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An Investigation of the Effect of Gender, Experience, and Occupation on Technological, Pedagogical, and Content Knowledge (TPACK) among English Language Teachers in Saudi Arabia

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Technological, Pedagogical, and Content knowledge (TPACK) has been used in several studies as a theoretical framework to explore teachers' use of technology in instruction. Numerous studies have contributed to understanding the effect of interaction between varied knowledge domains and differences between pre- and in-service teachers' knowledge. However, studies conducted to examine the influence of teachers' experience, gender, and occupation on TPACK have been limited. This study addresses this issue by evaluating 105 English language teachers from Saudi Arabian schools and universities. A TPACK survey and interview were used to measure pre- and in-service teachers' utilization of technology to support their teaching. Results indicated that using technology in language learning is unaffected by gender, experience, or occupation. However, a positive correlation was observed among the seven constructs of the model as established by the factor analysis test. Finally, the results indicated positive

attitudes toward the TPACK model and provided suggestions for better integration of technology in language learning.

Keywords: *TPACK, Information communication technology (ICT), Pre-service teachers, In-service teachers, Gender, Perceptions, Pedagogy*

INTRODUCTION

Rapid technological development demands the incorporation of information and communication technology (ICT) into language learning. Educational institutions have made several efforts to support pre- and in-service teachers by providing the required skills and knowledge to use technology effectively for educational purposes. Several studies have been conducted on the effective incorporation of technology in learning, analyzing the effectiveness of different tools to measure teachers' knowledge and technological capabilities (Tondeur, et al., 2016).

The technological, pedagogical, and content knowledge framework (TPACK) proposed by Koehler and Mishra (2005) was used in several studies to measure teachers' knowledge. The framework describes knowledge constructs required by teachers to efficiently integrate technological and pedagogical understanding into their teaching activities. Such an integrative approach is beneficial for higher educational institutes' competitiveness and for educators to be lifelong learners and independent knowledge creators (Tulinayo, et al., 2018). TPACK has often been used as a framework to measure teachers' knowledge and the use of digital technologies; however, limited attention has been paid to the level of experience, gender, and occupation (i.e., pre- or in-service teacher) that may influence English language teachers' use of TPACK. The study conducted by Ku, et al., (2021) focused primarily on pre-service secondary technology teachers, but did not consider the situation of in-service teachers.

Therefore, the current study attempted to bridge this gap by delving further into understanding the effect of TPACK among different types of teachers. The study sought to explore the effect of occupation (i.e., pre- or in-service teacher), experience level, and gender on teachers' TPACK. The study targeted student teachers in their final year of college teaching English language as well as active English language teachers working as school teachers or university instructors. Accordingly, the study addresses the following key research questions:

RQ1). Is there any significant correlation of TPACK with respect to occupation, experience level, or gender between pre- and in-service English language teachers?
RQ2). Is there any significant correlation among the constructs of TPACK between pre- and in-service English language teachers?
RQ3). What is the perception of TPACK constructs among pre- and in-service English language teachers?

REVIEW OF LITERATURE

TPACK Framework

Technology is an essential element of the present educational system and has become an integral component to measure teachers' competence and skills before starting the teaching profession (Fominykh, et al., 2022). According to Teng and Wang (2021), technological expertise, including how and when to utilize it effectively, has a positive impact on general engagement, thereby leading to better learning outcomes. Other elements of selecting pedagogy and content should not be ignored. Therefore, teachers must reach beyond merely using technology as a supplement to lessons; instead, they should fully integrate it into the learning process. The TPACK framework provides a means to understand and assess the different domains vital to technological integration in classrooms. Koehler and Mishra (2005) and Mishra and Koehler (2006) have determined the significance of excellent technology integration practices in their instructionally designed learning tasks to ensure successful implementation of TPACK. Schmidt et al. (2009) suggested an adjustment for the model they believed to be more reliable to assess pre-service (as well in-service) teachers' development of TPACK.

Mishra and Koehler (2006), Schmidt et al. (2009), Ku et al. (2021), and Roussinos and Jimoyiannis (2019) proposed an updated TPACK framework comprising seven constructs or knowledge domains. This study has adopted this framework, which emphasizes teachers becoming proficient by successfully integrating various aspects of ICT into classrooms. At the core of this framework, there are three types of foundational knowledge.

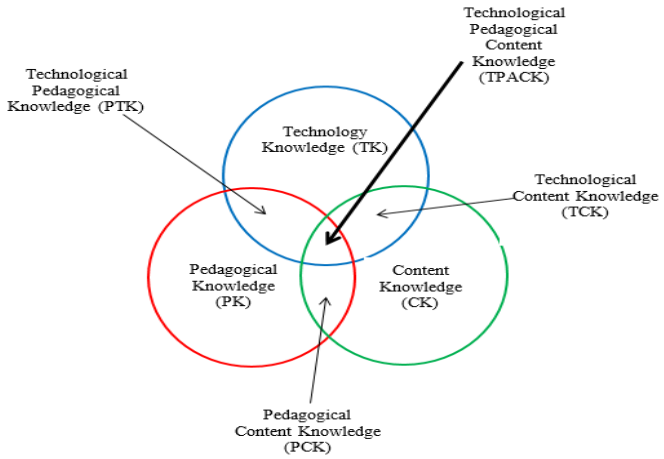
- Content knowledge (CK): knowledge about a particular subject area, such as biology or American history
- Pedagogical knowledge (PK): teaching processes and strategies, such as classroom management, instructional methods, and educational objectives
- Technological knowledge (TK): knowledge regarding the use of information technology tools, such as computer hardware, software, and smart boards (Ku, et al., 2021; Roussinos & Jimoyiannis, 2019).

The three basic elements interact with each other in different manner to form additional four constructs of the framework.

- Pedagogical content knowledge (PCK): integrates content and pedagogy to describe strategies used by teachers to organize and teach a specific content area.
- Technological content knowledge (TCK): use of specific digital tools to promote learning in a specific subject matter.
- Technological pedagogical knowledge (TPK): integration of technology tools with teaching regardless of content area.

- TPACK: refers to the integration of the three foundational constructs to implement the meaningful use of technology when teaching a specific content area using specific pedagogical strategies to achieve desired learning outcomes. A visual diagram of the TPACK framework is presented in Figure 1.

Figure 1. **TPACK Framework (Based on Ku et al., 2021 and Roussinos and Jimoyiannis, 2019)**



TPACK Surveys and Instruments

The TPACK framework has been useful in the development of surveys and instruments to measure the efficacy of teacher's implementation of technology in classrooms. Approximately 70% of instruments reported in literature use a self-report survey that adheres to seven domains of the TPACK framework (Ku et al., 2021; Baser, Kopcha, & Ozden, 2016). Many of those instruments also use a five-point Likert scale in which users are asked to rate their level of agreement with statements pertaining to each of the seven domains. Those scales typically range from 1 (strongly disagree) to 5 (strongly agree) (Ku et al., 2021; Roussinos & Jimoyiannis, 2019). However, not all assessments of TPACK use surveys, as other strategies are used, including performance assessments and lesson plan analysis (Schmid, et al., 2021). Such alternative strategies may be considered valid means of assessment for various TPACK components. Akyuz (2018) reported that performance assessment scores were lower than self-assessment scores in all domains except TCK. However, a high degree of correlation was observed between two assessment methods for all aspects aside from those with a P component (Akyuz, 2018).

An analysis of TPACK assessment tools focuses on the relationship among seven components of the framework. According to Pamuk et al., (2015), 80% of the variance in TPACK is explained by six other domains. The strongest core predictor of TPACK is TK and the strongest second-level

predictor of TPACK is TCK. However, domains containing the technology component, including TPK and TCK, may be difficult to quantify.

Occupational Differences in TPACK

The occupational type and its associated differences in being pre- or in-service teachers of English language play a significant role in TPACK. Teachers' professional differences are also influenced by their experience, perception, and competence regarding the growth and development of TPACK (Gill & Dalgarno, 2017). Additionally, such differences are determined by the amount of technical support and professional training received to support successful technology integration (Ifinedo & Kankaanranta, 2021) and appropriate utilization of applications (Cheok & Wong, 2015). Considering this framework, innovative TK, including its adaptation, has influenced teachers in general, regardless of the generations to which they belong (Taimalu & Luik, 2019). According to Kjeldsen (2012), variations in the occupational level have been proven to be a factor for users' level motivation. Akturk and Ozturk (2019) determined that teachers who have low occupational seniority have higher TK, PK, TPK, TCK, and TPACK levels than those with high seniority. Agyei and Voogt (2015) found that pre-service teachers, who were still in college, showed positive attitudes toward TPACK and its application.

Experience Differences in TPACK (Years of Teaching)

Experience, including the number of teaching years, shapes TPACK attitudes and skills. Egbert, et al., (2002) deduced that teachers who implemented technology-based tasks were previously experienced with technology. Further, Teo (2008) determined that the number of years spent using computers was positively correlated with the confidence level of using technology in language learning. Likewise, Meskill, et al., (2002) discovered that novice teachers were considerably less comfortable with technology use than experienced teachers. Yeh, et al., (2013) found that both related knowledge and teacher experience were indicators of teacher proficiency in TPACK. Saudelli and Ciampa (2016) deduced that compared to TCK, teachers' PK and years of teaching experience strongly influenced their decisions regarding mobile technology integration. Furthermore, Agyei and Voogt (2015) concluded that scaffolding authentic technological experiences, including feedback from teaching demonstrations, significantly improved pre-service teachers' competencies for technology integration.

Gender Differences in TPACK

There are gender differences in TPACK. For instance, male teachers and pre-service teachers rate themselves more competent in components that contain a technological element, including TK, TCK, TPK, and TPACK (Ergen, et al., 2019). Yet, both genders tend to rate their CK equally as high (Jordan, 2013), and female teachers rate themselves higher than males in PK (Lin, et al., 2013). Those differences could be due to factors, such as cultural expectations (Castéra et al.,

2020), gender gaps in self-efficacy, and underestimation of knowledge and skills by females (Scherer, et al., 2017). However, not all studies reported gender differences (Schmid et al., 2021; Castéra et al., 2020).

METHODOLOGY

Study Design

The study used a mixed-method design to build a comprehensive understanding of the potential benefits and challenges associated with teachers' TPACK use, considering their occupational and experiential differences. Therefore, an online survey and interview were key sources of data collection. Quantitative survey data were analyzed using descriptive statistics, including cross-tabulations, whereas qualitative analysis of online interviews involved thematic analysis.

Participants

Research participants for this study were pre-service teachers in their final year of university in the Department of English (n = 40) and in-service teachers in various primary, intermediate, and secondary schools and universities (n = 65) in Saudi Arabia. The age of teachers varied; however, they were all involved in programs that used English as a foreign language for communicative purposes. Participants were selected randomly and anonymously from a large population group of English language teachers across Saudi Arabia (in four regions) to complete research questionnaires. Participants were asked to fill the Google Form questionnaires online. The link was sent to the participants through their emails and WhatsApp.

Of 105 participants, 26 (male and female) voluntarily agreed to complete the online open-ended interview. The interview, comprising of thought-provoking questions, was completed online (see Appendix 2). The interviewees were encouraged to adequately understand the questions before expressing their thoughts, and they were asked to offer their insights in detail. They were also provided ample time to answer the questions.

The participants' demographic backgrounds are shown in Table 1. Twenty-five of the participants were male, and eighty were female. Regarding age, 49 of the participants were between 20 and 30, 49 of the participants were between 31 and 40, and 7 were above 40 years old. Five participants had more than 15 years of experience in teaching English, 22 participants had between 11 and 15 years of experience, 27 participants had between 6 and 10 years of experience, 38 participants had between 1 and 5 years of experience, and 13 participants had no experience as they were students. Some pre-service teachers reported to have had experience in teaching English as they considered teaching at private institutes to be equivalent to teaching English.

Table 1. Descriptive statistics of research participants

	Categories	Frequency	Percent (%)
Age	20–30	49	46.7
	31–40	49	46.7
	above 40	7	6.7
Gender	Male	25	23.8
	Female	80	76.2
Occupation	Pre-service (student teachers)	40	38.1
	In-service (teachers in schools)	45	42.9
	In-service (instructors at universities)	20	19.0
Experience	None	13	12.4
	1–5	38	36.2
	6–10	27	25.7
	11–15	22	21.0
	above 15	5	4.8

Instruments

The study used two data collection tools. The first was a modified TPACK questionnaire (see Appendix 1) for pre- and in-service English language teachers developed by Ku et al. (2021). It covered seven constructs: CK, PK, TK, PCK, TCK, TPK, and TPACK. In this study, we used the definitions of these constructs as defined by Ku et al. (2021). The questionnaire included three questions on CK, four on PK, five on TK, four on PCK, four on TCK, three on TPK, and four on TPACK. The TPCAK framework was based on a five-point Likert scale, with 1 representing "strongly disagree," 2 "disagree," 3 "neutral," 4 "agree," and 5 "strongly agree."

The confirmatory factor analysis (CFA) revealed a model with seven factors related to the seven identified constructs. The factor loading for each item in all the seven constructs was greater than 0.5. In addition, Cronbach's alpha was used to measure internal consistency between the full questionnaire and surveys. The analysis results for the separate surveys, expressed as Cronbach's alpha, were CK = 0.69, PK = 0.75, TK = 0.88, PCK = 0.78, TCK = 0.92, TPK = 0.82, and TPACK = 0.85; the Cronbach's alpha for the overall survey was 0.94, indicating good reliability.

The second instrument was an interview with 40 pre-service and in-service teachers to elicit teachers' perceptions, including their interpretations of using technology in their learning and teaching. The interview contained four open-ended questions (see Appendix 2) based on the questionnaire proposed by Ku et al. (2021). The questions assessed participants' understanding of the TPACK concept in English and teaching English, its significance in the teaching process of English as a second language, whether or not tools are used to facilitate this process, and reasons hindering English language teachers from adopting the latest tools.

Data Analysis

A structural equation modeling using Amos 23 was conducted to analyze questionnaire results. This modeling is "a collection of statistical techniques that allow a set of relationships between one or more independent variables, either continuous or discrete and one or more dependent variables, either continuous or discrete, to be examined" (Ullman & Bentler, 2003). Based on this definition, the correlation coefficient between participants' occupation, experience, and gender were calculated. Correlation coefficient *r* can be interpreted based on the benchmark suggested by Plonsky and Oswald (2014). In this scale, correlation coefficients close to 0.25, 0.40, and 0.60 are considered as indicative of small, medium, and large effect sizes, respectively.

Regarding the interview, a thematic content analysis was performed. A thematic content analysis is defined as "a method for identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006, p. 79). Following the phases proposed by Braun and Clarke (2006), the interview was analyzed in six phases: (1) interviews were transcribed, (2) initial codes were generated, (3) data were collated into themes, (4) themes were reviewed, (5) themes were defined and named, and (6) the report was written.

FINDINGS

A descriptive analysis was performed to answer the research questions. The mean, standard deviations, skewness, and kurtosis values were provided (Table 2). Skewness measures the degree to which a variable's distribution is balanced. If the responses are distributed either to the right or the left tail of the distribution, then it is referred to as skewed. Kurtosis is an assessment of whether the distribution is extremely narrow with most of the responses in the center (Hair, et al., 2017). It is considered a normal distribution if both skewness and kurtosis are zero.

Table 2. Descriptive statistical results of the data and normality

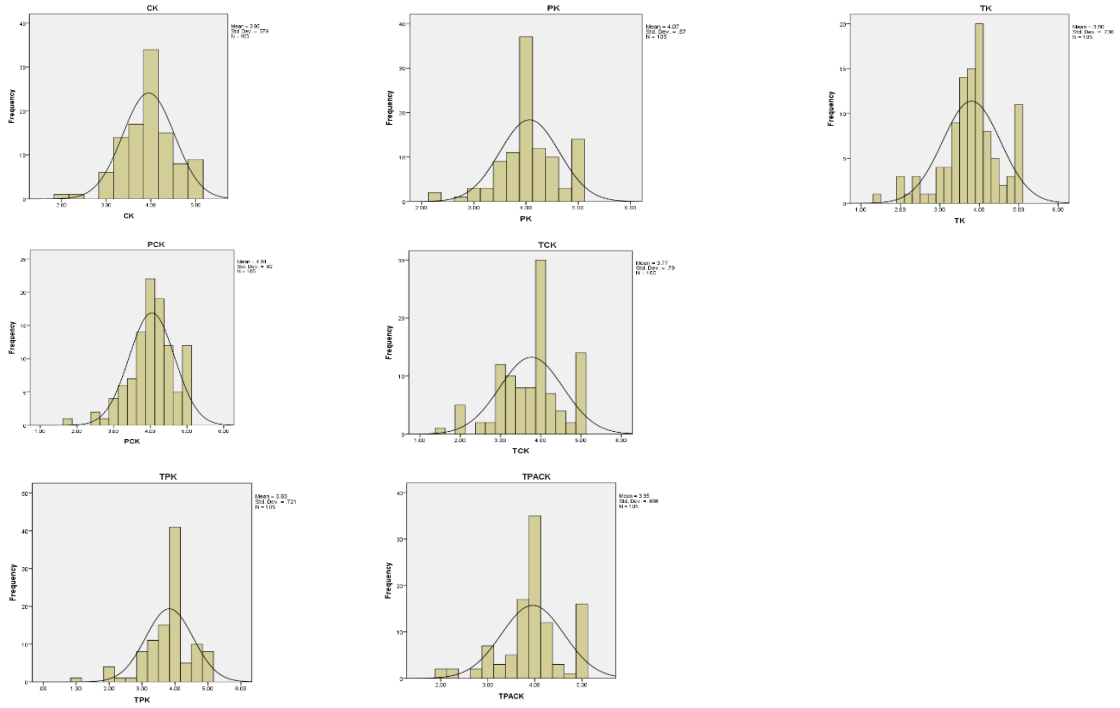
Construct	Mean	SD	Skewness	CR	Kurtosis	CR	Alpha
CK	3.9492	.57879	−.307	−1.284	.604	1.264	.69
PK	4.0667	.56995	−.434	−1.816	.927	1.940	.75
TK	3.8019	.73615	−.618	−2.585	.832	1.741	.88
PCK	4.0429	.61965	−.689	−2.880	1.047	2.190	.78
TCK	3.7690	.79034	−.428	−1.790	.070	.146	.92
TPK	3.8286	.72075	−.990	−4.140	2.049	4.286	.82
TPACK	3.9548	.66577	−.541	−2.264	.803	1.679	.85

Table 2 shows that the mean values on the Likert scales for all constructs ranged between 3.76 and 4.06, and their standard deviations ranged between 0.56 and 0.79. The values for skewness ranged between −.990 and −.307, and those for kurtosis were between .070 and 2.04. It indicated that

those properties were moderate for all constructs. Therefore, the maximum likelihood method with a normal distribution was adopted to estimate this model. Critical ratio (CR) values of skewness ranged from −4.14 to −1.28, and those of kurtosis ranged from .146 to 4.28. The normal distribution of the data was shown in Figure 2.

In addition, Cronbach's alpha was used to ensure internal consistency of the questionnaire. The analysis reported the following results: CK = 0.69, PK = 0.75, TK = 0.88, PCK = 0.78, TCK = 0.92, TPK = 0.82, and TPACK = 0.85; the Cronbach's alpha for the overall survey was 0.95, indicating good reliability.

Figure 2. **Histograms of normal distribution**



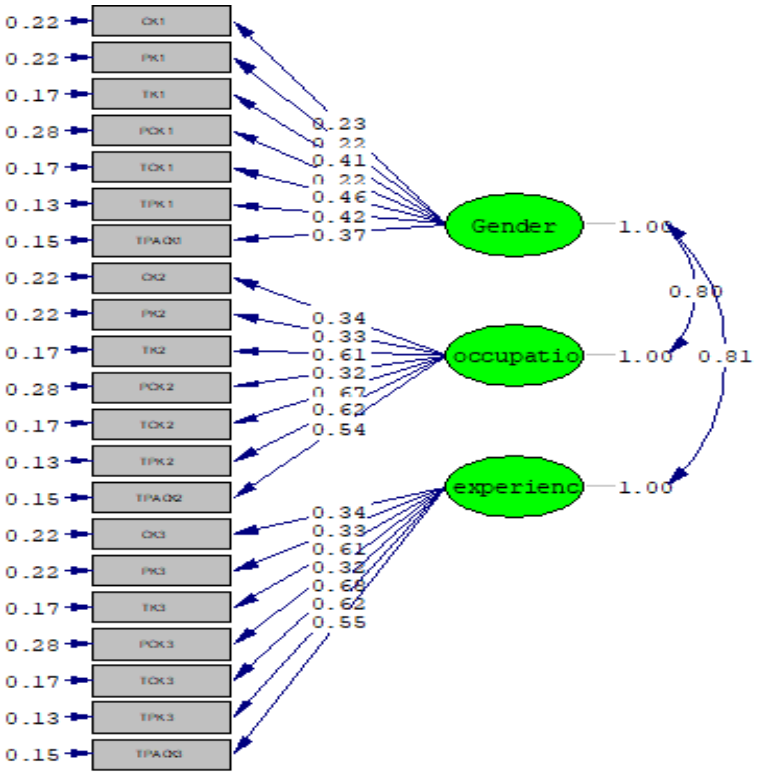
A Pearson correlation analysis was conducted to examine the relationships between the participants' occupation, experience level, and gender, and TPACK. The results are shown in Table 3.

Table 3. Correlations between TPACK constructs and the study factors

		CK	PK	TK	PCK	TCK	TPK	TPACK
Gender	Correlation Coefficient	−.053	.082	.090	−.037	.125	.157	.206*
	Sig. (2-tailed)	.592	.405	.360	.706	.205	.109	.035
Occupation	Correlation Coefficient	.143	.250*	.195*	.156	.203*	.260**	.186
	Sig. (2-tailed)	.145	.010	.046	.112	.038	.007	.058
Experience	Correlation Coefficient	−.307**	−.049	−.143	−.101	−.056	−.152	−.236*
	Sig. (2-tailed)	.001	.617	.146	.305	.572	.122	.015

The results presented in Table 3 show the correlation between gender, occupation, and experience level with the seven constructs of TPACK framework. A negative correlation was observed between gender with CK (r = −.053) and PCK (r = −.037). However, a weak positive correlation was observed between gender with PK (r = .082), TK (r = .090), TCK (r = .125), TPK (r = .157), and TPACK (r = .206). A weak positive correlation was observed between occupation and all the seven constructs, and a negative correlation was yielded between experience and all the seven constructs. The path analysis of the correlations between the constructs and factors is represented in Figure 3, which also presented the relational effect among those constructs.

Figure 3. Path analysis of correlations between the seven constructs



The study used LISERAL, a statistical software used for structural regression modeling, for CFA, with seven observation variables and three latent factors in the model; the results for the whole model showed $\chi 2(230) = 187$, $p < 0.000$, and root mean square error of approximation (RMSEA) = 0.33. Thus, it can be inferred that the model had a reasonable fit. A Pearson correlation analysis was performed to explore the relationship between the seven constructs of TPACK as shown in Table 4.

Table 4 shows a significant correlation among the constructs. TPCK had a small correlation with CK ($r = .346$) and TK ($r = .285$). TPK further had a small correlation with PK ($r = .389$). TK had a high positive correlation with TCK ($r = .704$), TPK ($r = .741$), and TPACK ($r = .653$). Moreover, TCK had a high positive correlation with TPK ($r = .779$) and TPACK ($r = .695$). TPK had a high positive correlation with TPACK ($r = .708$). The rest of the correlations were medium correlations.

Table 4. Correlations among different constructs in TPACK framework

		CK	PK	TK	PCK	TCK	TPK	TPACK
PK	Pearson Correlation	.472						
	Sig. (2-tailed)	.000						
TK	Pearson Correlation	.516	.515					
	Sig. (2-tailed)	.000	.000					
PCK	Pearson Correlation	.346	.473	.285				
	Sig. (2-tailed)	.000	.000	.003				
TCK	Pearson Correlation	.452	.473	.704	.433			
	Sig. (2-tailed)	.000	.000	.000	.000			
TPK	Pearson Correlation	.468	.389	.741	.420	.779		
	Sig. (2-tailed)	.000	.000	.000	.000	.000		
TPACK	Pearson Correlation	.497	.461	.653	.494	.695	.708	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	

The CFA results are presented in Table 5. Based on the theoretical model used in this study, all factor loadings of the observed variables on the latent variables were between 0.31 and 0.6. Additionally, R^2 of all constructs were between 0.27 and 0.67, indicating that the survey had good convergent validity and construct validity.

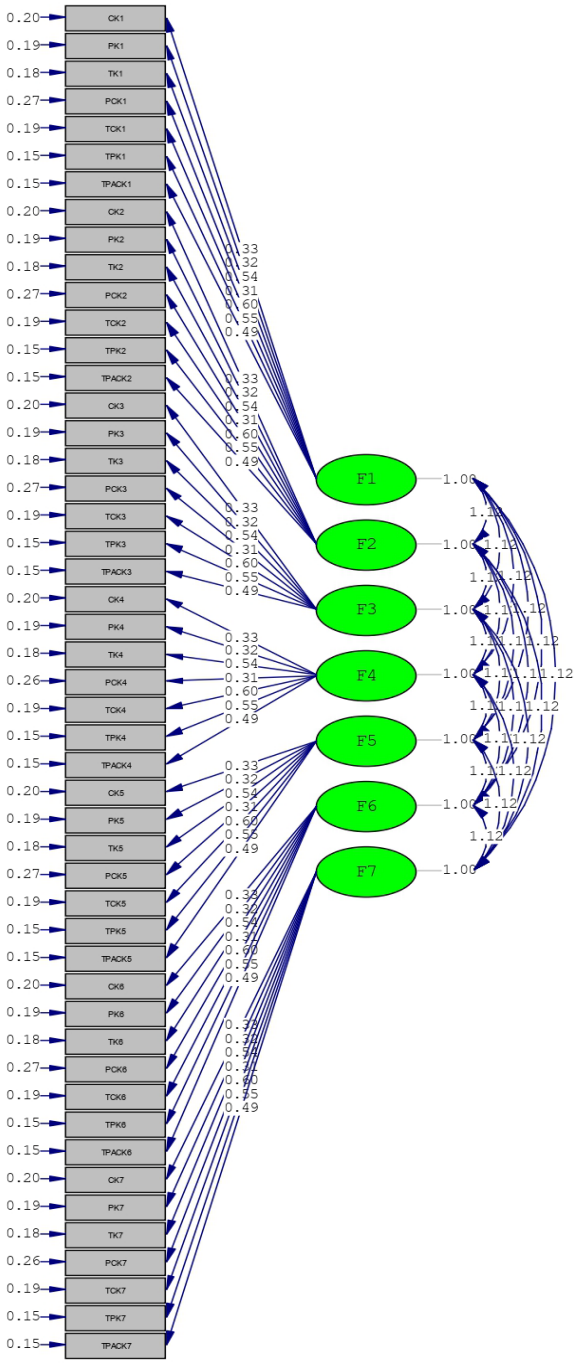
Table 5. Confirmatory factor analysis (CFA) of all variables

Construct and items	Factor loadings	R^2
Content knowledge (CK)		
PK	.32	.35
TK	.54	.62
PCK	.31	.27
TCK	.60	.66
TPK	.55	.66
TPACK	.49	.61
Pedagogical knowledge (PK)		
CK	.33	.35
TK	.54	.62
PCK	.31	.27
TCK	.60	.66
TPK	.55	.67
TPACK	.49	.61
Technological knowledge (TK)		
CK	.33	.35
PK	.32	.35
PCK	.31	.27
TCK	.60	.66
TPK	.55	.67
TPACK	.49	.61
Technological content knowledge (TCK)		
CK	.33	.35
PK	.54	.62
TK	.31	.27
PCK	.60	.66
TPK	.55	.67
TPACK	.49	.61
Pedagogical content knowledge (PCK)		
CK	.33	.35
PK	.32	.35
TK	.54	.62
TCK	.60	.66
TPK	.55	.67
TPACK	.49	.61

Technological, pedagogical knowledge (TPK)		
CK	.33	.35
PK	.54	.62
TK	.31	.27
PCK	.60	.66
TCK	.55	.67
TPACK	.49	.61
Technological, pedagogical, and content knowledge (TPACK)		
CK	.33	.35
PK	.32	.35
TK	.54	.62
PCK	.31	.27
TCK	.60	.66
TPK	.55	.67

This study used LISREL for CFA, with 49 observation variables and 7 latent factors in the model. The path analysis of the correlations among constructs is represented in Figure 4. In terms of goodness-of-fit, the goodness-of-fit index is 0.15, adjusted goodness-of-fit index is 0.054, parsimony goodness-of-fit index is 0.13, comparative fit index is 0.55, normed fit index is 0.53, non-normed fit index is 0.52, relative fit index is 0.50, root mean square residual is 0.083, RMSEA is 0.35, 90 percent confidence interval for RMSEA is (0.35 ; 0.36), *P*-value for test of close fit (RMSEA < 0.05) is 0.00, and normed chi-square is $\chi 2/df$. The minimum fit function chi-square is 21640.63 ($P = 0.0$), normal theory weighted least squares chi-square is 15234.79 ($P = 0.0$), and chi-square for independence model with 1176 degrees of freedom is 46337.77. Thus, it can be inferred that the model had a reasonable fit.

Figure 4. Path analysis of correlations among the constructs



Note: F1 = CK, F2 = PK, F3 = TK, F4 = PCK, F5 = TCK, F6 = TPK, F7 = TPACK

The first question in the interview was with regard to the respondents' definition of TPACK. The respondents' definitions were classified according to these constructs. For instance, one respondent stated: *it is an integrated mixture of educational, technological information, and the contents of the curriculum*.

Accordingly, regarding PK, the respondents focused on teaching methods, principles, and strategies suitable for language learning, teaching skills, classroom management, and understanding learning theories. They felt that teachers should know how to deal with learners, involve them in the learning process, and comprehend their needs. Additionally, teachers should be equipped with planning, evaluation, and problem solving skills. They also urged teachers to know how to use teaching aids.

Regarding TK, the respondents felt that teachers should know all cutting-edge technologies that can enhance teaching and learning and should be qualified to use them effectively in teaching English language. Moreover, teachers should know how to troubleshoot issues that may occur during teaching. Finally, teachers should keep themselves updated about new technologies. When considering responses to the third category, CK, most respondents felt that teachers should be aware of all information that they will teach during the course. Additionally, English language teachers should know the objectives, skills, and activities proposed in the course. The respondents felt that teachers should prepare lesson plans for teaching the content.

The second question in the interview focused on the effort to integrate TPACK during English language teaching. Most respondents felt that TPACK should be coordinated during English language teaching. However, they had two different views with regards to its implementation. The first view was that these components should be integrated and used as a whole. The second view was that these components should be presented successively. All respondents agreed that teachers should be trained with the basic skills in all these components. In addition, teaching methods need to be modified to match the new technology. One respondent, however, did not agree that these components should be coordinated during English language teaching. She stated as follows:

> *I do not see the need to integrate [these components] within one framework, but there is a need to be familiar with all this knowledge. Why? I believe that technical knowledge is separate from [and] renewed at a faster pace than pedagogical knowledge and content knowledge. (Aziza - student)*

The third question in the interview focused on particular technologies specific to English language teaching. The respondents stated that they used applications that enhance interaction, such as role play. Moreover, they used games for language teaching and learning. Cambly was used by some participants to improve learners' speaking skills. One of the respondents mentioned that they used augmented reality while teaching English to do some puzzles. Additionally, one of the respondents

mentioned that she used flipped learning and sheltered instruction. They further mentioned using applications and tools, such as Duolingo, YouTube, Grammarly, Apple Podcast, Tell Me More, Quizlet, Kahoot, and Wiki. Only two respondents stated that they have not used any application for teaching or learning English owing to lack of knowledge of using such applications.

The fourth question in the interview was addressed to pre-service teachers (student teachers). It aimed to elicit an explanation for the lack of technology use when teaching English language. Each respondent was asked if they took a specific course to contribute to their ability to use technology. Their answers indicated that attending training courses in using technology for teaching English was popular. However, others expressed that training courses were not useful because training for applications, such as statistical programs that can be used, was expensive and/or complex. Additionally, some respondents felt that these technologies were not updated on a regular basis. One participant highlighted that these applications did not match with the courses and the schedule of the courses in schools. For those who did not attend such training courses, reported different reasons for their absence. First, they stated that there was no requirement to attend such courses as information is readily available online, such as in YouTube. Second, limited time and fewer incentives were among the primary reasons for not attending such courses. Third, respondents suggested that they could learn by themselves by reading updated articles and experimenting on a personal level. Finally, most applications were provided with user manuals explaining necessary steps for using the application.

correlation analysis results revealed that these factors had no significant relationships with TPACK. The results indicated a weak positive correlation between gender and PK, TK, TCK, TPK, and TPACK. However, a negative correlation was observed between gender and CK and PCK. Moreover, a weak positive correlation between occupation and the entire of the seven constructs was observed. Conversely, the correlation was negative between experience and all the seven constructs. The negative or weak correlations could be attributed to the fact that occupation (i.e., pre- or in-service teachers), experience (years of teaching in school or university), and gender (male or female) have no effect on using technology in language learning.

DISCUSSION AND CONCLUSION

The current study attempted to explore if there was any significant correlation between TPACK and participants' occupation, experience level, and gender. Both pre- and in-service teachers recognized the necessity of integrating technology, including TK, in language learning. Teachers with different experiential backgrounds with technology demonstrated positive perceptions regarding technology use in language learning. Similarly, both male and female teachers perceived the requirement to use technology for language learning and teaching purposes. However, Hsu et

al. (2021) deduced that junior teachers, categorized by their years of teaching experience, tended to have higher encouraging perceptions regarding TPACK for games and actual teaching usage than seniors, including game knowledge, game PCK, and actual teaching use.

The study findings are consistent with Castéra et al. (2020), Jordan (2013), and Schmid et al. (2021), who reported no gender differences in using TPACK. However, few studies determined that female teachers rate themselves higher than males in PK (Lin et al., 2013). Regarding experience, the study findings contrast with Agyei and Voogt (2015); Janssen, Knoef, and Lazonder (2019); Saudelli and Ciampa (2016); and Yeh et al. (2013), who determined that teachers' experiences were an indicator of teacher proficiency of TPACK.

The analysis has shown significant correlations among various constructs of the TPACK framework. This indicates that improvement in performance in those constructs would have an effect on teachers' TPACK performance. This finding is consistent with the research findings of Ku et al. (2021), who discovered that the teachers' performance in TPACK revealed high correlations with six other constructs (including PCK and TPK). This finding is also consistent with the research findings of Graham et al. (2009) and Lin et al. (2013), who established that when teachers are equipped with sufficient TK, they are more confident in technology teaching and, thus, have improved TCK, TPK, and TPACK performance. The PCK had a small correlation with CK and TK. Further, the TPK had a small correlation with PK.

The seven components of TPACK framework provide a means to understand the crucial factors in the integration of ICT in classrooms. A variety of assessments based on this framework has helped identify areas for improvement in teachers. Additionally, such assessments revealed its impact on gender differences in relation to technology knowledge and the integration of technology into pedagogy and content area knowledge. Findings from studies pertaining to TPACK may reveal various ways of improving student learning through more effective integration of technology.

Regarding the perception of pre- and in-service teachers, the results from the interview revealed that respondents considered teaching methods, principles, and strategies suitable for language learning, teaching skills, classroom management, and understanding learning theories among the most important issues for language teachers. They also confessed that teachers should be familiar with cutting-edge technologies that can enhance teaching and learning process. Additionally, results indicated that CK, PK, and TK should be collaboratively introduced.

This study has no limitations. The purpose of the study was to primarily explore the relationship between pre- and in-service English language teachers' perceptions of various constructs of TPACK. Although study findings could be applicable to other teachers in different disciplines, e.g., arts, science, law, business administration, etc., they cannot be generalized to other specializations and other educational settings. The outcomes of the study were based on self-

reported measures to explore pre- and in-service teachers' perceptions about TPACK; the perceptions were dependent on a relatively small group of online interviews. Several contributors are encouraged to share further self-reflections on their views toward TPACK. Future studies could incorporate more qualitative data and instruments, such as focus groups, observations, and think-aloud protocols, to describe teachers' beliefs and values in detail.

Compliance with Ethical Standards

- Conflict of Interest: The authors declare that they have no conflict of interest.
- This research was conducted on humans who voluntarily agreed to be part of this study. They were all anonymous and their responses were not part of the course assessment or official grading. They were provided the opportunity to withdraw from this study at any given time without any consequences after being introduced to study objectives and expected outcomes.

Availability of Data and Material

Data collected will be shared upon request at any time.

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Availability of Data and Material

None

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Appendix 1: The TPACK Questionnaire

Personal information			
Age	……	Gender	……
Major	……	University	……
• Pre-service teacher- student teacher • In-service teacher- school teacher • In-service teacher- university instructor	……		

TPACK constructs	**Exemplary item**		**Likert scale**			
		SD 1	**A 2**	**N 3**	**A 4**	**SA 5**
(CK)	I have enough technological knowledge.					
	I can consider technology from the perspective of subject experts.					
	I can dive deeper in exploring and understanding technology-related content.					
(PK)	I can develop challenging tasks to instruct students to conduct in-depth thinking.					
	I can instruct my students to adopt suitable study strategies.					
	I can help my students manage their studying.					
	I can help my students reflect on their study strategies.					
(TK)	I can efficiently use digital fabrication tools.					
	I can easily learn to use different digital fabrication tools.					

	When using digital fabrication tools, I know how to address the relevant technical issues.					
	I can understand the latest information related to digital fabrication tools.					
	I can use the software that operates relevant digital fabrication tools (including computer drawing software).					
(PCK)	I can plan maker activities for students in groups.					
	I can instruct my students to have efficient discussions during group maker activities.					
	Even without using digital fabrication tools, I can help address students' myths about studying technology.					
	Even without using digital fabrication tools, I can use different methods to assist students in acquiring CK on technology.					
(TCK)	I can use digital fabrication tools to introduce real-world situations to my students.					
	I can enable my students to use digital fabrication tools to express their design thinking.					
	I can enable my students to use digital fabrication tools to test and adjust their design thinking.					
	I can enable my students to use digital fabrication tools to present their knowledge in different forms.					
(TPK)	I can enable my students to use digital fabrication tools to cooperate with other students.					
	I know which digital fabrication tools to use when designing maker-based teaching activities related to technology.					
	I can use appropriate digital fabrication tools to present study content related to technology.					
(TPACK)	I can suitably integrate technology, digital fabrication tools and teaching methods in the process of teaching technological content.					

	I can select appropriate digital fabrication tools to enhance my technological teaching content and methods, as well as the content that students study.					
	I can apply different teaching strategies to suitably integrate technology, digital fabrication tools and teaching methods based on my observations during teaching.					
	I can assist other teachers at my institution in integrating technology, digital fabrication tools and teaching methods.					

Appendix 2: The interview

It contained four broad questions:

Q1: How do you define the concept technological pedagogical content knowledge (TPACK) in teaching English? Please explain?

Q2: Should content knowledge, pedagogical knowledge, and technological knowledge be promoted to fit together during English language teaching? How/why?

Q3: Do you know any technologies specific to English language teaching? If yes, please name them and explain what they can be used for? and how? If no, is this a lack of professional knowledge? Are knowing such tools/technologies/applications a plus?

Q4: If you are a pre-service teacher, what do you lack in terms of using technology for teaching English? Did you take any course/program to contribute to your ability to use technology? If yes, what are your negative and positive opinions about it? If no, what are the reasons that hindered you?