

TECHNOLOGICAL, PEDAGOGICAL, AND CONTENT KNOWLEDGE (TPACK) OF THE PRE-SERVICE TEACHERS: AN EVALUATION

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Abstract:

In the twenty-first century, education uses a variety of technological tools to facilitate relationships between students, teachers, and the classroom's educational resources. One important framework for addressing the application of technology in education is the Technological, Pedagogical, and Content Knowledge (TPACK) framework. This study aimed to evaluate the pre-service teachers' technological, pedagogical, and content knowledge (TPACK). TPACK promotes the idea that teachers must develop not only content knowledge, but also the capacity to use new resources constructively. The study's respondents include thirty-one cooperating teachers and thirty-one pre-service teachers. Thirty-one cooperating teachers' evaluations and data from pre-service teachers who took part in the BEED program were gathered. The quantitative study focused on the TPACK survey instrument, which measures self-assessed competence and confidence in integrating technology across certain topic areas. The results showed that pre-service teachers understood TPACK well, particularly regarding Pedagogical Knowledge. However, the research highlights that pre-service teachers must become fluent in Technological, Pedagogical, and Content Knowledge (TPACK), with an emphasis on Content Knowledge expertise, to properly integrate it into the teaching and learning process. Teachers must constantly adjust their strategies to keep up with the rapid growth of technological development among students in the twenty-first century. There was no relationship between pre-service teachers' TPACK and the application of EdTech Tools. Finally, effective technology integration in the classroom demands pre-service teachers developing strong TPACK skills, which will enable them to fulfill the different needs of students in the twenty-first century.

Keywords: TPACK, Pre-service Teacher, EdTech Tools, Cooperating Teachers, Deped

Introduction:

Technological developments play a significant role in technology-assisted learning in education and teaching. There were many strategies for using technology in the classroom to provide the best quality of education to students while using technology. This study aims to determine the Technological, Pedagogical, and Content Knowledge (TPACK)

of the pre-service Teacher. The TPACK framework was a road map for teachers' and students' perspectives of technology as a tool to enhance learning experiences and knowledge. According to McGraw-Hill (2019), TPACK is a theory that explains the fact that teachers must use technology to teach students and utilize them effectively.

While acknowledging the complex, multidimensional, and situational character of teacher knowledge, it tries to define the type of information that teachers must include technology into their lessons since some students may need the most comprehensive adaptation of instruction—changing how it is delivered (Iris Center, 2019). TPACK implementation in the classroom still requires attention to deliver courses effectively. Teachers struggling to succeed in the use of technology in their courses is an indicator that teachers must focus on developing early literacy through technology.

Over the past few decades, digital technologies have become more widespread, opening new possibilities for organizing teacher education as well as opportunities for in-depth study and reflection on classroom practices. However, even though technology has been around for a while, the researchers on campus lack the needed facilities to meet the needs of the students to support their study of technological knowledge. This development streamlines the process of creating educational materials. However, technology must be used responsibly in every classroom. Teachers have reported that receiving specialized training has also enhanced their TPACK. The researcher wanted to support students by utilizing the proposed TPACK.

Literature Review:

A pre-service teacher must possess the TPACK (Technological, Pedagogical, and Content Knowledge) abilities outlined in the previous research question. The TPACK framework is supported by three key areas of knowledge: technology, content, and pedagogical, which looks at how these three interactions between different forms of knowledge and with subject matter (Turgut, 2017). According to Sañoban et al. (2019), incorporating technology into pre-service teacher education is crucial for improving TPACK learning. Education technology information management kept pre-service teachers abreast of most recent developments. They get the chance to learn about artificial intelligence applications and user interfaces. In (Habibi et al. 2019) Technology, Pedagogy, and Content Knowledge, or TPACK, is a strategy that pre-service teachers can apply. Technology allows a new approach to education. (Atar et. al., 2019). Particularly in 21st-century learning, technology has a big impact on the educational process (Tseng et al., 2019). In the twenty-first century, technology has become indispensable in many aspects of contemporary life, including education.

For teachers in this period, incorporating technology into the classroom was crucial. (Koh et al., 2018). Parts of the validated instruments were used for the measurements, leading us to believe that they can capture the growth and evolution of pre-service teachers' perceptions of their 21st-century competencies. The 21st century urges every teacher to get a thorough understanding of ICT as its advancement has a significant influence on learning today. (Wardani, 2020). Alharbi (2020) defines technological knowledge as the capacity to comprehend and know how to apply technology to enhance student learning, in addition to being aware of its diverse foundations. Technological, pedagogical, and content knowledge have been combined to create a theoretical framework called TPACK. This idea facilitates learning by making effective use of technology. The result in our study makes sense because, even if they have good opinions of technology, teacher candidates' beliefs about its efficacy and how much of it is used in the classroom might be quite low. (Aksoğan and Bulut Özek, 2020).

Since technology's application in education is still viewed as difficult, pre-service teachers must be committed to learning how to utilize it in addition to having the necessary knowledge and motivation. According to Kirana and Nabhan (2021), the area of study's context was impacted by the links that exist between the components of the TPACK schema: materials (C), pedagogy (P), and technology (T). Pedagogical knowledge (PK) refers to specific information about the philosophy and practice of teaching and learning, such as objectives, procedures, evaluations, techniques, and tactics. According to Dewi et al. (2020), knowledge of pedagogy necessitates comprehension of learning theories' cognitive, emotional, social, and developmental aspects as well as how to apply them to the process of learning. Technology knowledge (TK) is the foundational understanding of technology that may be used to improve learning (Ringotama, 2020).

Technological Content knowledge (TCK) was defined by Elas et al. (2019) as the understanding of technologies and associated issues that both support and potentially harm other components. Technological pedagogical knowledge (TPK) is a compilation of perspectives on how technology is transforming education and how it may support topic concepts and active learning (Kaarakainen and Saikkonen, 2021). Technology, pedagogy, and domain all need to interact and combine in some way for TPACK to work. The idea of integration, according to Putri and Adnan (2020), is the inclusion of several pedagogical areas and/or components that can assist pre-service teachers. Facilitating students' learning is the aim of the pre-service instructors' structured learning process. To improve and meet learning objectives, pre-service teachers' students must be able to organize their lessons utilizing creative learning innovations within the learning development process (SarĀĀşoban et al., 2019). These days, ICT research is used as a benchmark in education for creating the TPACK (Technological, Pedagogical, and Content Knowledge) learning paradigm (Wardani et al., 2020). Because TPACK is a component of competency, particularly pedagogical competence and professional ability, pre-service teachers need to possess a suitable level of TPACK competence (Syahria et al., 2022). Pre-service teachers can enhance their professionalism in the twenty-first century by working hard to handle students' physical, moral, social, cultural, emotional, and intellectual needs (Sindi, 2019).

The 21st century presents prospects for pre-service teachers to enhance their utilization of technology in organizing and endorsing pupils' educational endeavors. (Wardani, 2020). Teaching aspirants must be proficient in using technology, especially in the 21st century. The background of the pre-service teacher has a significant impact, which is said to be still unprofessional in the 21st century (Wardani et al., 2020). For pre-service teachers to continue to teach professionally in the middle of the twenty-first century, they required instructional leadership and technology. (Zipke et al., 2019). Research on pre-service teachers' understanding of classroom instruction is progressively growing (Wang et al. 2018), with particular attention paid to the impact of varying knowledge levels on pre-service teachers' TPACK knowledge across levels and backgrounds (Dai, Ren, and Li, 2018). Teachers' beliefs about technology strongly predict their TPACK (Cheng and Xie, 2018). In Mahmutoğlu's (2019) study, found that female pre-service teachers have stronger pedagogical skills and more comfortable and effective communication with students. Evidence from the literature indicates that pre-service teachers who achieve well academically also have better levels of technical, pedagogical, and overall self-efficacy. (Kara, 2020). Therefore, (Kara, 2020), states that overall teaching self-efficacy, including technological and pedagogical competencies, is strongly and positively correlated with high academic engagement and academic achievement.

TPACK fosters student learning, motivates teachers, and encourages the growth of schools, making them more appealing and useful to students, offering equal opportunities for all and leading to professional development for teachers (Malik, Rohendy, & Widiaty, 2019). TPACK and an approach to teaching that requires teachers to become experts in both the subjects they teach and the tools they use to do so are similar (Hakim, 2019). Technology, pedagogy, and student understanding of the subject matter are all integrated within the TPACK educational framework (Arwanto, 2019). This result is in line with research by Huang et al. (2018), which demonstrated that students' technical comprehension rose when teachers used technology in the classroom. But there is a chance that a technology-focused learning environment might limit student engagement to one person. Given that each student has unique needs, technology may be used to create a learning environment (Wibawani, 2019).

As one of the goals of the new curriculum is for pre-service teachers to be able to successfully utilize information technology in teaching-learning within the framework of teaching, and to demonstrate the knowledge and abilities they have gained during their training in front of their peers and the actual class, courses connected to ICT (HEC, 2018). Digital integration was influenced by numerous factors, including pre-service teachers' self-efficacy regarding their digital proficiency (Şimşek and Yazar, 2018). Research has focused on how pre-service teachers are developing TPACK. Through a variety of techniques, including the development and delivery of TPACK-based lesson plans, researchers have tried to raise the TPACK levels of pre-service teachers. (Tseng et al. 2019). The researchers agreed that one of the most important conditions for developing pre-service teachers' TPACK was their involvement in classroom activities. In Tseng et al. (2019). Lesson planning, peer collaboration, real classroom experience, the ideal role of teachers, an understanding of the value of technology in the classroom, lesson planning, and ongoing feedback were all positively correlated with PST TPACK levels, according to research by Baran et al. (2019) and Tondeur et al. (2019a, b). Pre-service teachers should actively participate in lesson presentations, class discussions, and worksheet

use, as demonstrated by Baran et al. (2019). This understanding is all that is required of teachers. (Kartimi et al., 2021; Irwanto, 2021).

Giving pre-service teachers the tools they need to successfully integrate technology into their future careers was the goal. To improve TPACK, it is important that pre-service teachers not only focus on technical skills but also apply digital technologies in their teaching. The benefits of integrating TPACK into teaching practices are well documented, for example, the use of technology can increase the self-confidence of teachers (Adamy and Boulmetis, 2006; Özçakır and Aydın, 2019), increase the level of motivation (Gómez-. Garcia). et al., 2021) and helps better visualize abstract concepts (Irmak and Tüzün, 2018). Pre-service teachers must be able to use their technical expertise in a particular educational setting to successfully employ digital technology tools in educational settings. According to Jwaifell et al. (2018), early childhood educators still lack the skills required to use technology gadgets. According to Santos and Castro's 2021 study, technology is used to enhance instruction in both traditional classrooms and teacher education programs. One of the most crucial foundational courses that pre-service teachers should take in order to gain real-world experience working with actual kids in a real classroom is teaching practice (Nurhidayat and Fakhruddin, 2020). According to Kristiyani (2020), the learners' teaching practices were encouraged, and they were ready for blended learning through the use of technology and feedback from peers and teachers.

Information for the proposed research comparable to other commonly used systems was gathered from local and international studies. As previously said, the TPACK Framework turns into a useful tool for thinking about how future educators would use technology in the classroom. The TPACK Framework was being applied among pre-service teachers, which is the reason this study was being employed.

Research Method:

This quantitative design is used to describe a population or scenario accurately. It is a popular research method for gathering and characterizing the characteristics of demographic divisions. The correlational research design was used in this quantitative study to examine correlations between variables without including any control or control on the part of the researcher. Correlational analysis was used since the researchers have linked the TPACK of the edtech tools that are easily available.

Findings and Discussion:

TPACK describes the skills educators need to integrate technology into all academic disciplines. CK, PK, and TK are the three fundamental components of knowledge. Teachers may develop a firm understanding of the intricate relationships between these components by employing appropriate pedagogical approaches and technology in their instruction. To determine the TPACK of the pre-service teachers, the components of the TPACK must be identified first which can be seen in the following tables.

<i>TPACK's General Average</i>		
	Weighted Mean	Description
Pedagogical Knowledge (PK)	3.65	Has strong knowledge
Pedagogical Content Knowledge (PCK)	3.55	Has strong knowledge
Technological Content Knowledge (TCK)	3.55	Has strong knowledge
Technological Pedagogical Knowledge (TPK)	3.50	Has strong knowledge
Technological Knowledge (TK)	3.46	Has strong knowledge
Technological Pedagogical and Content Knowledge (TPACK)	3.37	Has strong knowledge
Content Knowledge (CK)	3.36	Has strong knowledge

Table 1. TPACK's General Average

Table 1 presented the TPACK's General Average. Among the six components of the TPACK, Pedagogical Knowledge (PK) was the highest component of the TPACK weighted with an average of 3.65 means psts' had strong knowledge. CK was the lowest component of the TPACK weighted an average of 3.36 means psts' had strong knowledge also. Even if CK was the lowest TPACK component, CK obtained that average which indicated that a pre-service teacher still has a strong knowledge, meaning they have learning also. Overall, TPACK weighted an average of 3.37 means Pre-service teachers had strong knowledge.

Edtech Tools helps pre-service teachers foster a more interactive and effective educational environment in their teaching.

Table 2. Availability of EdTech Tools

<i>Availability of EdTech Tools</i>		
EDTECH TOOLS	Average mean of the Cooperating Schools	Description
Online Learning Environment (Edmodo, Google, Schoology, Moodle)	2.89	Adequate
Internet Connection	2.73	Adequate
Monitor for Projection/Television	2.68	Adequate
Projector	2.67	Adequate
Web-based Application Software	2.67	Adequate
Speaker	2.65	Adequate
Smart Phones	2.62	Adequate
Social Media Services (e.g. Blogs, Facebook, Youtube, Whatsapp, Instagram)	2.53	Adequate
Computer	2.50	Adequate
Laptop	2.50	Adequate
Printer	2.50	Adequate
Scanner	2.40	Adequate
Tablets	2	Fairly Adequate
TOTAL	2.56	Adequate

Table 2 presented the Availability Ed tech tools that are usually used by the cooperating teachers. The highest average of the Cooperating Schools has an average of 2.89 and the description of it is Adequate. Integrating technology into learning was a very important measure for teachers in this era (Koh et al., 2018). The 21st century encourages all teachers and educational professionals to acquire comprehensive knowledge of ICT because today its development significantly impacts learning (Wardani, 2020). Alharbi (2020) defined technological knowledge as the ability not only to know about the various foundations of technology but also should be aware of when, how, and how to utilize technology to improve the quality of student learning. The total description of Ed-tech tools being used was adequate, this means that schools integrate technological innovations. This implied that the cooperating schools had adequate Ed tech tools intended for use by students, psts, and Teachers. There was a need for educators to adapt their teaching methods to integrate these technologies effectively into the classroom.

Table 3. Relationship between TPACK and Adequacy of EdTech Tools

<i>Relationship between TPACK and Adequacy of Edtech Tools</i>				
Criteria	Critical r value	p value	Interpretation	Decision
TPACK & Adequacy of Edtech Tools	-0.235	0.10408	weak positive linear relationship between the variables; not significant	Accept Ho
<i>@ 0.05 level of significance</i>				

In Table 3, The variables showed a weak positive linear association, as demonstrated by the correlation value of 0.10408. At a traditional significance level (e.g., 0.05), the related p- value of 0.10408 was insufficiently strong to be deemed statistically significant. This meant that teachers still had the best instructional materials; no matter if there was technology, how the lessons were taught or what techniques they integrated relied on the teacher or the psts'. Educational technology tools needed to be crafted to support educators' TPACK growth. This can be accomplished by offering professional development sessions centered on merging technology, pedagogy, and content knowledge expertise. These workshops should empower educators to leverage Ed tech tools in alignment with their TPACK, thus enabling them to enhance their instructional strategies with technology effectively.

In Tables 1, 2, and 3, it presented the pre-service teachers' TPACK's general average, the adequacy of edtech tools, and the correlation between the TPACK of the pre-service teachers and the adequacy of edtech tools. It included the cooperating teacher and cooperating school of the respondents to determine the TPACK of the psts' regarding the cooperating school's edtech tool adequacy and the cooperating teachers' assessment of the pst. The TPACK of the pre-service teacher attained a higher weighted mean which indicates that the pre-service teacher had a strong impact. Of the six components of TPACK, the highest component of TPACK was pedagogical knowledge, which indicated that pre-service teachers had strong knowledge and the highest weighted average. There was no significant relationship between pre-service teachers' TPACK and the adequacy of ed-tech tools because the highest component of TPACK was pedagogical knowledge, and without Edtech tools, pre-service teachers would still have effective teaching and learning process.

Conclusion:

TPACK is a key framework in education for the twenty-first century, focusing on how technology, pedagogy, and content knowledge must be integrated to adequately educate students for the changing needs of the digital era. This study was conducted to evaluate the TPACK of the PST. The study's results lead the researchers to the conclusion that psts' were proficient in their TPACK. Among the six components of TPACK, pre- service teachers' highest skill

was Pedagogical Knowledge. The cooperative school's EdTech Tools were enough. According to this result, there was no significance between Pre-Service Teachers TPACK and EdTech Tool Adequacy.

Limitations and Further Research:

The result of this study is not completely generalizable because the recommendations were based on a specific sample of pre-service teachers. First, The Pre-service Teachers must focus on the content knowledge by implementing seminars about integrating the mastery of content knowledge. Second, Pre-service Teachers must integrate different factors in improving the application of content knowledge. Lastly, The Pre-service Teacher must acquire the knowledge and skills for successful teaching in the field.

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