



## PRACTICAL RESEARCH TEACHERS' TECHNOLOGICAL, PEDAGOGICAL, AND CONTENT KNOWLEDGE (TPACK) AND COMPETENCIES: A LITERATURE REVIEW

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**ABSTRACT.** This study highlights the literature review of the related studies and literature. The purpose of this review is to explore the development of Practical Research Teachers' professional knowledge through their Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK) and TPACK. Also, to bridge previous works on individual practices to TPACK, highlight literature about Information Communication Technology (ICT) integration and identify gaps in the literature relating to the effectiveness of ICT in teaching practical research at the K to 12 level.

**Keywords:** *competencies, practical research teaching, professional development program, TPACK*

### I. INTRODUCTION

The teachers' knowledge related to TPACK and their competencies with regard to the Department of Education's Most Essential Competencies (DEPED MELCs) are essential for comprehending the integration of ICT in school settings. Critical advancements in ICT have recently and frequently surfaced, and these advances have rapidly impacted educational settings as well. People now talk of incorporating Internet-based applications into school, including social networks, file-sharing software, and video-sharing websites. Digital technology's accessibility has been seen as a social equalizer and a way to advance education in a sustainable way (Wang, et al., 2019).

The majority of college courses are lecture-based and teacher-centered, even those that make use of a learning management system (LMS) (Vercellotti, 2018). Because experimenting with new tools and concepts involves risk and time commitment, higher education has a tendency to absorb innovations slowly (Serdyukov, 2017).

Education sciences have been impacted by recent significant breakthroughs in the realm of information and communication technologies (ICT) (Capar&Vural, 2013). The growth of social information pieces and the accessibility and affordability of access to information appear to have occurred concurrently with advancements in the field of ICT (Ciftci et al., 2013). Approaches that view teachers as role models who teach the processes of learning have grown more popular nowadays than those that view them only as information sources (Yorulmaz et al., 2015). It goes beyond just integrating technologically enhanced learning resources into classroom settings (Yurdakul, 2011).

Comparing information technologies to other instructional technologies, practitioners' adaption and implementation are more challenging and time-consuming activities (Selwyn, 2011). To promote the incorporation of technology into the learning environment, most educators do not, however, possess the necessary knowledge, skills, or confidence (El Fadil, 2015; Ferdig and Kennedy, 2014; Somera, 2018).

## **II.DISCUSSION**

### **Information access**

The Internet has been readily available to Generation Z (those born between 1995 and 2010) since they were young children, and they are used to multitasking, quickly accessing information, and witnessing something being done before trying it themselves (Seemiller and Grace, 2017). These students seek instruction that involves demonstrations and active participation (Adamson et al., 2018; Seemiller& Grace, 2016). Digital natives will represent one-third of the US population by 2020. (Seemiller& Grace, 2016)...Additionally, educators take into account advantages such equipment accessibility, user-friendliness, and the potential for piqued student interest (Porter & Graham, 2016).A significant level of self-education on the part of the instructor is required for the move from a traditional learning environment to a learning environment that integrates technology, and the change process could take years (Nicol et al., 2018). The professional development that is provided to professors may not be at the proper instructional level for the learners engaged, may have the incorrect instructional focus, or may be of the incorrect sort or structure (Reid, 2017).

### **Process of Change**

It might be challenging to learn how to use technology to improve teaching (Reid, 2017). Some teachers take a highly conventional approach to teaching How to act as a facilitator in a classroom with lots of technology is not something that teachers are taught (Nicol et al., 2018). Teachers who fail to recognize the shifts in student preferences may have a harder time instructing the younger generation. They may have a set perspective on change, attempting to utilize a latest technological tool but breaking up easily when things get difficult. They dread the

possibility of failure when doing new things and do not believe they are capable of learning how to use the new technology tools (Dress, 2016).

### **Integrating technology with a humanistic perspective**

According to this definition, the humanistic approach involves the full person and is expressed in the person's values, beliefs, self-assurance, and emotions (Fedorenko, 2018). Being able to interact with students and personally impart their knowledge to them makes teaching a fulfilling humanistic activity for educators (Azzaro, 2014). Learning institutions require lecturers who can integrate the cultures of the human and the technology (Dominici, 2018)

**An educator's beliefs about using technology become a factor in the ability to adopt the new technology into their pedagogy.** Teachers may be more likely to embrace adjustment if the transition is simple and the process is beneficial. If the change wasn't for the better, the revelation can leave people feeling bad or unsure about any future plans. Resistance, self-doubt, and uncertainty may result from the transition (Kilinc et al., 2017; Reid, 2017). Individuals become skeptical of both the shift and their perspective as a result of the uncertainty. Prior experiences may also influence educators' capacity to successfully embrace a new innovation, such as technology (Demirba&KInç, 2018; Reid, 2017). Teachers become resistant to change if the reforms' main objective conflicts with their current worldview. As a result, the reforms are less likely to be implemented. Changes that are in line with fundamental ideas have a higher chance of success (Demirba&KInç, 2018).

**Educators produce resistance by using the technology superficially or not at all.** When educational technology appears to have little to do with their usual teaching methods, resistance increases (Demirba&KInç, 2018). Teachers could think that learning to utilize the new technology is a hardship (Cheung et al., 2018). A teacher's efficacy is also tied to their opposition to technology. Self-efficacy is the belief that one can successfully complete an activity or act in a given scenario (Bandura, 1986; Alenezi, 2017). The capacity when using technology and computers with confidence and knowledge is referred to as computer self-efficacy (CSE). The ability and use of skills to attain a result are referred to as CSE (Alshammari et al., 2016). Since computer-based learning was introduced at all levels of education, the significance of CSE has grown (Bhatiasevi&Naglis, 2016). The use of technology by educators will be resisted by those who have little or no support, minimal access to technology in their daily and personal life, or both (Kilinc et al., 2017). The future use of technology will be increased by an instructor who exhibits higher levels of CSE since they will be less frustrated (Cheung et al., 2018).

If a piece of technology is simple to use and makes accomplishing tasks easier, users are more likely to trust in its usefulness (Bhatiasevi&Naglis, 2016). Lower levels of CSE are correlated with lower levels of motivation and a negative opinion of the technology (Alshammari et al., 2016). Educators' self-efficacy, as well as their knowledge of pedagogy and technology, would need to adapt (Reid, 2014).

### **Technology Use in Smart Classrooms**

Smart classrooms can increase students' active engagement and teachers' pedagogical imaginations without alienating the teachers' students. Smart classrooms are outfitted with

cutting-edge technologies such as tablets, interactive whiteboards, high-speed networks, learning management systems, software, and other educational tools for the benefit of both teachers and students (Alelaiwi, et al., 2015; Al-Qirim, 2011). Mobile handheld devices are becoming increasingly common in classrooms, which could provide a more interactive setting that motivates students to participate actively in their education and add to it (Terras, et al., 2012). Engagement is made possible through interactive and cooperative digital learning technologies, such as cloud-based learning management systems, touch-screen electronic whiteboards with shared classroom materials, digital textbook authoring tools, and learning resources for mobile handheld devices (Kim & Kim, 2014). Then, as mobile technologies developed, they made it possible for students to access a wide range of educational content and applications and engage in hyper-personalized learning (Alelaiwi et al., 2015).

When the objectives of technology use and instructors' readiness are in line, and when students show positive improvements in the new, technology-driven environment, smart classroom technology can reduce disengagement (Liang et al., 2012; Lee, 2012). Because there are so many different types of technologies available, students with various requirements and learning preferences can be inspired to learn (Liang et al., 2012; Lee, 2012). By using interactive whiteboards, PowerPoint, and Voice Thread, for instance, which cater to both visual and auditory learners, educational presentation has improved (Liang et al., 2012; Lee, 2012). Using tablets to enhance learning can depend on the interests of the students; there are many educational apps accessible, and students can select the ones that interest them (Aronin & Floyd, 2013).

### **Teachers' Adoption of Technology and How They Perceive Changes in their Students**

Howley et al (2011) contend that teachers in rural schools are more influenced by students' attitudes, readiness for using technology, and access to technology than by the setting of the school or the socioeconomic position of the students. Students' life and education can be significantly impacted by technology, and teachers have a huge impact on how technology is incorporated into classrooms.

**Teachers' Technology Integration and Effort towards Instructional Practices.** The degree to which school infrastructure supports integration, teachers' actual use of technology, their technological proficiency, their training in technology, the availability of educational software, and their availability are all factors that affect how well technology is integrated in schools (Comi, et al., 2017; Gil-Flores, et al., 2017). At the individual, school, district, and national levels, teachers' efforts toward instructional practices, such as professional development and the use of cutting-edge instructional approaches, can take many forms. These initiatives may have an effect on instructors' perceptions of student growth, instructional efficacy, and knowledge, skills, and knowledge. However, the lack of professional development and associated tools has made it difficult for instructors to practice in cutting-edge settings like smart classrooms. In order to improve the effectiveness of instructional techniques in the classroom, teachers who support the incorporation of technology should guarantee that their professional experiences are localized (Longhurst, et al., 2017; Clarke & Zagarell, 2012).

**Perceived Student Change and Teacher Continuance Intention.** Teachers' continued intention to utilize technology is correlated with their actual usage of it in the classroom, per

technology acceptance models for technology integration (Joo, et al., 2014; Sanchez-Prieto et al., 2016; Kim & Jang, 2015). This encourages schools and other educational institutions to consider incorporating ICT into their curricula in order to prepare pupils to live in a "knowledge society" (Ghavifekr, Afshari& Amla Salleh, 2012). This is due to ICT's capacity to provide a dynamic and active teaching-learning environment (Arnseth&Hatlevik, 2012). This is because technology in education contributes significantly to the pedagogical aspects, where the use of ICT will lead to successful learning with the support and assistance of ICT components and elements (Jamieson-Procter et al., 2013). Previous research has shown that incorporating ICT into the classroom can promote student participation in active learning and accelerate the process of learning (Jamieson-Procter et al., 2013).

According to the article, the community or parents' initiative assists schools with ICT infrastructure (Chapelle, 2011). Teachers are temporarily unable to use computers if there is a shortage of technical assistance and no repair (Jamieson-Proctor et al., 2013). Teachers will be discouraged from using computers due to equipment failure if they do not receive assistance with the situation. Technical concerns, according to Türel and Johnson (2012), provide a substantial challenge for teachers. Poor connection, virus infection, and faulty printers are among the difficulties. However, there are a few outliers. Schools in countries such as Malta, the United Kingdom, and the Netherlands have recognized the need of technical assistance in assisting teachers in using ICT in the classroom (Yang & Wang, 2012).

### **Vision and Plan for Technology Inclusion**

According to researchers Berrett et al. (2012), leaders in schools must clearly identify and describe what technology integration is and what role it will play in the school community for the benefit of their teachers and pupils. Education professionals may lose track of and get perplexed by technology integration attempts in the absence of a defined vision and well-articulated set of goals (Davies, 2011; Margolis & Huggins, 2012; Norton, 2013; Schrum & Levin, 2013).

A well-defined vision gives the school community emphasis and direction (Levin & Schrum, 2013; Margolis & Huggins, 2012; Norton, 2013), whereas a set of well-articulated goals gives the stakeholders structure and rules (Norton, 2013; Sabzian et al., 2013). The creation of a scope and sequencing for technology integration by grade level gives teachers clarity regarding what is expected of them and what applications are appropriate for their classrooms (Buabeng-Andoh, 2012; Levin & Schrum, 2013). Sharing the school's strategic technology plan with the community provides everyone with an understanding of what technology integration should look like and how it will evolve over the next few years (Johnson, 2013; Lim & Pannen, 2012; Norton 2013). The creation of a technological pedagogical framework offers a method to comprehend how technology may affect teaching and learning (Liu, 2013; Sabzian et al., 2013). Additionally, the framework offers teachers a guide for creating technology-enhanced learning activities and lessons (Hughes, 2013; Liu, 2013).

**Teacher support.** Any new technological effort is driven by teachers, who are widely recognized as "the heart of the education process" (Ghamrawi, 2013). (Berrett et al., 2012; Ghamrawi, 2013; Moore-Hayes, 2011). According to Schrum and Levin (2013), it takes teachers' passion and labor to actually improve, advance, or expand education. According to Ramirez (2011), instructors are crucial to the establishment and successful execution of technology-

infused programs. According to the findings of these researchers and as Berrett et al. (2012) noted, it is crucial to pay attention to teachers' needs and make use of their expertise in order to successfully integrate technology into the classroom. Teachers cannot be neglected as the "frontline stakeholders" in technology integration programs (Smolin & Lawless, 2011). The same leadership that provides for the educational needs of kids in their schools must also recognize educators as professionals (Knight, 2011; Schrum & Levin, 2013) and offer them with the same continuous educational support (Polly, 2012; Tondeur et al., 2012). Educator preparation that teachers cherish as a chance for professional development and collegial cooperation (Ghamrawi, 2013).

Teachers also see this educational experience as a chance to improve their existing abilities and develop expertise in newly discovered ones (Ghamrawi, 2013). The focus of professional development, according to researchers, should be on recognizing the requirements of the instructors and encouraging their engagement and buy-in of the program before effective technological integration can occur (Schlechty, 2011). Teachers must adopt the attitude of how the use of technology initiatives will improve their students' involvement and academic results without significantly adding to the workload of the teachers (Kurt, 2013; Winslow et al., 2014). When it comes to creating technology-enhanced learning environments that promote student achievement, teachers face a slew of hurdles and high expectations (Capo & Orellana, 2011; Buabeng-Andoh, 2012; Smith, 2012; Winslow et al., 2014).

### **Technology-based teaching and learning: Teachers' perspectives.**

The use of ICT in the teaching and learning process can increase students' accomplishment, according to numerous previous studies, therefore this has turned into a critical issue (Nakayima, 2011, Jamieson-Proctor et al., 2013). The factors influencing teachers' adoption of ICT use in the classroom have been the subject of extensive research (Capan, 2012; Zhang, 2013). It reveals that the biggest barrier to implementation was teachers' assumptions that they are the ones who effect change in their learners' teaching and learning processes. Furthermore, earlier research (Cassim&Obono, 2011) demonstrates that there is a strong association between teachers' beliefs and their usage of ICT.

### **Content and Organization of Research Curriculum in the Philippines**

Other issues included academic staff preferring research above teaching, which resulted in limited availability for students, among other things, or confining the curriculum of a course to the interests of the teacher-researchers (Lindsay et al., 2012).

In order to support its policy-making procedure, research agenda, establishment of policies and programs, and implementation of those policies and programs, the Department of Education (DepEd) continues to promote and enhance the culture of research in basic education. The Research Management Guidelines (RMG) are established by the Department of Education to give advice in managing research efforts at the national, regional, school division, and school levels. The policy also increases research support channels including financing, collaborations, and capacity building (DepEd,2017).

### **Competencies of Senior High School Teachers in Practical Research.**

Research self-efficacy and research productivity were found to be strongly correlated using path analysis, with educational attainment, research benefits, and incentive systems being the key determinants (Quimbo & Sulabo, 2014). According to Laya, who was referenced by Salmingo (2011), markers of institutional excellence include a capable faculty, a strong student body, suitable resources, and an environment that fosters intellectual curiosity, which is reflected in the institution's research output's number and quality. According to Kunter et al. (2013), teachers' excitement for teaching, pedagogical content knowledge, and self-control abilities all have a good impact on the quality of their lessons, which in turn has a favorable impact on student results.

According to Ismail and Meerah (2011), research training at local institutions is on par with that at international universities. However, the results showed that more work needs to be done to advance this research's competence and talents to a higher degree. Teachers should therefore develop the abilities and set up the programs necessary to help pupils meet their learning objectives. Additionally, Meerah, et al. (2011) underlined in their previous study that students need to have a moderate level of knowledge and skills in order to do research. Writing research abstracts is a challenge. Noguera (2012) came to the conclusion that aspiring educators and professionals should understand that writing an abstract is not a subordinate genre.

Gomez and Panaligan (2013) also discovered that while teachers are highly proficient in research format, they still require support for the improvement of their communication skills. According to Stallings' (2008) research on Public School Facilities and Job Satisfaction, the work environment and resource accessibility do have an effect on teachers' job satisfaction. A sensation of satisfaction is a crucial foundation for motivation, according to Marsh and Hattie (2002). One of the challenges in doing research, according to Alrahlah (2016), is a lack of suitable research facilities. All respondents who had at least one article published in the preceding two years verified using the library, illustrating how significant it is for researchers (Onuoha, Ikonne, & Madukoma, 2013). A study, on the other hand, shows that increased library resources boost researchers' research ability in terms of the amount and quality of publications they can access (Hadjinicola & Soteriou, 2006).

Tiemo (2016) found that although the library has many shortcomings in terms of its materials and services, its patrons weren't entirely unsatisfied. The faculty sought out more enhancements to the library's materials, personnel, and services. These competences are concerned with the utilization of technology for information management and processing, which includes all data manipulation and communication technologies (Selvi, 2010). The majority of participants in a study by Okojie and Olinzock (2013) admitted that they lacked the skills necessary to employ software tools to facilitate education. Sentovich (2004) also found that teachers who have appropriate time, materials, and autonomy in their own classes report higher levels of satisfaction. The aforementioned findings were corroborated by Roco (2001), who emphasized the importance of taking good care of teachers in order to raise the caliber of instruction.

Study experience, training, and managerial financial and technical support all have an impact on the productivity and distribution of the research, according to Alim and Diocolano (2011). Similarly, Kendagor et al. Al (2012) discovered that money plays a role in ensuring that research grants are used appropriately by the institution and the government. In addition, self-motivation and abilities are the basic motivations that urge professors to teach research, according to Bay and Clerigo (2013). As a result, children who perform badly are more likely to

encounter a double disadvantage because they are more likely to be taught by inexperienced and/or less competent teachers (Greenberg et al., 2014).

Bwendo (2015) reaffirmed that a crucial factor influencing instructors' competence is their educational background. Alternatively, Samuel and Utazi (2014) found that instructors' areas of expertise had a substantial impact on their level of skills and that there was a significant difference between teachers with more and less experience.

According to Osamwonyi, the significance of continuing education for teachers, which includes seminars, workshops, conferences, lectures, exhibitions, and other activities, cannot be understated (2016). Therefore, improving instructors' abilities and competency becomes crucial. Additionally, it was asserted by Akram et al. (2015) that job happiness and teacher competency had a substantial positive association.

### III.CONCLUSION

Educators are entering into the new innovations with limited skills and knowledge to successfully implement the educational strategies needed for integrating practical research into the curriculum. The findings from this study add to the literature on the complex issues educators encounter when integrating practical research into their classrooms and providing additional insights into a humanistic approach to change. Integration of research will assist teachers to the global requirement to replace traditional teaching methods with a technology-based teaching and learning research. As part of this, schools and other educational institutions which are supposed to prepare students to live in “a knowledge society” need to consider research integration in their curriculum. To successfully implement a professional development training to teachers requires a sustained and deliberate participation, collaboration and support. Technological Pedagogical and Content Knowledge of teachers in the teaching of practical research subjects and competencies in qualitative and quantitative research must be constantly assessed and revisited to successfully design, develop and implement a professional development program to continuously enhance the research skills and competencies of practical research teachers.

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