

## TECHNOLOGICAL, PEDAGOGICAL, AND CONTENT KNOWLEDGE OF PHYSICAL EDUCATION TEACHERS IN SELECTED PRIVATE JUNIOR HIGH SCHOOLS

### ABSTRACT<sup>1</sup>

**Aims:** This assessed the technological pedagogical and content knowledge (TPACK) level of Physical Education (PE) teachers relative to educational attainment and years of teaching. Likewise, it investigated the relationship between the demographics and the teachers' technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). Also, it associated between the demographics and technological content knowledge (TCK), technological pedagogical knowledge (TPK), and pedagogical content knowledge (PCK). Lastly, it correlated the demographics and their TPACK.

**Study design:** It utilized the quantitative design particularly the descriptive-correlational approach.

**Place and Duration of Study:** It was conducted among the selected private junior high school PE teachers in a highly urbanized city.

**Methodology:** The instrument used to measure the teachers' TPACK was a 35-item validated and reliability tested researcher-made questionnaire. It was responded using strongly agree to strongly disagree. In data analysis, mean and standard deviation analyzed the teachers' TPACK. Meanwhile, Spearman rank correlation was used for the inferential problems.

**Results:** Generally, they have a high level of TPACK ( $M=3.68$ ,  $SD=0.42$ ). In educational attainment, bachelor's degree ( $M=3.48$ ,  $SD=0.43$ ), masteral units ( $M=3.79$ ,  $SD=0.36$ ), and master's degree ( $M=4.00$ ,  $SD=0.00$ ) rated high. Regarding the years of teaching, those 6 years and below ( $M=3.63$ ,  $SD=0.45$ ) and 7 years and above ( $M=3.78$ ,  $SD=0.29$ ) rated high. Meanwhile, there was no relationship between TK and educational attainment [ $r_s(38)=0.288$ ,  $p=0.071$ ], and years of teaching [ $r_s(38)=0.007$ ,  $p=0.965$ ]. Also, there was no relationship between PK and educational attainment [ $r_s(38)=0.218$ ,  $p=0.176$ ] and years of teaching [ $r_s(38)=0.092$ ,  $p=0.574$ ]. Moreover, there was no relationship between CK and educational attainment [ $r_s(38)=0.255$ ,  $p=0.112$ ] and years of teaching [ $r_s(38)=0.092$ ,  $p=0.571$ ]. Furthermore, there was no relationship between the PCK and years of teaching [ $r_s(38)=-0.033$ ,  $p=0.841$ ]. However, a correlation with educational attainment [ $r_s(38)=0.341$ ,  $p=0.031$ ]. There was also no correlation between TCK and years of teaching [ $r_s(38)=-0.079$ ,  $p=0.626$ ]. However, a relationship with educational attainment [ $r_s(38)=0.473$ ,  $p=0.002$ ]. Further, there was no correlation between TPK and years of teaching [ $r_s(38)=0.078$ ,  $p=0.632$ ]. However, a relationship with educational attainment [ $r_s(38)=0.359$ ,  $p=0.023$ ]. Lastly, there was no correlation between TPACK and years of teaching [ $r_s(38)=0.148$ ,  $p=0.361$ ]. However, a relationship with educational attainment [ $r_s(38)=0.525$ ,  $p=0.001$ ].

**Conclusion:** The PE teachers' TPACK underscores the significant impact of educational qualifications on teaching expertise. It highlights the profound connection between higher education, particularly postgraduate studies, and the enhancement of educators' TPACK proficiency. The differences in TCK between bachelor's degree holders and those pursuing advanced studies emphasize the higher education's pivotal role in refining technological skills for PE instruction. Furthermore, the study emphasizes the strong correlation between TPACK and educational qualifications, emphasizing the importance of ongoing academic pursuits in shaping effective teaching practices in PE.

*Keywords: Physical Education, Technological, Pedagogical, and Content Knowledge, descriptive-correlational, Philippine private schools*

### 1. INTRODUCTION

Pedagogical content knowledge (PCK), initially coined by Shulman in the 1980s, merges pedagogy and subject expertise. Shulman [1] highlighted the inseparability of content and pedagogy, where content pertains to information and pedagogy to teaching methods. Mishra and Koehler [2] expanded Shulman's [1] concept, introducing the technological, pedagogical, and content knowledge (TPACK) framework, acknowledging technology's crucial role in teaching. TPACK is heuristic in exploring technology-assisted

instruction, enabling educators to leverage innovative technology, update teaching practices, and enhance learning environments [3].

Mishra and Koehler's [2] TPACK framework, involving seven domains, initially comprises content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). Content knowledge (CK) pertains to subject matter expertise, pedagogical knowledge (PK) employs effective teaching strategies, and technological knowledge (TK) on utilizing technologies for instruction. Domains were added namely: technological content knowledge (TCK), technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technological pedagogical content knowledge (TPACK). These encompass using technology for lesson content (TCK), applying pedagogical reasoning in content delivery (PCK), engaging students through technology (TPK), and integrating foundational knowledge (CK, PK, TK) for enhanced instruction.

Meanwhile, the Philippine PE curriculum covers fitness principles, sports, games, rhythms, and dance [4]. Quality teachers are pivotal in fostering holistic learners with 21st-century skills and values to learn these [5]. Filipino PE teachers adapt diverse approaches, employing digital competencies to boost student engagement [6]. Despite COVID-19 challenges, teachers seized professional development opportunities, fostering adaptability and resilience [7]. Baber [8] stresses the importance of teachers possessing good technological, pedagogical, and content knowledge (TPACK) for effective instruction. Meanwhile, Cahapay and Anoba[9]notes<sup>2</sup>positive values among teachers regarding technology's impact on education.

In private schools, PE and sports educators emphasize extensive technological opportunities that boost student<sup>3</sup> motivation [10,11]. Yıldız and Karakullukçu[12] noted that PE teachers, influenced by their own educational experiences, tend to favor teacher-centered methods, finding them more convenient albeit less effective for student<sup>4</sup> development. It is suggested that private schools, reliant on tuition and donations, modestly promote PE minutes and adhere to professional guidelines for PE standards [13]. These teachers also prioritize physical activity, mentor influence, and reduce sedentary habits while managing other classroom responsibilities [14].

However, these professionals encounter challenges such as integrating educational technology, grappling with internet inconsistencies, facing a shortage of equipment, and having limited technical support [15,16]. Additionally, PE teachers must establish connections between technological platforms and content [17]. Research emphasizes the teachers' enhancement of technological content knowledge (TCK) through adaptive training and professional development programs. Hence, conducive environment is encouraged to foster their professional development [18,19]. Furthermore, they are tasked with adeptly merging subject expertise, instructional methods, and various technologies to convey knowledge [20,21,22,23,24].

In Philippines, there were studies conducted concerning TPACK framework: among science teachers [25], secondary English teachers [26], elementary teachers [27], and among Science and Technology, Engineering, and Mathematics (STEM) teachers [28]. Given the available studies, there is a limited literature on employing TPACK framework among PE teachers especially in private schools. This is the gap which this study would like to fill in.

## 1.1 Research Problem

This study assessed the technological pedagogical and content knowledge (TPACK) level of PE junior high school teachers in selected private schools in a highly urbanized city during 2023-2024 relative to educational attainment and years of teaching experience. Likewise, it investigated the relationship between the demographics and the teachers' technological knowledge, pedagogical knowledge, and content knowledge. Also, it checked the correlation between the demographics and their technological content knowledge, technological pedagogical knowledge, and pedagogical content knowledge. Lastly, it correlated the demographics and their technological, pedagogical, content knowledge.

## 1.2 Framework of the Study

This study theorized that the PE teachers' TPACK level is influenced by their educational attainment and years of teaching experience. This was anchored on Mishra and Koehler's [2] TPACK framework. In this framework, PE teachers navigate the integration of technology, pedagogy, and content to enhance instruction. This framework draws support from educational theories influenced significantly by factors like educational attainment and teaching experience, specifically from human capital and experiential learning theories.

Human capital theory pertains to one's investments in education, training, and values that enrich his knowledge, skills, and capabilities [29]. This theory has popularized the concept of human capital, emphasizing the importance of investing in education and training as a fundamental form of capital crucial for individual, organizational, and community progress. Here, their level of educational attainment and years of service become potential investment results which influence also their acquisition, development, and application of learned technological, pedagogical, and content knowledge.

Experiential learning theory by Kolb and Kolb [30] posits learning as the fundamental human adaptation process. This advocates the experiential learning and cultivation of TPACK through extensive teaching engagement and effective technology integration. This framework extends beyond formal education, underscoring the importance of learning from practical experiences and fostering a cycle of doing, reflecting, thinking, and applying. Meaning, the exercise of knowledge is consequently produced by one's experiences of education and teaching which in this study are in their educational attainment and years of teaching. In this study, these frameworks have something to do with the TPACK assessment where the PE teachers' acquisition, development, and application of their technological, pedagogical, and content knowledge are influenced by their educational attainment and teaching experiences.

## 2. METHODOLOGY

### 2.1 Research Design

The study utilized the quantitative research design particularly the descriptive correlational approach. The descriptive approach assessed the PE teachers' TPACK relative to the demographics. Meanwhile, the correlational approach investigated the relationship between the demographics and the teachers' TPACK. Also, it checked the correlation between the demographics and their technological content knowledge, technological pedagogical knowledge, and pedagogical content knowledge. Lastly, it correlated the demographics and their technological knowledge, pedagogical knowledge, and content knowledge.

### 2.2 Respondents

The respondents of the study were the total enumeration of 40 junior high school Physical Education teachers from selected private high schools in a highly urbanized city during 2023-2024.

**Table 1.** Demographic Profile of the Respondents

Variable	f	%
Educational Attainment		
BSED	18	45.0
Masteral Units	17	42.5

Master's Degree	5	12.5
Years of Teaching		
6 years and below	29	72.5
7 years and above	11	27.5
<b>Total</b>	<b>40</b>	<b>100.0</b>

Note: average teaching experience is 6.65 years

## 2.3 Research Instrument

The instrument used to measure the teachers' Technological Pedagogical and Content Knowledge (TPACK) was a 35-item researcher-made questionnaire. It was responded using the scale from strongly agree to strongly disagree. Relative to validity, it was subjected to the validation and yielded a valid Content Validity Ratio (CVR) of 0.89. Regarding the reliability, it was pilot tested to 30 non-actual respondents and yielded a Cronbach's alpha score of 0.96.

## 2.4 Data Analysis

In data analysis, the descriptive-correlational analyses were employed. Specifically, mean and standard deviation analyzed the teachers' TPACK. Meanwhile, Kolmogorov-Smirnov tested the normality. The results revealed that the variables technological [KS=0.167, p=0.007], content [KS=0.17, p=0.005], pedagogical [KS=0.184, p=0.002], pedagogical content [KS=0.311, p=0.000], technological content [KS=0.214, p=0.000], technological pedagogical [KS=0.283, p=0.000], and TPACK [KS=0.282, p=0.000] were not normally distributed. Hence, the use of non-parametric tool for the inferential questions. Spearman rank correlation correlated the demographics and the technological, content, pedagogical, pedagogical content, technological content, technological pedagogical, and technological pedagogical and content knowledge.

## 2.5 Ethical Considerations

The study ensured the ethical soundness of the paper in adherence to the general principles of respect for persons, justice, and beneficence by the Philippine Health Research Ethics Board (PHREB). Lastly, it ensured the privacy of the respondents and the confidentiality of all the data gathered.

## 3. RESULTS AND DISCUSSION

### *Level of Technological Pedagogical and Content Knowledge (TPACK) of PE Teachers*

Table 2 presents the PE teachers' TPACK level. Generally, they have a high level of TPACK (M=3.68, SD=0.42). All domains were rated high in technological knowledge (M=3.47, SD=0.38), pedagogical knowledge (M=3.59, SD=0.38), content knowledge (M=3.46, SD=0.41), pedagogical content knowledge (M=3.67, SD=0.42), technological content knowledge (M=3.44, SD=0.44), and technological pedagogical knowledge (M=3.61, SD=0.45). In educational attainment, all those with bachelor's degree (M=3.48, SD=0.43), masteral units (M=3.79, SD=0.36), and master's degree (M=4.00, SD=0.00) rated high. Regarding the years of teaching, those 6 years and below (M=3.63, SD=0.45) and 7 years and above (M=3.78, SD=0.29) rated high.

The study assessed PE teachers' TPACK level, revealing varied levels of TCK based on educational backgrounds, with bachelor's degree holders scoring average. However, all teachers in these schools showed high levels across dimensions, highlighting their adept utilization of technology to enhance teaching methodologies and student comprehension, regardless of educational attainment or teaching experience.

The high level displayed by PE teachers across various TPACK dimensions is likely<sup>5</sup> due to the extensive training programs implemented within the private schools where they work. These comprehensive training initiatives presumably cover a wide array of educational elements, encompassing the effective use of educational technology, aligning curriculum with various competencies and standards, and implementing innovative teaching methodologies. Notably, PE teachers with bachelor's degrees exhibited an average level in their TCK, indicating a comparatively limited ability to utilize technology for content-based instruction compared to their peers holding master's degrees or pursuing advanced graduate studies. This observation underscores the potential influence of participation in advanced graduate programs, suggesting a pivotal role in enhancing overall proficiency levels across the diverse dimensions of TPACK among PE teachers.

Ibrohim et al. [31] highlights junior educators' strong TK, while Petalla[32] reveals<sup>6</sup> challenges older teachers face in adapting to ICT. Advanced teachers excel in lesson planning and technology use, with higher education correlating with increased TK and ICT proficiency [33,34]. Teacher training significantly influences technology utilization [17], while Li et al. [35] emphasizes the impact of professional development and experience on classroom effectiveness. PK remains strong across experience levels [36], but conflicting conclusions arise regarding CK [37]. Senior educators excel in PCK, and postgraduate degrees elevate PCK levels, yet incongruent results persist regarding TCK and TPACK [38,39]. Hence, continuous professional development is vital in enhancing the educators' digital competence through in-service training and relevant postgraduate studies in PE.

**Table 2.a.** Level of Technological Pedagogical and Content Knowledge (TPACK) of PE Teachers

Variable	Technological Knowledge			Pedagogical Knowledge			Content Knowledge			Pedagogical Content Knowledge		
	M	SD	Int	M	SD	Int	M	SD	Int	M	SD	Int
Educational Attainment												
Bachelor's Degree	3.36	0.39	Hi	3.51	0.38	Hi	3.32	0.34	Hi	3.49	0.46	Hi
Masteral Units	3.55	0.39	Hi	3.64	0.38	Hi	3.61	0.44	Hi	3.79	0.36	Hi
Master's Degree	3.60	0.24	Hi	3.72	0.41	Hi	3.44	0.41	Hi	3.92	0.11	Hi
Years of Teaching												
6 years and below	3.48	0.38	Hi	3.57	0.39	Hi	3.43	0.42	Hi	3.66	0.41	Hi
7 years and above	3.44	0.41	Hi	3.65	0.36	Hi	3.53	0.38	Hi	3.69	0.45	Hi
<b>Whole</b>	<b>3.47</b>	<b>0.38</b>	<b>Hi</b>	<b>3.59</b>	<b>0.38</b>	<b>Hi</b>	<b>3.46</b>	<b>0.41</b>	<b>Hi</b>	<b>3.67</b>	<b>0.42</b>	<b>Hi</b>

**Table 2.b.** Level of Technological Pedagogical and Content Knowledge (TPACK) of PE Teachers

Variable	Technological Content Knowledge			Technological Pedagogical Knowledge			TPACK		
	M	SD	Int	M	SD	Int	M	SD	Int
Educational Attainment									
Bachelor's Degree	3.20	0.40	Av	3.41	0.47	Hi	3.48	0.43	Hi
Masteral Units	3.64	0.40	Hi	3.72	0.42	Hi	3.79	0.36	Hi
Master's Degree	3.64	0.36	Hi	3.92	0.11	Hi	4.00	0.00	Hi
Years of Teaching									
6 years and below	3.47	0.44	Hi	3.59	0.46	Hi	3.63	0.45	Hi
7 years and above	3.36	0.48	Hi	3.65	0.46	Hi	3.78	0.29	Hi
<b>Whole</b>	<b>3.44</b>	<b>0.44</b>	<b>Hi</b>	<b>3.61</b>	<b>0.45</b>	<b>Hi</b>	<b>3.68</b>	<b>0.42</b>	<b>Hi</b>

**Relationship between the Demographics and the Technological Knowledge of PE Teachers**

Table 3 presents the relationship between the PE teachers demographics and their TK. There was no relationship between TK and educational attainment [ $r_s(38)=0.288$ ,  $p=0.071$ ], and years of teaching [ $r_s(38)=0.007$ ,  $p=0.965$ ].

The **no**<sup>7</sup> correlation between PE teachers' technological knowledge and educational background and teaching experience suggests that factors beyond formal education may contribute to their technological proficiency. The high utilization of technology in various aspects of PE could be attributed to specialized training from schools and postgraduate studies, emphasizing the potential impact of tailored professional development programs in enhancing teachers' technological skills.

The findings challenge both the human capital and experiential learning theories regarding PE teachers' TK. On the contrary, no relationship exists between TK and teachers' educational background and teaching experience. The study suggests specialized training and postgraduate **studies may**<sup>8</sup> contribute to technological proficiency, highlighting the need for tailored professional development programs to enhance skills in PE settings and challenging assumptions about the sole influence of formal education and teaching experience on TK proficiency.

Aligning with the study's results, Tanucan's[17] and Koyuncuoglu's[40] findings imply that PE teacher's TK is not influenced by their highest educational attainment. Contrarily, other research highlights that educators with higher academic qualifications tend to demonstrate superior technological integration in their teaching methods [35,34]. Moreover, numerous studies consistently reveal an insignificant impact of teaching experience on teachers' TK [41], yet a few studies note an augmentation in technological proficiency with increased teaching years [42].

**Table 3.** Relationship between the Demographics and the TK of PE Teachers

Variable	$r_s$	Df	p
Educational Attainment	0.288	38	0.071
Years of Teaching	0.007	38	0.965

Note: correlation is significant when  $p \leq 0.05$

### Relationship between the Demographics and the Pedagogical Knowledge of PE Teachers

Table 4 presents the relationship between the PE teachers' demographics and their PK. There was no relationship between PK and educational attainment [ $r_s(38)=0.218$ ,  $p=0.176$ ] and years of teaching [ $r_s(38)=0.092$ ,  $p=0.574$ ].

This suggests that the pedagogical expertise these educators demonstrate is not significantly tied to their educational qualifications and years of teaching experience. The **no**<sup>9</sup> correlation between their PK and the demographics among PE teachers suggests that their pedagogical expertise might not be strongly tied to formal education and tenure. Their proficiency in various aspects of pedagogy could stem from specialized training provided by schools and postgraduate studies, highlighting the potential impact of tailored professional development programs in enhancing PE educators' pedagogical skills beyond their educational backgrounds and teaching tenure.

Additionally, the findings challenge the human capital and experiential learning theories. This suggests that traditional education and tenure may not be the main determinants of pedagogical proficiency, with specialized training and postgraduate studies possibly playing a more significant role. This underscores the importance of tailored professional development programs in enhancing PE educators' pedagogical skills, questioning the straightforward applicability of established theories in understanding pedagogical expertise within this context.

Various studies show a relationship between advanced degrees, teaching experience, and PK among educators. Li et al. [35] highlights that while advanced degrees may not directly correlate with PK, factors like teaching experience and professional development influence classroom effectiveness. Gore et al.

[36]perceives a positive link between teaching experience and teaching quality. Kini and Podolsky[43]emphasizes<sup>10</sup> the role of teaching experience in shaping teaching effectiveness and PK, echoing Agustini et al. [44] regarding the positive correlation between teaching experience and PK. Overall, experienced teachers tend to demonstrate higher levels of PK, contributing to their teaching effectiveness [45].

**Table 4.** *Relationship between the Demographics and the PK of PE Teachers*

Variable	$r_s$	df	p
Educational Attainment	0.218	38	0.176
Years of Teaching	0.092	38	0.574

### Relationship between the Demographics and the Content Knowledge of PE Teachers

Table 5 presents the relationship between the PE teachers' demographics and their CK. There was no relationship between CK and educational attainment [ $r_s(38)=0.255$ ,  $p=0.112$ ] and years of teaching [ $r_s(38)=0.092$ ,  $p=0.571$ ].

The no<sup>11</sup> correlation between CK and educational attainment and teaching experience among PE teachers suggests that their content-related expertise may not strongly rely on formal education and tenure. Other factors beyond conventional qualifications could contribute to their demonstrated content knowledge. Specialized training from schools and postgraduate studies may positively influence skills such as creating inclusive environments, using diverse teaching methods, and crafting engaging lesson plans, emphasizing the potential impact of tailored professional development programs for PE educators' content skills, regardless of their educational backgrounds and teaching experience.

Meanwhile, the result challenges the human capital theory, which emphasizes the role of education and training in enhancing expertise, and experiential learning theory, which suggests that knowledge grows with teaching experience. Instead, the results suggest that factors beyond formal education and tenure may contribute to PE teachers' content-related expertise. The potential influence of specialized training and professional development programs underscores the importance of considering alternative pathways for cultivating content skills among educators, irrespective of their educational backgrounds or years of teaching experience.

The study aligns with prior research, suggesting that factors like teaching experience and professional development, such as graduate studies and training, might restrict teachers' CK [37]. While the influence of teaching experience on CK appears limited, newer educators showcase comparable levels to their more seasoned counterparts, albeit demonstrating significant contributions to content mastery [46]. Moreover, the study highlights advanced educational attainment and self-efficacy as contributors to CK development among educators, indicating that higher educational achievements are associated with a greater mastery of CK [35].

**Table 5.** *Relationship between the Demographics and the CK of PE Teachers*

Variable	$r_s$	df	p
Educational Attainment	0.255	38	0.112
Years of Teaching	0.092	38	0.571

### Relationship between the Demographics and the Pedagogical Content Knowledge of PE Teachers

Table 6 presents the relationship between the PE teachers' demographics and their PCK. There was no relationship between the PCK and years of teaching [ $r_s(38)=-0.033$ ,  $p=0.841$ ]. However, a correlation was observed with educational attainment [ $r_s(38)=0.341$ ,  $p=0.031$ ].

This suggests that educators demonstrated PCK might not heavily rely on teaching experience but could significantly relate to their educational qualifications. Skills like designing instruction aligned with standards and fostering lifelong physical activity habits could be influenced by specialized school training and postgraduate studies. These highlight the potential impact of tailored professional development programs in enhancing PE educators' PCK, irrespective of teaching tenure, while emphasizing the influence of educational qualifications on this expertise area. Additionally, these findings reject the experiential learning theory's linear progression of knowledge acquisition through teaching experience. However, these align with the human capital theory emphasizing the importance of investing in education and training as essential forms of capital for individual and organizational development.

Li et al. [35] found correlations between the teachers' PCK and teaching experience, similar to the study's results. However, this study, supported by Hughes [47], suggests that the teaching experience's impact on PCK is not significant, despite the research by De Miranda [48] indicating effects. Senior teachers generally exhibit better PCK, attributed to increased experience [49]. Additionally, Mailizar et al. [38] agree that educational attainment affects PCK, contrasting Koyuncuoglu's [40] findings.

**Table 6.** Relationship between the Demographics and the PCK of PE Teachers

Variable	$r_s$	df	p
Educational Attainment	0.341*	38	0.031
Years of Teaching	-0.033	38	0.841

### Relationship between the Demographics and the Technological Content Knowledge of PE Teachers

Table 7 presents the relationship between the PE teachers' demographics and their TCK. There was no correlation between TCK and years of teaching [ $r_s(38)=-0.079$ ,  $p=0.626$ ]. However, a relationship emerged with educational attainment [ $r_s(38)=0.473$ ,  $p=0.002$ ].

The results suggest that TCK may be more associated with their educational qualifications than teaching experience. Proficiency in technological innovations in PE and utilizing technology for data analysis and student skill development could be influenced by training or postgraduate studies. These findings underscore the significance of professional development programs and higher education in improving PE educators' TCK, highlighting the influence of educational qualifications. Furthermore, this outcome rejects the experiential learning theory, which posits that knowledge acquisition primarily occurs through practical experience. Instead, the findings align with human capital theory, which emphasizes the importance of investing in education and training as valuable capital.

Zhen [50] found a positive link between TCK and educational attainment and a suggested correlation with teaching experience. Similarly, Mapulanga et al. [51] connected higher academic qualifications to teachers' increased PCK. Conversely, Li et al. [35] and Koyuncuoglu [40] reported no TCK support for those with advanced educational attainment. Regarding TCK and teaching years, while Mapulanga et al. [51] and Mohamad [52] found no influence, Antony et al. [49] noted junior teachers outperforming seniors, and Idrus et al. [53] found similar TCK levels regardless of experience.

**Table 7.** Relationship between the Demographics and the TCK of PE Teachers

Variable	$r_s$	df	p
Educational Attainment	0.473**	38	0.002
Years of Teaching	-0.079	38	0.626

### Relationship between the Demographics and the Technological Pedagogical Knowledge of PE Teachers

Table 8 presents the relationship between the PE teachers' demographics and their TPK. There was no correlation between TPK and years of teaching [ $r_s(38)=0.078$ ,  $p=0.632$ ]. However, a relationship was observed with educational attainment [ $r_s(38)=0.359$ ,  $p=0.023$ ].

The results suggest that the demonstrated TPK might not strongly depend on teaching experience but could relate to educational qualifications. Proficiencies like using technology for student engagement, providing targeted feedback, and fostering collaborative learning might be influenced by specialized training or postgraduate studies. These findings highlight the potential impact of tailored professional development programs and higher education in enhancing PE educators' TPK, indicating the influence of educational qualifications.

Moreover, the findings among PE teachers reject the experiential learning theory's notion of a direct correlation between TPK and years of experience. Instead, the study supports the human capital theory, demonstrating a relationship between TPK and educational attainment. This implies that while TPK proficiency may not strongly hinge on teaching experience, it correlates with educational qualifications. Proficiencies in utilizing technology for student engagement, providing targeted feedback, and fostering collaborative learning seem influenced by specialized training or postgraduate studies.

The study aligns with Tanucan[17] in establishing a correlation between teachers' TPK and their highest educational achievements and finding that TPK remains unaffected by the duration of teaching experience. However, diverging perspectives are presented by Li et al. [35] and Koyuncuoglu[40], contending that educational attainment does not influence TPK. Moreover, this study concurs with Mohamad [52], suggesting that years of teaching experience do not influence TPK.

**Table 8.** Relationship between the Demographics and the TPK of PE Teachers

Variable	$r_s$	df	p
Educational Attainment	0.359*	38	0.023
Years of Teaching	0.078	38	0.632

### Relationship between the Demographics and the Technological Pedagogical and Content Knowledge of PE Teachers

Table 9 presents the relationship between the PE teachers' demographics and their TPACK. There was no correlation between TPACK and years of teaching [ $r_s(38)=0.148$ ,  $p=0.361$ ]. However, a relationship was established with educational attainment [ $r_s(38)=0.525$ ,  $p=0.001$ ].

The insights suggest that educators' TPACK might not heavily depend on teaching experience but could significantly link to their educational qualifications. Proficiencies like using technology for instruction design, comprehensive assessments, and personalized learning experiences might be influenced by specialized training or postgraduate studies. These findings emphasize the potential impact of tailored professional development programs and higher education in enhancing PE educators' TPACK, highlighting the influence of educational qualifications on this multifaceted expertise.

The research on PE teachers shows no correlation between TPACK and teaching experience but a substantial link between technological pedagogical and content knowledge and educational attainment. These findings reject the experiential learning theory but support the human capital theory, emphasizing

the importance of education and training in shaping educators' TPACK. Proficiencies such as using technology for instruction design and personalized learning may be influenced by specialized training or postgraduate studies, highlighting the impact of educational qualifications.

The findings align with prior research indicating a lack of correlation in teachers' TPACK levels based on their teaching experience [41]. However, several studies emphasize that teaching experience influences teacher effectiveness [54], enhancing their ability to design and develop TPACK effectively [43]. Additionally, other research highlights that higher academic qualifications among postgraduate teachers might elevate TPACK proficiency, influencing teaching methodologies and potentially enhancing educational effectiveness compared to bachelor graduates [35,34]. However, Koyuncuoglu's[40] study states that educational attainment does not influence teacher's TPACK.

**Table 9.** Relationship between the Demographics and the TPACK of PE Teachers

Variable	$r_s$	df	p
Educational Attainment	0.525**	38	0.001
Years of Teaching	0.148	38	0.361

The study theorized that the PE teachers' TPACK is contributed by their educational attainment and years of teaching experience. The findings present a nuanced understanding of the PE teachers' TPACK. Contrary to the experiential learning theory, positing that TPACK increases with teaching experience, the study reveals **no**<sup>12</sup> correlation between TPACK and years of teaching experience among PE teachers. This finding challenges the assumption that TPACK development is solely contingent upon tenure in the teaching profession.

However, the research aligns well with the human capital theory. This emphasizes the importance of investing in education and training as a form of capital essential for individual, organizational, and community development. The findings underscore the significance of educational attainment and training in shaping PE teachers' TPACK levels. Specifically, individuals with higher educational qualifications, such as master's degrees, demonstrate elevated levels of expertise across various TPACK dimensions.

The absence of correlations between TPACK dimensions and teaching experience suggests that while experiential learning undoubtedly contributes to professional growth, it may not be the sole determinant of TPACK proficiency. Instead, the study highlights the critical role of postgraduate education and specialized training programs in enhancing PE teachers' TPACK competencies. Lastly, the research emphasizes the multifaceted nature of TPACK development and challenges the linear progression suggested by experiential learning theories. By acknowledging the influence of human capital theory, the study underscores the importance of continuous education initiatives in fostering robust teachers' TPACK.

#### 4. CONCLUSION

The PE teachers' TPACK in private schools underscores the significant impact of educational qualifications on teaching expertise. It highlights the profound connection between higher education, particularly postgraduate studies, and the enhancement of TPACK proficiency among educators. The notable differences in TCK between bachelor's degree holders and those pursuing advanced studies emphasize the pivotal role of higher education in refining technological skills for PE instruction. Furthermore, the study emphasizes the strong correlation between TPACK and educational qualifications, emphasizing the importance of ongoing academic pursuits in shaping effective teaching practices in physical education.

A significant limitation lies in its focus on Physical Education (PE) teachers in private junior high schools located within an urbanized city. This limited scope restricts the generalizability, as the specific characteristics and dynamics of these schools might not mirror other PE educators in diverse settings.

Addressing these limitations, future studies are encouraged adopting<sup>13</sup> a more expansive approach, encompassing a broader range of educational institutions, including public schools and those across varied regions. Additionally, employing a mixed-method design would offer a more nuanced understanding of PE teachers' TPACK. Furthermore, exploring the students' perspectives regarding teachers' TPACK could provide valuable insights. Lastly, employing similar or other variables and frameworks are encouraged to validate the claims.

## 8. CONSENT

As per international standard or university standard, the respondents' written consents were collected and preserved by the authors.

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