

This is the knowledge that teachers need to have to know how to use technology in the classroom and to be able to determine which technology is acceptable for learning (Wangdi et al., 2023).

The three kinds of knowledge are essential components of a competent teacher, as stated by Mishra and Koehler (2006). To be able to effectively teach with ICT, teachers need to have a grasp of how these three different types of knowledge can relate to one another. This understanding is vital. Therefore, according to the TPACK framework, when these three different kinds of knowledge that were discussed earlier are joined or intersected, they will generate three further integrated kinds of knowledge, which are as follows:

3.6 Pedagogical Content Knowledge (PCK)

This type of knowledge refers to the understanding of how the content of a specific topic should be presented in a classroom setting.

3.7 Technological Pedagogical Knowledge (TPK)

It refers to the various ways in which technology can be integrated into the process of education. TPK refers to the understanding of how to employ various forms of technology to investigate different aspects of the topic at hand.

When each of these three facets of knowledge intersects with one another, the following will emerge as the foundation of what is known as the Technological, Pedagogical, and Content Knowledge Framework (TPACK): This refers to the information that teachers need to possess to effectively instruct a certain topic while utilizing the most suitable pedagogical strategies and

technological tools. In this stage, teachers should have the freedom to select the information and communication technologies (ICT) as well as the instructional methods that are most suitable for the material being covered (Ouyang & Scharber, 2018). The approach assumes that teachers who acquire TPACK can better integrate ICT into their lessons. The TPACK framework also recommends teacher professional development programmes that help them integrate ICT (Schmidt et al. 2009). According to Koehler et al. (2011) and González-Sanmamed et al. (2017), the TPACK model is generally accepted in ICT-related professional development programmes, teacher education programmes, and university courses. It is vital to note that constructing professional development programmes with a single dominating body of information is the result of disregarding alternative subsets of knowledge. Shulman proposed his PCK framework, which incorporates multiple types of knowledge (Mishra & Koehler, 2006; AlMulhim, 2014). Since PCK is the cornerstone of TPACK, professional development for ICT teachers should focus on developing these forms of knowledge. This sort of knowledge should not be limited to technological skills (Mishra & Koehler, 2006). According to Mishra and Koehler (2006), teachers must now understand new technologies and combine them with pedagogy and subject matter expertise.

To support and encourage ICT integration, teachers must grasp how to blend the three basic categories of knowledge in their lesson, not the TPACK framework (Voogt & McKenney, 2017). The framework has been criticized for many shortcomings. Graham (2011) cites a few studies that found the TPACK framework theoretically unclear. However, Koehler et al. (2011) argue that there has been a misunderstanding in the research about the framework in describing modern technologies that only focus on TPACK and that technologies in TPACK include both digital and old technology, while the goal of TPACK is technology, content, and pedagogy. Graham (2011) also criticizes the TPACK framework for not dividing categories, making research harder. Mishra and Koehler (2006) suggest that one of TPACK's knowledge categories may become increasingly important. Graham (2011) also claims the framework lacks clarity when identifying its concepts. Several investigations show that the definitions are similar. Sun, Ma, Zeng, Han, and Jin (2023) outline TPACK ideas from several studies and identify commonalities.

Conversely, this paradigm is necessary since providing ICT resources or skills does not guarantee ICT integration into teaching and learning. Teachers must know how to use ICT to improve teaching and learning when integrating technology into the classroom. As mentioned, TPACK includes a variety of knowledge that guides teachers and their professional development programmes. Educational and ICT strategy planning must consider this convergence of knowledge. This planning should consider teacher professional development programmes to help them effectively integrate ICT. This is crucial because today's learners are more likely to engage with ICT than with the subject matter or their teachers' pedagogy, but when ICT is integrated into that content and pedagogy, learning should improve. Teachers must also be flexible in their teaching methods. This involves using the one pedagogy that improves youngsters' learning. ICT should not be used unless it improves learning. Thus, TPACK will enable teachers to understand and evaluate whether a pedagogy or ICT is worth applying in the classroom. This integrated body of knowledge helps teachers achieve the educational system's goals and improves learning and education. (Govender et al., 2023). However, to ensure the efficacy and effectiveness of professional development programmes for teachers and to acquire TPACK, it is crucial to identify and solve barriers to the real use of information and communications technology (ICT) in the classroom for educational processes (Ertmer et al., 2012).

4. Conclusion

ICT integration demands teacher expertise. Information and communication technology must improve teaching and learning (Mishra & Koehler, 2006; Koehler et al., 2011). TPACK assumes that teachers who can learn it can better integrate ICT. TPACK guides teachers' professional development programmes to integrate ICT (Schmidt et al. 2009). Supporting and encouraging teachers to

incorporate ICT effectively does not require them to know the TPACK framework, but rather how to integrate the three basic forms of knowledge into their teaching (Voogt & McKenney, 2017). TPACK-integrated knowledge enhances education. However, to ensure the usefulness and effectiveness of professional development programmes for teachers and to acquire TPACK, it is necessary to identify and remove impediments to the classroom usage of information and communications technology (ICT) for educational activities (Ertmer et al., 2012).

5. Recommendations

Based on the extant studies, the authors recommend the following strategies to enhance the integration of ICT into classroom practices, through ICT- driven professional development of teachers in South Africa:

- Teachers should be assessed to determine the appropriate ICT-based professional development that can be designed for them. A one-size-fits-all type of professional development does not cater to teachers' classroom needs. Hence, there is a need to establish what teachers want or need in their classroom practices.
- Schools should be provided with adequate and serviceable ICT gadgets for teaching and learning processes. Skilled teachers cannot use gadgets if they are not available in schools. Stakeholders should adequately and appropriately provide necessary ICT gadgets for schools.
- Mentoring of teachers should be encouraged between skilled teachers and the upcoming ones. Experienced teachers in ICT usage can be paired with teachers who are struggling with mentoring, as this will enhance the use of ICT across schools.
- Teachers should be monitored for feedback on ICT-driven professional development. Provision of support to teachers can only be possible, when teachers who attend various professional development programmes are followed-up, up to ensure they integrate knowledge and skills from professional development into their classroom practices.
- Appropriate subject-based professional development activities should be designed regularly for teachers across South Africa. Teachers who teach or lead professional development activities in ICT should make sure that theory and practice are linked in ICT training.
- ICT-based professional development programmes should be designed on a rural and urban basis for teachers in various schools across South Africa. Classroom situations in schools across South Africa are not the same, this is why activities for professional development should be strictly designed to address the classroom needs and context of teachers.

References

- Agyei, D. D. (2021). Integrating ICT into schools in Sub-Saharan Africa: From teachers' capacity building to classroom implementation. *Education and Information Technologies*, 26(1), 125-144.
- Ajani, O. A. (2019). Understanding teachers as adult learners in professional development activities for enhanced classroom practices. *AFFRIKA Journal of Politics, Economics, and Society*, 9(2), 195-208.
- Ajani, O. A. (2020). Teachers' professional development in South African high schools: how well does it suit their professional needs? *African Journal of Development Studies*, 10(3), 59.
- Ajani, O. A. (2020b). Investigating the Quality and Nature of Teachers' Professional Development in South Africa and Nigeria. *Gender & Behaviour*, 18(2), 15813-15823.
- Ajani, O. A. (2021). Teachers' perspectives on professional development in South Africa and Nigeria: Towards an andragogical approach. *Journal of Educational and Social Research*, (11) 3, 288-300. <https://doi.org/10.36941/jesr-2021-0070>.
- Ajani, O. A. (2022). Exploring the teacher professional development activities: Perspectives of Nigerian high school teachers. *International Journal of Learning, Teaching and Educational Research*, 21(6).
- Ajani, O. A., & Govender, S. (2019). Teachers' perspectives on in-service professional development in South African and Nigerian high schools. *Gender and Behaviour*, 17(2), 13146-13160.

- Albion, P. R., Tondeur, J., Forkosh-Baruch, A., & Peeraer, J. (2015). Teachers' professional development for ICT integration: Towards a reciprocal relationship between research and practice. *Education and information technologies, 20*, 655-673.
- Al-Madani, F. & Allafajiy, I. (2014). Teachers' professional development on ICT use: a Saudi sustainable development model. *Journal of Modern Education Review, 4* (6): 448-456.
- AlMulhim, E. (2014). The barriers to the use of ICT in teaching in Saudi Arabia: a review of the literature. *Universal Journal of Educational Research, 2* (6): 487-493.
- Angeli, C. & Valandies, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers and Education, 52*: 154-168.
- Barakabitze, A. A., William-Andey Lazaro, A., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., ... & Sanga, C. (2019). Transforming African education systems in science, technology, engineering, and mathematics (STEM) using ICTs: Challenges and opportunities. *Education Research International, 2019*, 1-29.
- Barakabitze, A. A., William-Andey Lazaro, A., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., ... & Sanga, C. (2019). Transforming African education systems in science, technology, engineering, and mathematics (STEM) using ICTs: Challenges and opportunities. *Education Research International, 2019*, 1-29.
- Behar, A. & Mishra, P. (2015). ICTs in Schools: Why Focusing Policy and Resources on Educators, Not Children, Will Improve Educational Outcomes. *Michigan State University, Chapter 1.7, World Economic Forum – Global Information Technology Report 2015* [online]. Available from: http://www3.weforum.org/docs/WEF_GITR_Chapter1.7_2015.pdf [Accessed 7 December 2022].
- Cennamo, K., Ross, J. & Ertmer, P. (2010). *Technology integration for meaningful classroom use: A standards-based approach*. Belmont, CA: Wadsworth, Cengage Learning.
- Concina, E. (2023). Effective Music Teachers and Effective Music Teaching Today: A Systematic Review. *Education Sciences, 13*(2), 107.
- de Beer, J. (2023). Looking at teacher professional development through a fourth-generation Cultural-Historical Activity Theory lens: The value of "Change Laboratories". In *Future-Proofing Teacher Education* (pp. 112-129). Routledge.
- Dube, B. (2020). Rural online learning in the context of COVID-19 in South Africa: Evoking an inclusive education approach. *REMIE: Multidisciplinary Journal of Educational Research, 10*(2), 135-157.
- Ellis, V., Correia, C., Turvey, K., Childs, A., Andon, N., Harrison, C., ... & Hayati, N. (2023). Redefinition/redirection and incremental change: A systematic review of innovation in teacher education research. *Teaching and Teacher Education, 121*, 103918.
- Ertmer, P. & Ottenbreit-Leftwich, A. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42* (3): 255-284.
- Ertmer, P., Ottenbreit-Leftwich, A., Sadik, O., Sendurur, E. & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers and Education, 59* (2): 423-435.
- Esfijani, A., & Zamani, B. E. (2020). Factors influencing teachers' utilisation of ICT: The role of in-service training courses and access. *Research in Learning Technology, 28*.
- Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Digital competencies for teacher professional development. Systematic review. *European Journal of Teacher Education, 45*(4), 513-531.
- González-Sanmamed, M., Sangrà, A. & Muñoz-Carril, P. (2017). We can, we know how. But do we want to? Teaching attitudes towards ICT based on the level of technology integration in schools. *Technology, Pedagogy, and Education, 26* (5): 633-647.
- Govender, S., & Ajani, O. A. (2021). Monitoring and Evaluation of Teacher Professional Development for Resourceful Classroom Practices. *Universal Journal of Educational Research, 9*(4), 870-879.
- Govender, S., Ajani, O. A., Ndaba, N. H., & Ngema, T. (2023). Making In-service Professional Development Effective in a Rural Context: Enhancing Social Justice for Rural Teachers. In *Contextualising Rural Education in South African Schools* (pp. 78-95). Brill.
- Graham, C. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers and Education, 57*: 1953-1960.
- Hinostriza, J., Labbé, C., Brun, M. & Matamala, C. (2011). Teaching and learning activities in Chilean classrooms: Is ICT making a difference? *Computers and Education, 57*: 1358-1367.
- Hrastinski, S., & Ekman Rising, M. (2020). Communities, networks, and ICT professional development across schools in close physical proximity. *Technology, Pedagogy, and Education, 29*(2), 219-229.

- Ifinedo, E., Rikala, J., & Hämäläinen, T. (2020). Factors affecting Nigerian teacher educators' technology integration: Considering characteristics, knowledge constructs, ICT practices, and beliefs. *Computers & Education, 146*, 103760.
- Jaiya, A. (2015). ICT and teachers' education. *Golden Research Thoughts, 4* (12): 1-8.
- Jiménez Sierra, Á. A., Ortega Iglesias, J. M., Cabero Almenara, J., & Palacios Rodríguez, A. D. P. (2023). Development of the teacher's technological pedagogical content knowledge (TPACK) from the Lesson Study: A systematic review.
- Koehler, M. & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32* (2): 131-152.
- Koehler, M. & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education, 9* (1): 60-70.
- Koehler, M., Mishra, P., Bouck, E., DeSchryver, M., Kereluik, K., Shin, T. & Wolf, L. (2011). Deep-play: Developing TPACK for 21st-century teachers. *International Journal of Learning Sciences, 6* (2): 146-163.
- Lembani, R., Gunter, A., Breines, M., & Dalu, M. T. B. (2020). The same course, different access: the digital divide between urban and rural distance education students in South Africa. *Journal of Geography in Higher Education, 44*(1), 70-84.
- Li, S., Yamaguchi, S., Sukhbaatar, J., & Takada, J. I. (2019). The influence of teachers' professional development activities on the factors promoting ICT integration in primary schools in Mongolia. *Education Sciences, 9*(2), 78.
- Lipscombe, K., Tindall-Ford, S., & Lamanna, J. (2023). School middle leadership: A systematic review. *Educational Management Administration & Leadership, 51*(2), 270-288.
- Maipita, I., Dongoran, F. R., Syah, D. H., & Sagala, G. H. (2023). TPACK, Organizational Support, and Technostress in Explaining Teacher Performance During Fully Online Learning. *IJIKM, 18*.
- Maisiri, W., Darwish, H., & Van Dyk, L. (2019). An investigation of industry 4.0 skills requirements. *South African Journal of Industrial Engineering, 30*(3), 90-105.
- Makhananasa, J. L., & Sepeng, M. S. (2023). Exploring Threats to Novice Teachers' Development in Selected Secondary Schools in South Africa. *International Journal of Learning, Teaching and Educational Research, 21*(12).
- Mishra, P. & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. *Teachers College Record, 108* (6): 1017-1054.
- Mwalongo, A. (2011). Teachers' perceptions about ICT for teaching, professional development, administration, and personal use. *International Journal of Education and Development Using Information and Communication Technology, 7* (3): 36-49.
- Ouyang, F., & Scharber, C. (2018). Adapting the TPACK framework for online teaching within higher education. *International Journal of Online Pedagogy and Course Design (IJOPCD), 8*(1), 42-59.
- Purwianingsih, W., Novidsa, I., & Riandi, R. (2022). Program for Integrating Education for Sustainable Development (ESD) into Prospective Biology Teachers' Technological Pedagogical Content Knowledge (TPACK). *Jurnal Pendidikan IPA Indonesia, 11*(2).
- Raman, A., & Thannimalai, R. (2019). Importance of technology leadership for technology integration: Gender and professional development perspective. *Sage Open, 9*(4), 2158244019893707.
- Rodríguez-Jiménez, C., de la Cruz-Campos, J. C., Campos-Soto, M. N., & Ramos-Navas-Parejo, M. (2023). Teaching and Learning Mathematics in Primary Education: The Role of ICT-A Systematic Review of the Literature. *Mathematics, 11*(2), 272.
- Sanusi, I. T., Oyelere, S. S., & Omidiora, J. O. (2022). Exploring teachers' preconceptions of teaching machine learning in high school: A preliminary insight from Africa. *Computers and Education Open, 3*, 100072.
- Schildkamp, K., Wopereis, I., Kat-De Jong, M., Peet, A., & Hoetjes, I. (2020). Building blocks of instructor professional development for innovative ICT use during a pandemic. *Journal of Professional Capital and Community, 5*(3/4), 281-293.
- Schmidt, D., Baran, E., Thompson, A., Mishra, P., Koehler, M. & Shin, T. (2009). Technological Pedagogical Content Knowledge (TPACK). *Journal of Research on Technology in Education, 42* (2): 123-149.
- Sun, J., Ma, H., Zeng, Y., Han, D., & Jin, Y. (2023). Promoting the AI teaching competency of K-12 computer science teachers: A TPACK-based professional development approach. *Education and Information Technologies, 28*(2), 1509-1533.
- Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*: 122.
- Thompson, A. & Mishra, P. (2007). Breaking news: TPCK becomes TPACK! *Journal of Computing in Teacher Education, 24* (2): 38-64.

- United Nations Education Science and Cultural Organisation (UNESCO). (2009). *Guide to measuring information and communication technology (ICT) in education*. Montreal: UNESCO.
- van Wyk, M. D., & Waghid, Z. (2022). South African Pre-service Teachers' Preparedness for fourth industrial revolution teaching and Learning. *Education and Information Technologies*, 1-21.
- Venesta, R., & Zijing, H. U. (2022). Exploring challenges experienced by foundation phase teachers in using technology for teaching and learning: a South African case study. *Journal for the Education of Gifted Young Scientists*, 10(2), 221-237.
- Voogt, J. & McKenney, S. (2017). TPACK in teacher education: are we preparing teachers to use technology for early literacy? *Technology, Pedagogy, and Education*, 26: 69-83.
- Wangdi, T., Dhendup, S., & Gyelmo, T. (2023). Factors influencing teachers' intention to use technology: Role of TPACK and facilitating conditions. *International Journal of Instruction*, 16(2), 1017-1036.
- Yesilyurt, E. & Celik, V. (2013). Attitudes to technology perceived computer self-efficacy and computer anxiety as predictors of computer-supported education. *Computers and Education*, 60: 148-158.